

**Department of Computer Science**

**Curriculum of Bachelor of Science in Computer Science (BSCS) Program**

**IQRA University**

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| **Name of the program:** | Bachelor of Science in Computer Science (BSCS) |
| **Department of Study:** | Computer Science,  Faculty of Engineering Sciences and Technology |
| **Intakes:** | Spring and Fall, every year |
| **Program Duration:** | 4 years |
| **Mode of study:** | Full-Time |
| **Professional body accreditation:** | National Computing Education Accreditation  Council (NCEAC) |
| **Head of Department:** | Prof. Dr. Mansoor Ebrahim |

**PREFACE**

The Bachelor of Science in Computer Science (BSCS) program at Iqra University Main Campus has been meticulously designed to address the ever-growing demand for proficient computer scientist in today's technology-driven world. This curriculum design document serves as a comprehensive guide to the academic framework, learning objectives, instructional methodologies, and evaluation mechanisms that underpin this program.

In crafting this curriculum, we have drawn upon the collective expertise of our esteemed faculty, insights from industry leaders, and feedback from our alumni and current students. The program aims to provide students with a robust foundation in computer science principles, coupled with hands-on experience in contemporary software development practices. By integrating theoretical knowledge with practical application, we strive to produce graduates who are well-equipped to tackle complex computing challenges and contribute meaningfully to the technological advancements in various sectors.

Our curriculum is aligned with the standards set by the Higher Education Commission (HEC) and National Computing Education Accreditation Council (NCEAC), ensuring that our students receive an education that meets the highest quality benchmarks. We are committed to fostering an environment that encourages innovation, critical thinking, and ethical practice, preparing our students not only for successful careers but also for lifelong learning and leadership in the field of computer science.

At Iqra University, we believe in the transformative power of education and its ability to shape the future. This curriculum is a testament to our dedication to academic excellence and our commitment to equipping our students with the skills and knowledge necessary to excel in the dynamic field of computer science. We are excited to embark on this journey with our students, faculty, and industry partners, and we look forward to the many successes that will emerge from this program.

Prof. Dr. Mansoor Ebrahim

HoD, Department of Computer Science,

Iqra University Main Campus

# PREFACE

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# INTRODUCTION

Iqra University traces its geneses to January 1998, when it started its operations in Karachi. The Government of Sindh chartered the University; vide Sindh Ordinance VI of 2000. Currently, Iqra University has campuses in Karachi and Islamabad. The aim of the top management of Iqra University is to develop an institution of higher learning that provides quality education to the people of Pakistan at an affordable price.

Iqra University offers a variety of programs in different disciplines including Business Administration, Computer Science, Software Engineering, Electrical Engineering, Media Science, Fashion Design, Education, Social Science, Pharmacy and Health Sciences. These programs are offered on multiple campuses in Karachi and Islamabad. All programs offered in the university are recognized by Higher Education of Pakistan and fully accredited by various regulatory bodies like the Pakistan Engineering Council (PEC), National Business Education Accreditation Council (NBEAC), National Computing Education Accreditation Council (NCEAC), National Accreditation Council for Teacher Education (NACTE), and Pakistan Pharmacy Council (PPC).

Karachi campus is geographically spread over five prominent locations viz. Main Campus at Shaheed-e-Millat Road, Gulshan Campus in Gulshan-e-Iqbal, North Campus in North Karachi, Bahria Town campus, and Airport Campus covering the population of different districts of Karachi. The facilities on campuses include a well-stocked library, state-of-the-art computing facilities, well-equipped teaching labs, centrally air-conditioned classrooms equipped with the latest audio-visual aids, incubation centres, auditoriums, seminar rooms, sports facilities, prayer halls, swimming pool and gymnasiums.

The University is prominently ranked in QS Ranking (Asian and Subject), Times Higher Education Ranking, UI Green Metric, and other prestigious international ranking bodies. These bodies ranked the University in research excellence, academic and employer reputation, sustainable goals, and environmental protection.

## Vision of Iqra University:

To transform the lives of youth through world class education at an affordable price.

## Mission of Iqra University:

To be a world class institution of higher education and research, promoting technical skills, critical thinking and public duty, to help develop a prosperous and progressive society.

## Department of Computer Science:

The Computer Science Department fosters innovation, critical thinking, and technical expertise through undergraduate, graduate, and doctoral programs. It equips students with foundational knowledge in programming, algorithms, and emerging technologies like AI, cybersecurity, and data science.

With state-of-the-art labs and cutting-edge research in fields such as computer vision, robotics, and IoT, the department collaborates with industry and academic partners to provide real-world exposure and career opportunities, preparing students to excel in the modern information society.

The major strengths of the department are as follows:

* Foreign qualified faculty with MS/ PhD Degrees
* International collaboration
* State of the art hardware labs
* State of the art computer labs
* Huge Library with ample number of books
* Excellent research facilities with access to IEEE, IET and ACM Digital Library
* E-Learning/ Online student information system

## Vision of Computer Science Department:

To emerge as a global leader in computer science research and education by driving technological innovation, solving real-world challenges, and empowering future leaders.

## Mission of Computer Science Department:

Our mission is to foster academic excellence and cutting-edge research, positioning our department as a global leader in computer science innovation. By instilling ethical values, technical prowess, and interdisciplinary knowledge, we prepare students for impactful careers in the field. We strive to shape the technological landscape of tomorrow by equipping our students with professionalism, resilience, and a collaborative mindset.

## Mission of BS Computer Science Program:

We aim to deliver top-tier education with an equal emphasis on both theoretical and applied aspects of computer science. Technical proficiency, critical thinking, and a commitment to public duty are the hallmarks of our graduates. Through innovative curricula, an inclusive environment, and excellence in teaching and research, we empower our students for success in various computer science specializations.

## Curriculum Development and Revision Process:

The academic curriculum of a Computer Science program is designed to address both current and future demands of the field. In this regard, stakeholder perceptions serve as a driving force behind the development and continuous updating of the curriculum. The intended learning outcomes of the program are achieved by offering a curriculum that balances Computing and Non-Computing content, along with appropriate assessment and evaluation methods. The curriculum is structured to facilitate progressive knowledge transfer to students, incorporating a well-defined core of essential subjects supported by both compulsory and elective courses. Additionally, it encourages students to develop an understanding of societal challenges, motivating them to seek innovative solutions that improve quality of life. The theoretical content is complemented by practical experimentation and laboratory work.

The curriculum includes fundamental courses in core Computing, Mathematics, and Humanities at the introductory level, gradually advancing to more in-depth learning within the Computing domain. A key feature of the curriculum is its focus on fostering original thinking, resourcefulness, and entrepreneurial spirit among students. The program integrates foundational courses with both general and specialized professional content, including relevant Humanities and Natural Science components. This design ensures the acquisition of knowledge and skills while providing essential exposure to interdisciplinary fields.

Each course within the curriculum is regularly updated to reflect the latest technological and knowledge advancements, aligning with international standards and addressing national needs. Efforts are also made to

ensure that the curriculum content is closely tied to industrial practices within the field. Graduates are expected to demonstrate professional ethics and proficiency in areas such as oral communication, scientific and quantitative reasoning, critical analysis, system design, logical thinking, creativity, and a capacity for lifelong learning. The delivery of subject matter and the assessment methods are designed to help students effectively develop both intellectual and practical skills, as outlined in the program’s outcomes.

For complex computing problems which are difficult to quantify such as communication (oral and written), critical thinking, ethics, and teamwork; rubrics are often used as a tool for assessment, employing both direct and indirect methods. In addition to regular teaching and learning activities such as classroom instruction, project-based assignments, lab experiments, and faculty consultations, the curriculum also includes other learning components such as tutorials, research/design projects, seminars/workshops, and exposure to industrial practices. Periodic internal reviews of quality assurance processes are conducted to ensure the curriculum's continued effectiveness.

## Program Objectives (POs) of BSCS Program:

Program objectives (POs) are general statements that outline the goals graduates are expected to achieve a few years after completing their studies in the department. These goals are primarily focused on meeting the needs of stakeholders. In the case of computer science education, the industry is the key stakeholder, as it provides employment opportunities for graduates. Therefore, it is crucial to involve the industry directly in defining the educational objectives. To this end, the Computer Science Department at Iqra University has established an Industry Advisory Board (IAB), which includes not only the department's top management but also representatives from various industries. The POs for BS (Computer Science) program as recommended by IAB and approved by the Board of Faculty (BoF) and Academic Council (AC) are as follows:

|  |  |
| --- | --- |
| **PO #** | **Program Objectives (POs)** |
| **PO - 1** | Establishing in-depth understanding of theoretical concepts related to Computer Science. |
| **PO - 2** | Applying core Computer Science knowledge and analytical skills to optimally solve real-world problems. |
| **PO - 3** | Imbuing quest for learning and engaging in continuous professional development in the field of computer science by carrying research and adopting professional practices. |
| **PO - 4** | Developing the ability to work in a multi-disciplinary and multicultural environment in teams incorporating soft skills and maintaining high ethical standards. |

## Program Objectives (POs) mapping with Vision and Mission:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **S.No.** | **Vision and Mission** | **PO-1** | **PO-2** | **PO-3** | **PO-4** |
|  | **Vision of Iqra University** | ***✓*** | ***✓*** | ***✓*** | ***✓*** |
|  | **Mission of Iqra University** | ***✓*** | ***✓*** | ***✓*** | ***✓*** |
|  | **Vision of Computer Science Department** | ***✓*** | ***✓*** | ***✓*** | ***✓*** |
|  | **Mission of Computer Science Department** | ***✓*** | ***✓*** | ***✓*** | ***✓*** |
|  | **Mission of BS Computer Science Program** | ***✓*** | ***✓*** | ***✓*** | ***✓*** |

## Graduate Attributes (GAs):

Graduate Attributes (GAs) represent a set of measurable outcomes that reflect a graduate’s potential to develop the competence needed to practice at an appropriate level. These attributes serve as benchmarks for what is expected from graduates of an accredited program. Graduate attributes are clear and concise statements of the expected capabilities, which may be further qualified by a range indicative of the program type.

The curriculum plays a crucial role in shaping students in alignment with these Graduate Attributes (GAs). Program objectives (POs) are narrower statements that describe what students should know and be able to do by the time they graduate. The GAs primarily focus on the knowledge, skills, and attitudes that students develop as they progress through the program. It is essential to demonstrate that students have acquired these defined GAs by the time of graduation.

The program must show that, at a minimum, students have achieved a certain level of knowledge, skills, and behavioral traits by graduation. This minimum threshold for Graduate Attribute attainment should not be below 50% initially. However, as the program evolves through continuous quality improvement (CQI), this threshold is expected to increase. Specifically, the program must demonstrate that all students in an accredited batch have achieved the following Graduate Attributes (GAs).

|  |  |  |
| --- | --- | --- |
| **GA #** | **Graduate Attributes (GAs)** | |
| **GA -1** | **Academic Education** | To prepare graduates as computing professionals. |
| **GA -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. |
| **GA -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. |
| **GA -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. |
| **GA -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. |
| **GA -6** | **Individual and Team Work** | Function effectively as an individual and as a member or leader in diverse teams and in multi-disciplinary settings. |
| **GA -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. |
| **GA -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. |
| **GA -9** | **Ethics** | Understand and commit to professional ethics, responsibilities, and norms of professional computing practice. |
| **GA -10** | **Life-long Learning** | Recognize the need, and have the ability, to engage in independent learning for continual development as a computing professional. |

## Mapping of GAs with POs:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **S. No.** | **GAs** | **PO-1** | **PO-2** | **PO-3** | **PO-4** |
|  | **Academic Education** | ***✓*** | ***✓*** |  |  |
|  | **Knowledge for Solving Computing Problems** | ***✓*** | ***✓*** |  |  |
|  | **Problem Analysis** |  | ***✓*** | ***✓*** |  |
|  | **Design/ Development of Solutions** |  | ***✓*** | ***✓*** |  |
|  | **Modern Tool Usage** |  | ***✓*** |  |  |
|  | **Individual and Team Work** |  |  | ***✓*** | ***✓*** |
|  | **Communication** |  |  | ***✓*** | ***✓*** |
|  | **Computing Professionalism and Society** |  |  | ***✓*** |  |
|  | **Ethics** |  |  |  | ***✓*** |
|  | **Life-long Learning** |  |  | ***✓*** |  |

## The Assessment:

**Assessment policy** embraces diverse models tailored for different types of courses. Practical courses may utilize performance-based evaluations and portfolio assessments. Theoretical courses are subject to traditional exams, project-based assessments, case studies, and open book exams. However, a continuous assessment approach involves regular quizzes and assignments, presentations to ensure ongoing feedback.

**Assessment Types:**

1. Assessments in courses include formal written examinations, continuous assessments, projects, or any other academic exercises subject to evaluation, as specified in the course or program regulations.
2. The assessment may include Case Studies, Assignments, Quizzes, Class Workshops, Portfolios, Semester Projects, Presentations, viva, Hourly, Mid-term, and Final Examination.

The course wise assessment distribution is given in Course Information Sheet (CIS) of each course.

## Grading System:

The following grading system will be followed (effective from Spring 2025 semester):

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Letter Grade** | **Percentage** | **Grade Points** | **Remarks** | **Notes** |
| A | 90% - 100% | 4.00 | Outstanding |  |
| A- | 85% - 89% | 3.67 | Excellent |  |
| B+ | 80% - 84% | 3.33 | Very Good |  |
| B | 75% - 79% | 3.00 | Good |  |
| B- | 70% - 74% | 2.67 | Fairly Good |  |
| C+ | 65% - 69% | 2.33 | Above Average |  |
| C | 60% - 64% | 2.00 | Average | Undergraduate Degree Requirement |
| C- | 56% - 59% | 1.67 | Below Average | Revised Probation Threshold Limit 1.70 Semester GPA |
| D+ | 53% - 55% | 1.33 | Poor |  |
| D | 50% - 52% | 1.00 | Unsatisfactory |  |
| F | Below 50% | 0 | Failed  (course repeat) |  |
| I |  |  | Incomplete |  |
| W |  |  | Withdrawal |  |
| IP |  |  | In Progress |  |
| QQ |  |  | Qualified | Only for non-credited Course |
| NQ |  |  | Not Qualified | Only for non-credited Course |
| PASS |  |  | Thesis / Project |  |
| FAIL |  |  | Thesis / Project |  |
| XF |  |  | F-Grade due to  shortage of attendance |  |

*\*The XF letter grade shall not be counted towards the calculation of GPA.*

## Sustainable Development Goals (SDGs):

The Sustainable Development Goals (SDGs) are a set of 17 global objectives established by the United Nations in 2015 to address the world's most pressing challenges, including poverty, inequality, climate change, environmental degradation, peace, and justice. The SDGs are part of the 2030 Agenda for Sustainable Development, which aims to ensure a better future for all.

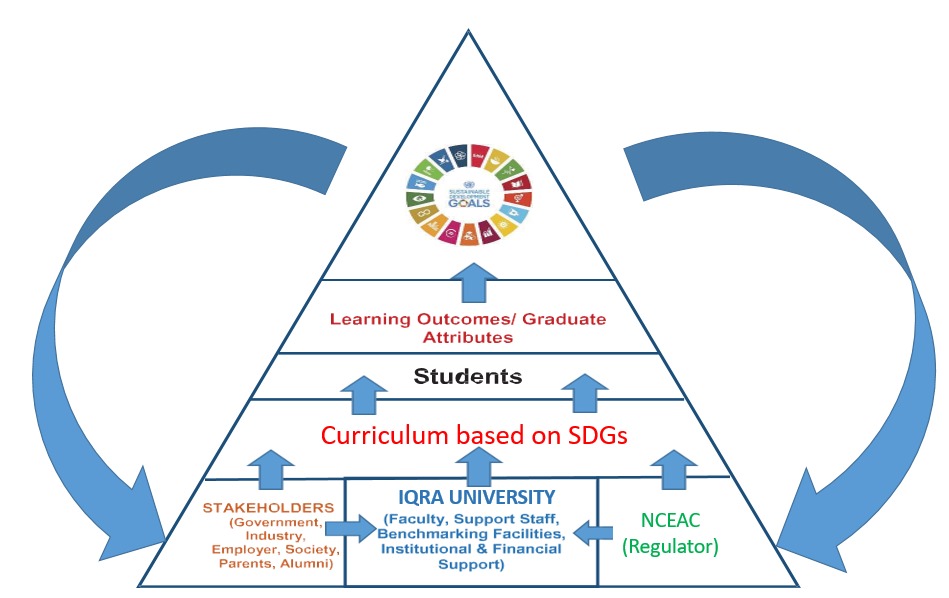


United Nation’s Sustainable Development Goals (UN SDGs)

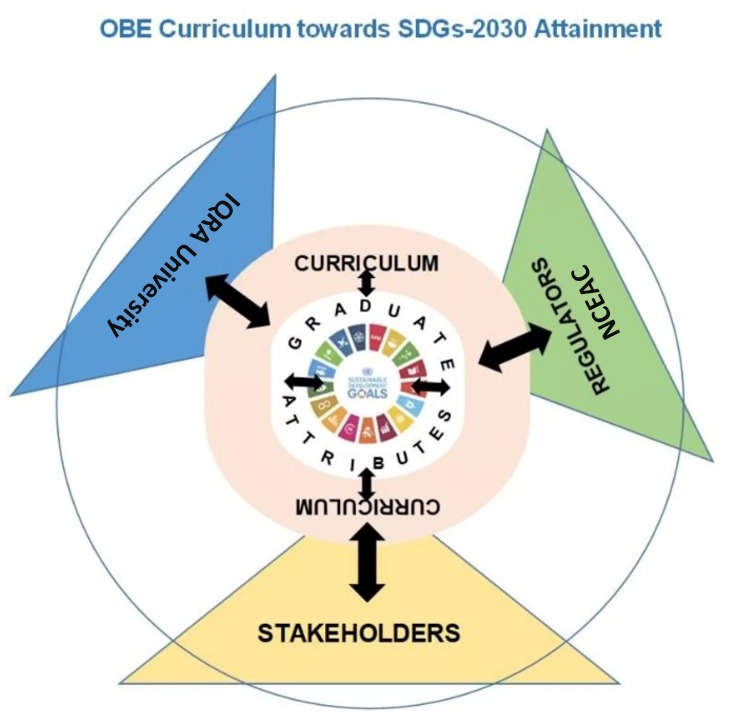
Here are the 17 SDGs:

1. **No Poverty:** End poverty in all its forms everywhere.
2. **Zero Hunger:** End hunger, achieve food security and improved nutrition, and promote sustainable agriculture.
3. **Good Health and Well-Being:** Ensure healthy lives and promote well-being for all at all ages.
4. **Quality Education:** Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.
5. **Gender Equality:** Achieve gender equality and empower all women and girls.
6. **Clean Water and Sanitation:** Ensure availability and sustainable management of water and sanitation for all.
7. **Affordable and Clean Energy:** Ensure access to affordable, reliable, sustainable, and modern energy for all.
8. **Decent Work and Economic Growth:** Promote sustained, inclusive, and sustainable economic growth, full and productive employment, and decent work for all.
9. **Industry, Innovation, and Infrastructure:** Build resilient infrastructure, promote inclusive and sustainable industrialization, and foster innovation.
10. **Reduced Inequalities:** Reduce inequalities within and among countries.
11. **Sustainable Cities and Communities:** Make cities and human settlements inclusive, safe, resilient, and sustainable.
12. **Responsible Consumption and Production:** Ensure sustainable consumption and production patterns.
13. **Climate Action:** Take urgent action to combat climate change and its impacts.
14. **Life Below Water:** Conserve and sustainably use the oceans, seas, and marine resources for sustainable development.
15. **Life on Land:** Protect, restore, and promote sustainable use of terrestrial ecosystems, manage forests sustainably, combat desertification, halt and reverse land degradation, and halt biodiversity loss.
16. **Peace, Justice, and Strong Institutions:** Promote peaceful and inclusive societies for sustainable development, provide access to justice for all, and build effective, accountable, and inclusive institutions at all levels.
17. **Partnerships for the Goals:** Strengthen the means of implementation and revitalize the global partnership for sustainable development.

These goals aim to balance the economic, social, and environmental dimensions of development, and they are interconnected—success in one area often requires progress in others. These SDGs are incorporated into our curriculum to ensure that students understand their responsibility in shaping a sustainable future through technology. By recognizing the potential of Computer Science to address the world’s most urgent challenges, students can be empowered to innovate and collaborate in ways that drive positive social, economic, and environmental change. It fosters a generation of computer scientists who not only possess technical expertise but also have the vision and ethical grounding to contribute meaningfully to the global sustainable development.



The curriculum therefore has been designed based upon the above SDGs alongside their mapping strategy with program mission, objectives, learning attributes and the scheme of study.



Consideration of UN SDGs in curriculum design

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Sr. #** | **Description** | **UN SDGs** | | | | | | | | | | | | | | | | |
| **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **13** | **14** | **15** | **16** | **17** |
| 01 | HEI vision and mission with focus on specific engineering program |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 02 | Bachelor of Engineering Curriculum (Engg. & Non-Engg. Courses) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03 | Final Year Design Project (FYDP) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 04 | Other pre-requisite activities (Internship, Community service, Survey camp, etc.) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 05 | Co- and Extra- Curricular Activities |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

## Knowledge Areas:

The Association for Computing Machinery (ACM), USA, is the largest global organization for computer scientists, with members spread across the world. It comprises a network of highly respected professionals who periodically convene to evaluate the evolving trends in the computing field. Based on these assessments, ACM identifies key knowledge areas and their anticipated significance in the coming years. As a result, ACM provides guidance for computing academia and professionals worldwide on the direction to follow. The curriculum is designed with consideration of the knowledge areas identified by ACM. The following knowledge areas provided by ACM have been addressed with in the curriculum.

|  |  |
| --- | --- |
| **S. No.** | **Knowledge Area** |
|  | **AL-Algorithms and Complexity** |
|  | **AR-Architecture and Organization** |
|  | **CN-Computational Science** |
|  | **DS-Discrete Structures** |
|  | **GV-Graphics and Visualization** |
|  | **HCI-Human-Computer Interaction** |
|  | **IAS-Information Assurance and Security** |
|  | **IM-Information Management** |
|  | **IS-Intelligent Systems** |
|  | **NC-Networking and Communication** |
|  | **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 Practice** |

## Learning Domains:

Bloom's Taxonomy is a framework used to categorize educational goals, focusing on different levels of skills. The curriculum is designed with consideration of Bloom’s Taxonomy domains as shown below.

The **cognitive domain** of Bloom's Taxonomy focuses on intellectual skills and processes related to acquiring knowledge and thinking critically. It outlines six levels of cognitive complexity, ranging from basic recall of information to higher-order thinking. These levels are:

* + **Remembering (C1):** Recalling facts, definitions, or concepts.
  + **Understanding (C2):** Explaining ideas or concepts in your own words.
  + **Applying (C3):** Using knowledge in new situations or to solve problems.
  + **Analyzing (C4):** Breaking down information into parts and examining relationships.
  + **Evaluating (C5):** Making judgments or forming opinions based on criteria or standards.
  + **Creating (C6):** Combining elements to form a new, original whole.

The cognitive domain emphasizes the development of critical thinking, problem-solving, and creativity. As learners progress through these levels, they move from simple recall to complex, original thinking, which is crucial for deeper learning.

The **affective domain** of Bloom's Taxonomy focuses on emotions, attitudes, values, and feelings. It deals with how learners respond to stimuli, including their ability to organize values, form opinions, and adopt behaviors. This domain has five levels, which reflect increasing degrees of emotional involvement:

* **Receiving (A1):** Being aware of or paying attention to stimuli.
* **Responding (A2):** Actively participating or reacting to stimuli.
* **Valuing (A3):** Recognizing the worth of something and showing a commitment to it.
* **Organizing (A4):** Integrating new values with existing ones and prioritizing them.
* **Characterizing (A5):** Adopting values or behaviors consistently, leading to a new worldview or lifestyle.

The affective domain emphasizes emotional development and personal growth, helping learners not only acquire knowledge but also shape their attitudes, motivations, and values in various contexts. It's particularly important in fostering empathy, social responsibility, and ethical decision-making.

The **psychomotor domain** of Bloom's Taxonomy focuses on physical skills and the ability to perform tasks that require hand-eye coordination, fine motor skills, and physical manipulation. This domain is concerned with the development of motor skills through practice and the application of physical abilities. It includes several levels of increasing complexity:

* **Perception (P1):** The ability to use sensory cues to guide physical actions (e.g., using sight or hearing to guide a task).
* **Set (P2):** Being ready to perform a task by having the necessary mental, physical, and emotional state.
* **Guided Response (P3):** Performing tasks under guidance, often with practice or in a controlled environment.
* **Mechanism (P4):** The ability to perform tasks with proficiency and some degree of independence.
* **Complex Overt Response (P5):** Performing tasks skillfully and efficiently, often automatically.
* **Adaptation (P6):** Adjusting or modifying skills to meet changing conditions or to solve new problems.
* **Origination (P7):** Creating new movements or patterns of behavior based on high-level mastery of skills.

## Program Structure:

The structure of Bachelor of Science in Computer Science (BSCS) program is shown below:

|  |  |
| --- | --- |
| **Structure of BS(CS) Program**  Total Credit Hours: 136  Total Courses: 44  Semesters: 8  Duration: 4 Years | **Category: Courses (Credit Hours)**  General Education: 12 (30)  Major courses: 18 (64) + 7 (21)  Allied/interdisciplinary courses: 5 (15)  Internship/field experience: N/A  Capstone project: 2 (6)  Total: 44 (136) |

**CURRICULUM PLAN FOR BS (COMPUTER SCIENCE)**

**(04 Year Degree Program)-2024**

# Scheme of Studies of BS Computer Science

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **S#** | **COURSE CODES** | | **CLASS** | **COURSE TITLE** | | **CREDIT HOURS** | **PRE-REQ** | **CO-REQ** | |
| **SEMESTER 1** | | | | | | | | | |
| 1 | CMC111 | | CORE | Programming Fundamentals | | 3 + 0 | - | CMC111-L | |
|  | CMC111-L | | CORE | Programming Fundamentals (Lab) | | 0 + 1 |  |  | |
| 2 | GER111 | | GER | Application of Information & Communication Technologies | | 2 + 0 | - | GER111-L | |
|  | GER111-L | | GER | Application of Information & Communication Technologies (Lab) | | 0 + 1 |  |  | |
| 3 | GER121 | | GER | Functional English | | 3 + 0 | - |  | |
| 4 | GER131 | | GER | Calculus and Analytic Geometry | | 3 + 0 | - |  | |
| 5 | GER152 | | GER | Natural Science (Applied Physics) | | 2 + 0 | - | GER152-L | |
|  | GER152-L | | GER | Natural Science (Applied Physics (Lab)) | | 0 + 1 |  |  | |
| 6 | GER141 | | GER | Islamic Studies | | 2 + 0 | - |  | |
|  |  | |  |  | | **15+3 (18)** |  |  | |
| **SEMESTER 2** | | | | | | | | | |
| 1 | MTE111 | | MATHS | Multivariable Calculus | | 3 + 0 | GER131 |  | |
| 2 | CMC112 | | CORE | Object Oriented Programming | | 3 + 0 | CMC111 | CMC112-L | |
|  | CMC112-L | | CORE | Object Oriented Programming (Lab) | | 0 + 1 | CMC111-L |  | |
| 3 | CMC123 | | CORE | Digital Logic Design | | 2 + 0 | GER152 | CMC121-L | |
|  | CMC123-L | | CORE | Digital Logic Design (Lab) | | 0 + 1 | GER152-L |  | |
| 4 | GER122 | | GER | Expository Writing | | 3 + 0 | GER121 |  | |
| 5 | GER132 | | GER | Discrete Structures | | 3 + 0 | GER131 |  | |
| 6 | GER142 | | GER | Ideology and Constitution of Pakistan | | 2 + 0 | - |  | |
|  |  | |  |  | | **16+2 (18)** |  |  | |
| **SEMESTER 3** | | | | | | | | | |
| 1 | | MTE212 | MATHS | | Probability & Statistics | 3 + 0 | MTE111 | |  |
| 2 | | CMC222 | CORE | | Computer Organization & Assembly Language | 3 + 0 | CMC121 | | CMC222-L |
|  | | CMC222-L | CORE | | Computer Organization & Assembly Language (Lab) | 0 + 1 | CMC121-L | |  |
| 3 | | CMC251 | CORE | | Data Structures | 3 + 0 | CMC112 | | CMC251-L |
|  | | CMC251-L | CORE | | Data Structures (Lab) | 0 + 1 | CMC112-L | |  |
| 4 | | AIC211 | DOMAIN CORE | | Artificial Intelligence | 2 + 0 | CMC112 | | CMC 112-L |
|  | | AIC211-L | DOMAIN CORE | | Artificial Intelligence (Lab) | 0 + 1 | CMC 112-L | |  |
| 5 | | CMC261 | CORE | | Computer Networks | 3 + 0 | CMC123 | | CMC261-L |
|  | | CMC261-L | CORE | | Computer Networks (Lab) | 0 + 1 | CMC123-L | |  |
|  | |  |  | |  | **14+4(18)** |  | |  |
| **SEMESTER 4** | | | | | | | | | |
| 1 | | MTE213 | MATH | | Linear Algebra | 3 + 0 | MTE212 | |  |
| 2 | | MTE221 | GER | | Technical & Business Writing | 3 + 0 | GER122 | |  |
| 3 | | AIC212 | DOMAIN CORE | | Programming for AI | 2 + 0 | AIC211 | | AIC212-L |
|  | | AIC212-L | DOMAIN CORE | | Programming for AI (Lab) | 0 + 1 | AIC211-L | |  |
| 4 | | CMC241 | CORE | | Operating Systems | 3 + 0 | CMC251 | | CMC241-L |
|  | | CMC241-L | CORE | | Operating Systems (Lab) | 0 + 1 | CMC251-L | |  |
| 5 | | CMC252 | CORE | | Analysis of Algorithms | 3 + 0 | CMC251 | |  |
| 6 | | GERXXX | GER | | Social Science (ELECTIVE 1)(GRE – Intro to Mgmt.) | 2 + 0 | GER122 | |  |
|  | |  |  | |  | **16+2 (18)** |  | |  |
| **SEMESTER 5** | | | | | | | | | |
| 1 | | CMC331 | CORE | | Database Systems | 3 + 0 | CMC241 | | CMC331-L |
|  | | CMC331-L | CORE | | Database Systems (Lab) | 0 + 1 | CMC241-L | |  |
| 2 | | AIC221 | DOMAIN CORE | | Introduction to Machine Learning | 2 + 0 | AIC211 | | AIC221-L |
|  | | AIC221-L | DOMAIN CORE | | Introduction to Machine Learning (Lab) | 0 + 1 | AIC211-L | |  |
| 3 | | CMC362 | CORE | | Information Security | 3 + 0 | CMC21161 | | CMC362-L |
|  | | CMC362-L | CORE | | Information Security (Lab) | 0 + 1 | CMC261-L | |  |
| 4 | | CMC371 | CORE | | Software Engineering | 3 + 0 | CMC253 | |  |
| 5 | | CSEXXX | DOMAIN ELEC | | Domain Elective 1 | 3 + 0 | - | |  |
|  | |  |  | |  | **14+3 (17)** |  | |  |
| **SEMESTER 6** | | | | | | | | | |
| 1 | | AIC322 | DOMAIN CORE | | Artificial Neural Networks and Deep Learning | 3 + 0 | AIC221 | | AIC322-L |
|  | | AIC322-L | DOMAIN CORE | | Artificial Neural Networks and Deep Learning (Lab) | 0 + 1 | AIC221-L | |  |
| 2 | | AIE423 | DOMAIN CORE | | Computer Vision | 2 + 0 | AIC221/ AIC211 | | AIE423-L |
|  | | AIE423-L | DOMAIN CORE | | Computer Vision (Lab) | 0 + 1 | AIC221/AIC211 | |  |
| 3 | | AIC331 | DOMAIN CORE | | Knowledge Representation and Reasoning | 2 + 0 | CMC331 | | AIC331-L |
|  | | AIC331-L | DOMAIN CORE | | Knowledge Representation and Reasoning (Lab) | 0 + 1 | CMC331-L | |  |
| 4 | | CSEXXX | DOMAIN ELEC | | Domain Elective 2 | 2 + 1 | - | |  |
| 5 | | ESCXXX | GER | | Social Science II (ESC311 – Intro to Mark.) | 3 + 0 | - | |  |
| 6 | | GER141 | GER | | Islamic Studies | 2 + 0 | - | |  |
|  | |  |  | |  | **14+4(18)** |  | |  |
| **SEMESTER 7** | | | | | | | | | |
| 1 | | CSC442 | DOMAIN CORE | | Parallel & Distributed Computing | 3 + 0 | CMC241/ AIC322 | | CSC442-L |
|  | | CSC442-L | DOMAIN CORE | | Parallel & Distributed Computing (Lab) | 0 + 1 | CMC241-L/ AIC322-L | |  |
| 2 | | GER462 | GER | | Technopreneur ship | 2 + 0 | - | |  |
| 3 | | CMC491 | CORE | | Final Year Project - I | 0 + 3 | CMC371/AIC322 | |  |
| 4 | | CSEXXX | DOMAIN ELEC | | Domain Elective 3 | 2 + 1 | - | |  |
| 5 | | CSEXXX | DOMAIN ELEC | | Domain Elective 4 | 2 + 1 | - | |  |
| 6 | | CSEXXX | DOMAIN ELEC | | Domain Elective 5 | 2 + 1 | - | |  |
|  | |  |  | |  | **11+7(18)** |  | |  |
| **SEMESTER 8** | | | | | | | | | |
| 1 | | GER443 | GER | | Civics and Community Engagement | 2 + 0 | - | |  |
| 2 | | GER463 | GER | | Professional Practices | 2 + 0 | - | |  |
| 3 | | CMC492 | CORE | | Final Year Project - II | 0 + 3 | CMC491 | |  |
| 4 | | CSEXXX | DOMAIN ELEC | | Domain Elective 6 | 2 + 1 | - | |  |
| 5 | | CSEXXX | DOMAIN ELEC | | Domain Elective 7 | 2 + 1 | - | |  |
|  | |  |  | |  | **8+5(13)** |  | |  |
|  | |  |  | | **TOTAL CREDIT HOURS** | **136** |  | |  |

**Total Credit Hours: 136**

*\*\*Campus will decide to offer a course.*

**Note:**

1. One credit hour is equal to 3 contact hours for lab course and 1 contact hour for theory course.
2. Elective courses will be selected in a semester from the list of electives in each domain based on the availability of instructor, market trend and fulfilling the required number of students’ registrations.
3. Theory and Lab are treated as separate courses.
4. Lab courses have “L” at the end of Course Code.

## List of Elective Courses:

**List of Elective Courses for BS (Computer Science) Program**

**Social Science Course(s):**

|  |  |  |  |
| --- | --- | --- | --- |
| **S.No** | **Course Code** | **Title** | **Cr.Hrs** |
| 1 | GER261 | Introduction to Management | 2 |
| 2 | ESC311 | Introduction to Marketing | 3 |

**Domain Elective 1 Course(s):**

|  |  |  |  |
| --- | --- | --- | --- |
| **S.No** | **Course Code** | **Title** | **Cr.Hrs** |
| 1 | CSEXXX | Information System Audit | 3 + 0 |
| 2 | CSEXXX | Artificial Neural Networks | 3 + 0 |
| 3 | CSEXXX | Numerical Analysis | 3 + 0 |
| 4 | CSEXXX | Internet of Things | 3 + 0 |
| 5 | CSEXXX | Design Patterns | 3 + 0 |

**Domain Elective 2 Course(s):**

|  |  |  |  |
| --- | --- | --- | --- |
| **S.No** | **Course Code** | **Title** | **Cr.Hrs** |
| 1 | CSEXXX | Advanced Programming – Visual Prog + Lab | 2 + 1 |
| 2 | CSEXXX | Web Engineering + Lab | 2 + 1 |
| 3 | CSEXXX | Software Testing & Quality Assurance + Lab | 2 + 1 |

**Domain Elective 3 Course(s):**

|  |  |  |  |
| --- | --- | --- | --- |
| **S.No** | **Course Code** | **Title** | **Cr.Hrs** |
| 1 | CSEXXX | FPGA Based System Design + Lab | 2 + 1 |
| 2 | CSEXXX | E-Business + Lab | 2 + 1 |
| 3 | CSEXXX | Data Warehousing & Data Mining + Lab | 2 + 1 |

**Domain Elective 4 Course(s):**

|  |  |  |  |
| --- | --- | --- | --- |
| **S.No** | **Course Code** | **Title** | **Cr.Hrs** |
| 1 | CSEXXX | Routing & Switching + Lab | 2 + 1 |
| 2 | CSEXXX | Virtualization & Cloud Computing | 2 + 1 |
| 3 | CSEXXX | Machine Learning | 2 + 1 |

**Domain Elective 5 Course(s):**

|  |  |  |  |
| --- | --- | --- | --- |
| **S.No** | **Course Code** | **Title** | **Cr.Hrs** |
| 1 | CSEXXX | Web Technologies + Lab | 2 + 1 |
| 2 | CSEXXX | Mobile Application Development 1 + Lab | 2 + 1 |
| 3 | CSEXXX | Cyber Security Lab | 2 + 1 |

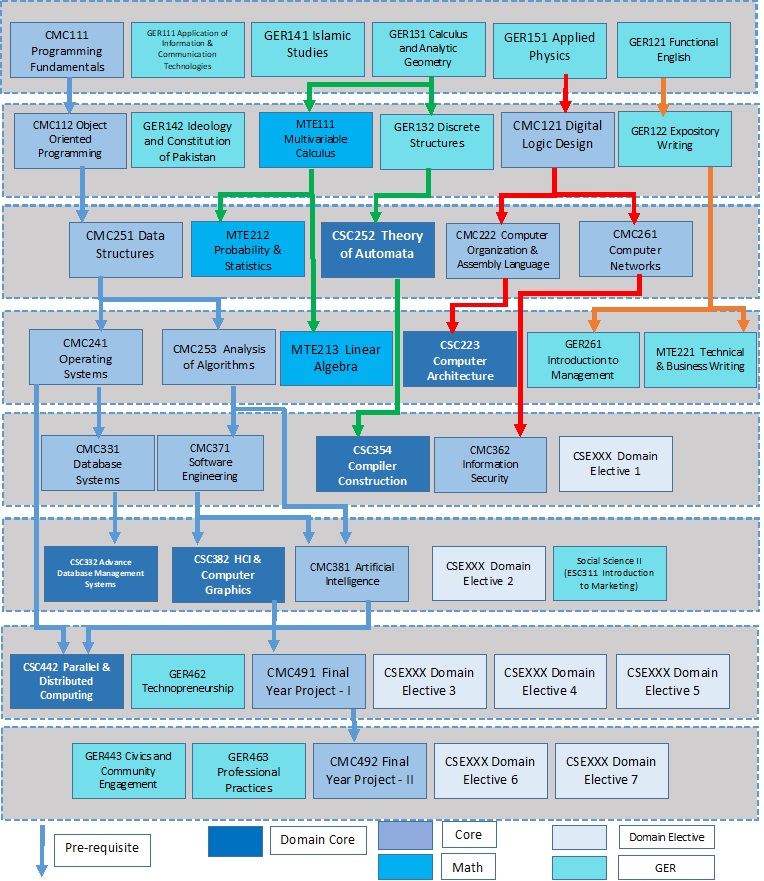
**Domain Elective 6 Course(s):**

|  |  |  |  |
| --- | --- | --- | --- |
| **S.No** | **Course Code** | **Title** | **Cr.Hrs** |
| 1 | CSEXXX | Embedded Systems + Lab | 2 + 1 |
| 2 | CSEXXX | Digital Image Processing + Lab | 2 + 1 |

**Domain Elective 7 Course(s):**

|  |  |  |  |
| --- | --- | --- | --- |
| **S.No** | **Course Code** | **Title** | **Cr.Hrs** |
| 1 | CSEXXX | Software Testing & Quality Assurance + Lab | 2 + 1 |
| 2 | CSEXXX | Web Technologies + Lab | 2 + 1 |

## Courses Flowchart:



## Curriculum mapping:

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Course Count** | **Semester** | **Course Code** | **Domain** | **Course Name** | **Credit Hour** | **SDGs** | **Knowledge Areas** | **GA1** | **GA2** | **GA3** | **GA4** | **GA5** | **GA6** | **GA7** | **GA8** | **GA9** | **GA10** |
| 1 | **1** | CMC111 | CORE | Programming Fundamentals | 3 | 9 | 14 | TRUE | **C2,C2** |  | **C3** |  |  |  |  |  |  |
| CMC111L | CORE | Programming Fundamentals Lab | 1 | 9 | 14 | TRUE | **C3** | **P3** | **A3** |  |  |  |  |  |  |
| 2 | GER111 | GER | Application of Information & Communication Technologies | 2 | 9 | 14 | TRUE | **C2,C2** |  |  | **C3** |  |  |  |  |  |
| GER111L | GER | Application of Information & Communication Technologies Lab | 1 | 9 | 14 | TRUE | **C2** |  |  |  | **A2** | **P2** |  |  |  |
| 3 | GER121 | GER | Functional English | 3 | 10 |  | TRUE |  |  |  |  |  | **C3,A3,A2** |  |  |  |
| 4 | GER131 | GER | Calculus and Analytic Geometry | 3 | 4 | 4 | TRUE | **C2** | **C3,C3** |  |  |  |  |  |  |  |
| 5 | GER141 | GER | Islamic Studies | 2 | 12,16,10 | 18 | TRUE |  |  |  |  | **A2** |  |  | **C2** | **C2** |
| 6 | GER151 | GER | Natural Science (Applied Physics) | 2 | 4 |  | TRUE | **C2,C3,C3** |  |  |  |  |  |  |  |  |
| GER151L | GER | Natural Science (Applied Physics) Lab | 1 | 4 |  | TRUE | **P3** |  |  |  |  | **A2** |  |  |  |
| 7 | **2** | MTE111 | MATHS | Multivariable Calculus | 3 | 4 | 4 | TRUE | **C2** | **C3,C3** |  |  |  |  |  |  |  |
| 8 | CMC112 | CORE | Object Oriented Programming | 3 | 9 | 14 | TRUE | **C2,C3** |  | **C4** |  |  |  |  |  |  |
| CMC112L | CORE | Object Oriented Programming Lab | 1 | 9 | 14 | TRUE | **P2** |  |  | **C3** | **A3** |  |  |  |  |
| 9 | CMC121 | CORE | Digital Logic Design | 2 | 4 | 2 | TRUE | **C2,C3** | **C4** |  |  |  |  |  |  |  |
| CMC121L | CORE | Digital Logic Design Lab | 1 | 4 | 2 | TRUE |  | **A3** |  | **P3** |  |  |  |  |  |
| 10 | GER122 | GER | Expository Writing | 3 | 8,10 | 18 | TRUE |  |  |  |  | **A3** | **A2, C3** |  |  |  |
| 11 | GER132 | GER | Discrete Structures | 3 | 4 | 4 | TRUE | **C2,C3** | **C3** |  |  |  |  |  |  |  |
| 12 | GER142 | GER | Ideology and Constitution of Pakistan | 2 | 12,16 |  | TRUE |  |  |  |  |  |  | **A2** | **C2** | **C2** |
| 13 | **3** | MTE212 | MATHS | Probability & Statistics | 3 | 4 | 4 | TRUE | **C3,C3** | **C3** |  |  |  |  |  |  |  |
| 14 | CMC222 | CORE | Computer Organization & Assembly Language | 3 | 4 | 2 | TRUE | **C2,C3** | **C4** |  |  |  |  |  |  |  |
| CMC222L | CORE | Computer Organization & Assembly Language Lab | 1 | 4 | 2 | TRUE |  | **A3** |  | **P3** |  |  |  |  |  |
| 15 | CMC251 | CORE | Data Structures | 3 | 4 | 1 | TRUE | **C2** | **C4** |  | **C3** |  |  |  |  |  |
| CMC251L | CORE | Data Structures Lab | 1 | 4 | 1 | TRUE | **P3** |  |  | **C3** | **A3** |  |  |  |  |
| 16 | CSC252 | DOMAIN CORE | Theory of Automata | 3 | 4 | 1 | TRUE | **C2** | **C4** | **C5** |  |  |  |  |  |  |
| 17 | CMC261 | CORE | Computer Networks | 3 | 9 | 10 | TRUE | **C2,C4** | **C4** |  |  |  |  |  |  |  |
| CMC261L | CORE | Computer Networks Lab | 1 | 9 | 10 | TRUE | **P1** |  | **C4** |  | **A2** |  |  |  |  |
| 18 | **4** | MTE213 | MATH | Linear Algebra | 3 | 4 | 4 | TRUE | **C2** | **C3,C3** |  |  |  |  |  |  |  |
| 19 | MTE221 | GER | Technical & Business Writing | 3 | 8 | 18 | TRUE |  |  |  |  |  | **C3,C3** |  | **C3** |  |
| 20 | CSC223 | DOMAIN CORE | Computer Architecture | 2 | 4 | 2 | TRUE | **C2,C3** |  |  |  | **C6** |  |  |  |  |
| CSC223L | DOMAIN CORE | Computer Architecture Lab | 1 | 4 | 2 | TRUE | **P3** |  |  |  | **A3** |  |  |  |  |
| 21 | CMC241 | CORE | Operating Systems | 3 | 9 | 11 | TRUE | **C2,C3** | **C4** |  |  |  |  |  |  |  |
| CMC241L | CORE | Operating Systems lab | 1 | 9 | 11 | TRUE | **C3** |  |  |  | **A2** |  |  |  |  |
| 22 | CMC253 | CORE | Analysis of Algorithms | 3 | 4 | 1 | TRUE | **C2** | **C4** | **C6** |  |  |  |  |  |  |
| 23 | GERXXX | GER | Social Science I (Introduction to Management) | 2 | 8,17 | 18 | TRUE |  | **C2,C3** |  |  | **A3** |  |  |  |  |
| 24 | **5** | CMC331 | CORE | Database Systems | 3 | 4 | 8 | TRUE | **C2** | **C4** |  | **C3** |  |  |  |  |  |
| CMC331L | CORE | Database Systems Lab | 1 | 4 | 8 | TRUE | **P3** | **C4** |  |  | **A3** |  |  |  |  |
| 25 | CSC354 | DOMAIN CORE | Compiler Construction | 2 | 4,9 | 14 | TRUE | **C2** | **C4** | **C5** |  |  |  |  |  |  |
| CSC354L | DOMAIN CORE | Compiler Construction Lab | 1 | 4,9 | 14 | TRUE | **P3** |  |  |  | **A3** |  |  |  |  |
| 26 | CMC362 | CORE | Information Security | 3 | 9 | 7 | TRUE | **C2** | **C4** | **C6** |  |  |  |  |  |  |
| CMC362L | CORE | Information Security Lab | 1 | 9 | 7 | TRUE | **P1** |  | **C4** |  | **A2** |  |  |  |  |
| 27 | CMC371 | CORE | Software Engineering | 3 | 4 | 16 | TRUE | **C2,C3** | **C4** |  |  |  |  |  |  |  |
| 28 | CSEXXX | DOMAIN ELEC | Domain Elective 1 | 3 |  |  | TRUE |  |  |  |  |  |  |  |  |  |
| 29 | **6** | CSC332 | DOMAIN CORE | Advance Database Management Systems | 2 | 4 | 8 | TRUE | **C2** | **C3** |  | **C4** |  |  |  |  |  |
| CSC332L | DOMAIN CORE | Advance Database Management Systems Lab | 1 | 4 | 8 | TRUE | **P3** | **C4** |  |  | **A3** |  |  |  |  |
| 30 | CMC381 | CORE | Artificial Intelligence | 3 | 9 | 9 | TRUE | **C2** |  | **C4** | **C3** |  |  |  |  |  |
| CMC381L | CORE | Artificial Intelligence Lab | 1 | 9 | 9 | TRUE | **C3** |  |  | **P2** |  |  |  |  |  |
| 31 | CSC382 | DOMAIN CORE | HCI & Computer Graphics | 2 | 9 | 6 | TRUE |  | **C3** | **C4** | **C6** |  |  |  |  |  |
| CSC382L | DOMAIN CORE | HCI & Computer Graphics Lab | 1 | 9 | 6 | TRUE | **C3** |  |  |  |  |  |  | **A3** |  |
| 32 | CSEXXX | DOMAIN ELEC | Domain Elective 2 | 2 |  |  | TRUE |  |  |  |  |  |  |  |  |  |
| CSEXXX | DOMAIN ELEC | Domain Elective 2 | 1 |  |  | TRUE |  |  |  |  |  |  |  |  |  |
| 33 | ESCXXX | GER | Social Science II (Introduction to Marketing) | 3 | 17 | 18 | TRUE |  |  |  |  |  | **C4** | **C2** | **A2** |  |
| 34 | **7** | CSC442 | DOMAIN CORE | Parallel & Distributed Computing | 3 | 4 | 13 | TRUE | **C2** |  | **C4** | **C6** |  |  |  |  |  |
| CSC442L | DOMAIN CORE | Parallel & Distributed Computing Lab | 1 | 4 | 13 | TRUE |  |  |  | **P4** | **A4** |  |  |  |  |
| 35 | GER462 | GER | Technopreneurship | 2 | 9,5,10,1 | 18 | TRUE |  |  |  |  |  | **C3** |  | **A4** | **C6** |
| 36 | CMC491 | CORE | Final Year Project - I | 3 |  |  | TRUE |  |  |  |  |  |  |  |  |  |
| 37 | CSEXXX | DOMAIN ELEC | Domain Elective 3 | 2 |  |  | TRUE |  |  |  |  |  |  |  |  |  |
| CSEXXX | DOMAIN ELEC | Domain Elective 3 | 1 |  |  | TRUE |  |  |  |  |  |  |  |  |  |
| 38 | CSEXXX | DOMAIN ELEC | Domain Elective 4 | 2 |  |  | TRUE |  |  |  |  |  |  |  |  |  |
| CSEXXX | DOMAIN ELEC | Domain Elective 4 | 1 |  |  | TRUE |  |  |  |  |  |  |  |  |  |
| 39 | CSEXXX | DOMAIN ELEC | Domain Elective 5 | 2 |  |  | TRUE |  |  |  |  |  |  |  |  |  |
| CSEXXX | DOMAIN ELEC | Domain Elective 5 | 1 |  |  | TRUE |  |  |  |  |  |  |  |  |  |
| 40 | **8** | GER443 | GER | Civics and Community Engagement | 2 | 16,17 | 18 | TRUE |  |  |  |  |  |  | **C2** | **C4** | **A4** |
| 41 | GER463 | GER | Professional Practices | 2 | 8 | 18 | TRUE |  |  |  |  |  |  | **C3** | **A2** | **C2** |
| 42 | CMC492 | CORE | Final Year Project - II | 3 |  |  | TRUE | **C3** | **C4** | **C4,C5** | **P4** | **A3** | **A1,A2** | **A2,A4** | **A2** | **C6** |
| 43 | CSEXXX | DOMAIN ELEC | Domain Elective 6 | 2 |  |  | TRUE |  |  |  |  |  |  |  |  |  |
| CSEXXX | DOMAIN ELEC | Domain Elective 6 | 1 |  |  | TRUE |  |  |  |  |  |  |  |  |  |
| 44 | CSEXXX | DOMAIN ELEC | Domain Elective 7 | 2 |  |  | TRUE |  |  |  |  |  |  |  |  |  |
| CSEXXX | DOMAIN ELEC | Domain Elective 7 | 1 |  |  | TRUE |  |  |  |  |  |  |  |  |  |

## Graduate Attributes (GAs) distribution in Curriculum:

The graduate attributes (GAs) are mapped on all courses as shown in curriculum mapping. The count and distribution of GAs in curriculum are shown below:

\*GA1 is mapped on all courses.

## Sustainable Development Goals (SDGs) distribution in Curriculum:

The SDGs are mapped on different courses as shown in curriculum mapping. The coverage of SDGs in curriculum is shown below:

## Knowledge Area (KAs) distribution in Curriculum:

The knowledge area (KAs) are mapped on different courses as shown in curriculum mapping. The count and distribution of KAs in curriculum are shown below:

## 

## Learning Domain Distribution in Curriculum:

Mapping Bloom's Taxonomy to courses in a curriculum is crucial for structuring educational content in a way that fosters the development of different cognitive, affective and psychomotor skills in students. The count and distribution of learning domains in curriculum are shown below:

Learning Domain Distribution in Curriculum

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Graduate Attributes** | | **Cognitive Domain** | | | | | | **Psychomotor Domain** | | | | | | **Affective Domain** | | | | |
| **C1** | **C2** | **C3** | **C4** | **C5** | **C6** | **P1** | **P2** | **P3** | **P4** | **P5** | **P6** | **A1** | **A2** | **A3** | **A4** | **A5** |
| **GA -1** | **Academic Education** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **GA -2** | **Knowledge for Solving Computing Problems** | 0 | 26 | 16 | 1 | 0 | 0 | 2 | 1 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **GA -3** | **Problem Analysis** | 0 | 1 | 11 | 14 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 |
| **GA -4** | **Design/ Development of Solutions** | 0 | 0 | 1 | 7 | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| **GA -5** | **Modern Tool Usage** | 0 | 0 | 6 | 1 | 0 | 2 | 0 | 1 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **GA -6** | **Individual and Team Work** | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 9 | 1 | 0 |
| **GA -7** | **Communication** | 0 | 0 | 5 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 4 | 1 | 0 | 0 |
| **GA -8** | **Computing Professionalism and Society** | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 1 | 0 |
| **GA -9** | **Ethics** | 0 | 2 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 1 | 1 | 0 |
| **GA -10** | **Life-long Learning** | 0 | 3 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| **Domain Occurrences** | | **0** | **34** | **41** | **25** | **3** | **7** | **2** | **3** | **9** | **2** | **0** | **0** | **1** | **13** | **14** | **4** | **0** |

# SEMESTER WISE COURSE INFORMATION SHEETS (CIS)

## SEMESTER 1

|  |  |  |  |
| --- | --- | --- | --- |
| **S.No** | **Course Code** | **Title** | **Cr.Hrs** |
| 1 | CMC111 | Programming Fundamentals | 3 + 0 |
| 2 | CMC111-L | Programming Fundamentals (Lab) | 0 + 1 |
| 3 | GER111 | Application of Information & Communication Technologies | 2 + 0 |
| 4 | GER111-L | Application of Information & Communication Technologies (Lab) | 0 + 1 |
| 5 | GER121 | Functional English | 3 + 0 |
| 6 | GER131 | Calculus and Analytic Geometry | 3 + 0 |
| 7 | GER151 | Natural Science (Applied Physics) | 2 + 0 |
| 8 | GER151-L | Natural Science (Applied Physics (Lab)) | 0 + 1 |
| 9 | GER141 | Islamic Studies | 2 + 0 |
|  |  |  | **15+3 (18)** |

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| **IQRA University (IU)** | | |
| **Faculty of Engineering Sciences and Technology (FEST)** | | |
| **Computer Science Department (CS)** | | |
| **Course Code** | **Course Name** | **Credit Hr** |
| **CMC111** | Programming Fundamentals | **3+1** |

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| --- | --- | --- | --- |
| 1. **Basic Information** | | | |
| **Instructor** |  | **Designation** |  |
| **Prerequisite(s)** | None | **Semester** |  |
| **Email** |  | **Phone** |  |
| **Consulting Hours** |  | **Office Location** |  |

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| --- |
| 1. **Course Objective(s)** |
| The objective of Programming Fundamentals is to provide students with foundational understanding and practical skills in programming. Students will learn fundamental concepts, algorithm design, and coding techniques. The course aims to instill proficiency in writing efficient, maintainable code using various programming languages. By the end, students will be able to analyze problems, design solutions, and debug programs. Ultimately, the goal is to cultivate logical thinking and problem-solving abilities essential for further studies and software development. |

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| --- |
| 1. **Course Contents** |
| Introduction to problem solving, 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, multi-dimensional 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. |

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| 1. **Course Learning Outcomes** | | | | | | |
| **CLOs** | **CLO Statement** | **BT Level** | **Mapping** | | | **% Weight** |
| **GAs** | **ACM KA** | **SGDs** |
| CLO1 | **Understand** basic problem-solving steps and logic constructs | C2 | GA2 | #14  PL | 9 | 31% |
| CLO2 | **Determine** programming construct and articulate how it is used to achieve desired output | C2 | GA2 | 34% |
| CLO3 | **Construct** a computer program to a well-defined problem. This includes developing a general flow of logic, identifying the variables, conditional/iterative execution, fail conditions | C3 | GA4 | 35% |
| ***Note: On successful completion of course GA1 (Academic Education) will automatically attain.*** | | | | | | |

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| 1. **Course Textbook / Reference Books and Supplementary Reading Material** | | | |
| **#** | **Book Title** | **Author(s)** | **Edition/ publication year/publisher** |
| 1. 1 | Problem Solving and Program Design in C | Jeri R. Hanly & Elliot B. Koffman | Eighth Edition / 2016 |
| 1. 2 | C How to Program | Paul Deitel & Harvey Deitel | Ninth Edition / 2022 / Pearson Education, Inc |
| 1. 3 | Let us C | Yashavant P. Kanetkar | Fifteenth Edition / 2017 |

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| 1. **CLO Outcome Based Assessment (OBA) Tentative** | | | | | | |
| **Assessment Tool** | | **CLO Mapped** | **CLO Marks** | **% Weight** | **Total Marks** | **Assessment Date** |
| **Quizzes**  **10** | Quiz #1 | CLO 1 | 3 | 30% | 3 | TBD |
| Quiz #2 | CLO 2 | 3 | 30% | 3 | TBD |
| Quiz #3 | CLO 3 | 4 | 40% | 4 | TBD |
| **Total Quizzes %** | | | **100%** | 10 |  |
|  | | | | | | |
| **Assignments**  **15** | Assignment #1 | CLO 1 | 5 | 33% | 5 | TBD |
| Assignment #2 | CLO 2 | 5 | 33% | 5 | TBD |
| Assignment #3 | CLO 3 | 5 | 33% | 5 | TBD |
|  | **Total Assignments %** | | | **100%** | 15 |  |
|  | | | | | | |
| **Midterm**  **25** | Midterm Q#1 | CLO 1 | 5 | 20% | **5** | TBD |
| Midterm Q#2 | CLO 1 | 5 | 20% | **5** | TBD |
| Midterm Q#3 | CLO 1 | 5 | 20% | **5** | TBD |
| Midterm Q#4 | CLO 2 | 5 | 20% | **5** | TBD |
| Midterm Q#5 | CLO 2 | 5 | 20% | **5** | TBD |
|  | **Total Midterm %** | | | **100%** | **25** |  |
|  | | | | | | |
| **Project/CCP**  **10** | Project/CCP | CLO3 | 10 | **100%** | **10** | **TBD** |
|  | **Total Project /CCP %** | | | **100%** |  |  |
|  | | | | | | |
| **Final Exam**  **40** | Final Q #1 | CLO1 | 8 | 20% | 8 | TBD |
| Final Q#2 | CLO2 | 8 | 20% | 8 | TBD |
| Final Q #3 | CLO2 | 8 | 20% | 8 | TBD |
| Final Q#4 | CLO3 | 8 | 20% | 8 | TBD |
| Final Q#5 | CLO3 | 8 | 20% | 8 | TBD |
|  | **Total Final Exam %** | | | **100%** |  |  |
| **100** | **Total Marks** | | | | **100** |  |
| ***Note: Please make sure every CLO must be assessed at least 3 time.*** | | | | | | |

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| 1. **Weekly Plan** | | | | |
| **Week** | **Lecture No** | **Topic Covered** | **CLO** | **Assessment Tool** |
| 1 | 1 | Introduction to problem solving: The importance of problem solving in programming. | **1** |  |
| 2 | What is a computer? | **1** |  |
| 3 | Overview of computer systems, components, and memory | **1** |  |
| 2 | 4 | Introduction to algorithms: What are algorithms and their importance in problem-solving? | **1** |  |
| 5 | Steps in creating an algorithm: Flowcharts, pseudo-code. | **1** |  |
| 6 | Role of the compiler, Compilation process and types of programming languages. | **1** |  |
| 3 | 7 | Introduction to data types: Integers, floats, characters, and Booleans. | **1** |  |
| 8 | Variables: Declaration, initialization, and scope. | **2** |  |
| 9 | Variable naming conventions and memory allocation for variables. | **2** | **Q1** |
| 4 | 10 | Basic input/output constructs: Using standard input/output streams. | **2** |  |
| 11 | Formatting output and handling input. | **2** |  |
| 12 | Practice exercises for input/output operations | **2** | **A1** |
| 5 | 13 | Arithmetic operators: Addition, subtraction, multiplication, division. | **2** |  |
| 14 | Comparison operators: Equal to, greater than, less than. | **2** |  |
| 15 | Logical operators: AND, OR, NOT. | **2** |  |
| 6 | 16 | Introduction to conditional statements: if, else if, and else. | **1** |  |
| 17 | Execution flow for conditional statements. | **2** |  |
| 18 | Nested conditionals and practical exercises. | **2** | **Q2** |
| **7** | 19 | Introduction to repetitive statements: for, while, and do-while loops. | **1** |  |
| 20 | Loop control: Break, continue, and nested loops. | **2** |
| 21 | **Project / CCP Discussion and Group allocation** | **3** |
| **8** | **Midterm Exam** | | | |
| 9 | 22 | Introduction to lists/arrays: Concept and basic operations. | **2** |  |
| 23 | Memory organization of lists: How arrays are stored in memory. | **2** |  |
| 24 | Manipulating lists/arrays with practical examples. Array Sorting (bubble sort) | **2** | **A2** |
| 10 | 25 | Introduction to multi-dimensional lists/arrays. | **2** |  |
| 26 | Accessing elements of a 2D array. | **2** |  |
| 27 | Practical examples and exercises with multi-dimensional arrays. | **2** |  |
| 11 | 28 | Concept of modular programming: Functions | **2** |  |
| 29 | Function declaration, definition and calling: Syntax and usage. | **2** |  |
| 30 | Library Functions and User-defined functions, Math Library built-in functions programs | **2** | **Q3** |
| 12 | 31 | Recursive functions | **2** |  |
| 32 | Stack memory: Understanding function call stacks. | **1** |  |
| 33 | Stack rolling (push) and stack unrolling (pop) during function calls. | **1** |  |
| 13 | 34 | Introduction to Pointers. | **1** |  |
| 35 | Building understanding of pointers using examples. | **2** |  |
| 36 | Passing pointers as arguments to the function (Pass by reference) | **2** | **A3** |
| 14 | 37 | Introduction to strings: Declaring, initializing, and storing strings. | **1** |  |
| 38 | String operations: Concatenation, comparison, and manipulation. | **1** |  |
| 49 | practice with string operations. | **2** |  |
| 15 | 40 | Introduction to file input/output: Opening, reading, writing, and closing files. | **1** |  |
| 41 | File handling: Text vs binary files. | **2** |  |
| 42 | Practical exercises: File I/O operations for simple applications. | **2** |  |
| 16 | 43 | Final review of all topics covered. Revision | **1/2/3** |  |
| 44 | **Project / CCP presentations and submissions.** | **3** |  |
| 45 |  |
| **17** | **Final Exam** | | | |

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| 1. **IU Assessment / grading Policy** | **Instructor grading for course \*** |
| Quizzes 10-15%  Assignments 10-15%  Projects/Presentation/CCP 0-10%  Mid Semester Examination/ 20-30%  End Semester Examination 40-50% | 10%  15%  10%  25%  40% |

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| **IQRA University (IU)** | | |
| **Faculty of Engineering Sciences and Technology (FEST)** | | |
| **Computer Science Department (CS)** | | |
| **Course Code** | **Course Name** | **Credit Hr** |
| **CMC111-L** | Programming Fundamentals Lab | **3+1** |

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| --- | --- | --- | --- |
| 1. **Basic Information** | | | |
| **Instructor** |  | **Designation** |  |
| **Prerequisite(s)** | None | **Semester** |  |
| **Email** |  | **Phone** |  |
| **Consulting Hours** |  | **Office Location** |  |

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| 1. **Course Objective(s)** |
| The objective of Programming Fundamentals is to provide students with foundational understanding and practical skills in programming. Students will learn fundamental concepts, algorithm design, and coding techniques. The course aims to instill proficiency in writing efficient, maintainable code using various programming languages. By the end, students will be able to analyze problems, design solutions, and debug programs. Ultimately, the goal is to cultivate logical thinking and problem-solving abilities essential for further studies and software development. |

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| 1. **Course Contents** |
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| 1. **Course Learning Outcomes** | | | | | | |
| **CLOs** | **CLO Statement** | **BT Level** | **Mapping** | | | **% Weight** |
| **GAs** | **ACM KA** | **SGDs** |
| CLO1 | **Performs** a Lab Task as demonstrated. Follow instructions to build a solution. Responds to hand-signals of instructor while learning to use an IDE. | P3 | GA3 | #14  PL | 9 | 31% |
| CLO2 | **Apply** knowledge of C programming concepts (conditional statements, loops, functions, arrays, structures, pointers, and file handling) using critical thinking and debugging strategies to solve computational problems. | C3 | GA2 | 34% |
| CLO3 | **Describe** and **differentiate** C programming knowledge to solve computational problems by applying critical thinking and debugging strategies. | A3 | GA4 | 35% |
| ***Note: On successful completion of course GA1 (Academic Education) will automatically attain.*** | | | | | | |

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| --- | --- | --- | --- |
| 1. **Course Textbook / Reference Books and Supplementary Reading Material** | | | |
| **S No** | **Book Title** | **Author(s)** | **Edition/ publication year/publisher** |
| 1. 1 | Problem Solving and Program Design in C | Jeri R. Hanly & Elliot B. Koffman | Eighth Edition / 2016 |
| 1. 2 | C How to Program | Paul Deitel & Harvey Deitel | Ninth Edition / 2022 / Pearson Education, Inc |
| 1. 3 | Let us C | Yashavant P. Kanetkar | Fifteenth Edition / 2017 |

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| 1. **CLO Outcome Based Assessment (OBA) Tentative** | | | | | | |
| **Assessment Tool** | | **CLO Mapped** | **CLO Marks** | **% Weight** | **Total Marks** | **Assessment Date** |
| **Quizzes**  **0** |  |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
| **Total Quizzes %** | | | **0** | 0 |  |
|  | | | | | | |
| **Lab Manual Task**  **15** | Lab task | **CLO 1/2/3** | 15 | **100%** | 15 | TBD |
| **Total Assignments %** | | | **100%** | **15** |  |
|  | | | | | | |
| **Midterm**  **25** | Midterm Q#1 | CLO 1 | 10 | 40% | 10 | TBD |
| Midterm Q#2 | CLO 1 | 10 | 40% | 10 | TBD |
| Midterm Q#3 | CLO 2 | 5 | 20% | 5 | TBD |
|  | **Total Midterm %** | | | **100%** | **25** |  |
|  | | | | | | |
| **Project/OEL**  **20** | Project/OEL | CLO 3 | 20 | 100% | 20 | TBD |
|  | **Total Project /CCP %** | | | **100%** | **20** |  |
|  | | | | | | |
| **Final Exam**  **40** | Final Exam Q#1 | CLO2 | 10 | 25% | 10 | TBD |
| Final Exam Q#2 | CLO2 | 10 | 25% | 10 | TBD |
| Final Exam Q#3 | CLO3 | 20 | 50% | 20 | TBD |
|  | **Total Final Exam %** | | | **100%** | **40** |  |
| **100** | **Total Marks** | | | | **100** |  |
| **Note: Please make sure every CLO must be assessed at least 3 time.** | | | | | | |

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| 1. **Weekly Plan** | | | | |
| **Week**  **No** | **Lab No** | **Lab Description** | **Contact**  **Hr** | **CLO** |
| 1 | 1 | Learn the basics of Scratch programming to create interactive projects. | 3 | **1/2/3** |
| 2 | 2 | Understand and apply blocks and functions in Scratch to build organized, functional projects. | 3 | **1/2/3** |
| 3 | 3 | To Learn about compiler installation, basic C program, basic data types, basic input or output and the use of variables. | 3 | **1/2/3** |
| 4 | 4 | To Learn how to use selection building blocks (if, if-else, Nested if-else and cascaded if-else) To learn Switch Case. To understand the use of Switch Case. | 3 | **1/2/3** |
| 5 | 5 | To learn how to use loop constructs including:  While loop  do While loop  For loop  To learn which problems to use loop constructs on | 3 | **1/2/3** |
| 6 | 6 | To learn how to use nested loop constructs including:  Nested while loop  Nested do-while loop  Nested for loop | 3 | **1/2/3** |
| 7 |  | **Open Ended Lab/ Project / PBL** | 3 | **1/2/3** |
| 8 | Midterm Exam | | | |
| 9 | 7 | To learn about Arrays  Single and multi-dimensional arrays.  Arrays and loops. Sorting data in arrays | 3 | **1/2/3** |
| 10 | 8 | To learn about functions in C language  Why we use functions  How to define and use functions | 3 | **1/2/3** |
| 11 | 9 | To learn about Recursion  Function Call Stack  Stack rolling (push) and stack unrolling (pop) during function calls.  Stack Overflow/ Stack Underflow | 3 | **1/2/3** |
| 12 | 10 | To learn about Pointers.  Building understanding of pointers using examples.  Passing pointers as arguments to the function (Pass by reference) | 3 | **1/2/3** |
| 13 | 11 | To learn about Strings.  To understand how a string constant is stored in an array of characters  To learn the use of character array (String)  To Learn the use of loops with character arrays and string manipulations | 3 | **1/2/3** |
| 14 | 12 | To Learn about Filing , Learning file I/O in C | 3 | **1/2/3** |
| 15 | 13 | Revision and Q/A Session | 3 | **1/2/3** |
| 16 | 14 | **Open Ended Lab/Project / PBL Assessment** | 3 | **1/2/3** |
| 17 | **Final Exam** | | | |

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| 1. **IU Assessment / grading Policy** | **Instructor grading for course \*** |
| Quizzes 0-10%  Labs Task Assessment 10-20%  Projects/OEL/PBL 5-20%  Mid Semester Examination/ 20-30%  End Semester Examination 40-50% | 0  15%  20%  25%  40% |

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| **IQRA University (IU)** | | |
| **Faculty of Engineering Sciences and Technology (FEST)** | | |
| **Computer Science Department (CS)** | | |
| **Course Code** | **Course Name** | **Credit Hr** |
| **GER111** | Application of Information & Communication Technologies | **2+1** |

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| 1. **Basic Information** | | | |
| **Instructor** |  | **Designation** |  |
| **Prerequisite(s)** | None | **Semester** |  |
| **Email** |  | **Phone** |  |
| **Consulting Hours** |  | **Office Location** |  |

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| 1. **Course Objective(s)** |
| As we live in the Computer Age, most of our day-to-day activities are being influenced by the use of computers. While in some areas like Science & Technology improvements cannot be achieved without computer, it has become necessary for everyone to have knowledge of computers. This course, intended for new students without a computer science background, covers the core components seen in a computer science undergraduate curriculum on which other computer science courses. |

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| 1. **Course Contents** |
| This course is designed to act as a foundation to the key concepts and technologies used in the field of Information and Communication Technologies (ICTs) and their applications. It will cover a wide range of topics including computer networking, database systems, web development, programming. The course will also introduce students to the latest trends in the field of ICTs and their applications in various industries. |

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| 1. **Course Learning Outcomes** | | | | | | |
| **CLOs** | **CLO Statement** | **BT Level** | **Mapping** | | | **% Weight** |
| **GAs** | **ACM KA** | **SGDs** |
| CLO1 | **Understand** computer programming and software development basics | C2 | GA2 | #14  PL | 9 | 31% |
| CLO2 | **Understand** emerging technologies and their impact on various fields and industries | C2 | GA2 | 34% |
| CLO3 | **Apply** problem solving skills through the use of the latest tools and develop small scale computer programs. | C3 | GA5 | 35% |
| ***Note: On successful completion of course GA 1 (Academic Education) will automatically attain.*** | | | | | | |

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| 1. **Course Textbook / Reference Books and Supplementary Reading Material** | | | |
| **S No** | **Book Title** | **Author(s)** | **Edition/ publication year/publisher** |
|  | **Discovering Computers: Digital Technology, Data, and Devices,** | Misty E. Vermaat, Susan L. Sebok, Steven M. Freund, Jennifer T. Campbell, and Mark Frydenberg | 17th edition, 2021, Cengage Learning, 2022 |
|  | **Fundamentals of Information and Communication Technologies** | Shun-Ping Chen | Cambridge Scholars Publishing, 2020 |

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| 1. **CLO Outcome Based Assessment (OBA)** | | | | | | |
| **Assessment Tool** | | **CLO Mapped** | **CLO Marks** | **% Weight** | **Total Marks** | **Assessment Date** |
| **Quizzes**  **10** | Quiz #1 | CLO 1 | 3 | 30% | 3 | TBD |
| Quiz #2 | CLO 2 | 3 | 30% | 3 | TBD |
| Quiz #3 | CLO 3 | 4 | 40% | 4 | TBD |
| **Total Quizzes %** | | | **100%** | 10 |  |
|  | | | | | | |
| **Assignments**  **15** | Assignment #1 | CLO 1 | 5 | 33% | 5 | TBD |
| Assignment #2 | CLO 2 | 5 | 33% | 5 | TBD |
| Assignment #3 | CLO 3 | 5 | 33% | 5 | TBD |
| **Total Assignments %** | | | **100%** | 15 |  |
|  | | | | | | |
| **Midterm**  **25** | Midterm Q#1 | CLO 1 | 5 | 20% | **5** | TBD |
| Midterm Q#2 | CLO 1 | 5 | 20% | **5** | TBD |
| Midterm Q#3 | CLO 1 | 5 | 20% | **5** | TBD |
| Midterm Q#4 | CLO 2 | 5 | 20% | **5** | TBD |
| Midterm Q#5 | CLO 2 | 5 | 20% | **5** | TBD |
|  | **Total Midterm %** | | | **100%** | **25** |  |
|  | | | | | | |
| **Project/CCP**  **10** | Project/CCP | CLO3 | 10 | **100%** | **10** | **TBD** |
|  | **Total Project /CCP %** | | | **100%** | **10** |  |
|  | | | | | | |
| **Final Exam**  **40** | Final Exam Q#1 | CLO1 | 8 | 20% | 8 | TBD |
| Final Exam Q#2 | CLO2 | 8 | 20% | 8 | TBD |
| Final Exam Q#3 | CLO2 | 8 | 20% | 8 | TBD |
| Final Exam Q#4 | CLO3 | 8 | 20% | 8 | TBD |
| Final Exam Qn5 | CLO3 | 8 | 20% | 8 | TBD |
|  | **Total Final Exam %** | | | **100%** | **40** |  |
| **100** | **Total Marks** | | | | **100** |  |
| **Note: Please make sure every CLO must be assessed at least 3 time.** | | | | | | |

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| 1. **Weekly Plan** | | | | |
| **Week** | **Lecture No** | **Topic Covered** | **CLO** | **Assessment Tool** |
| 1 | 1 | **Introduction** to Information and Communication Technologies | **1** |  |
| 2 | Applications and Emerging Trends in ICT | **1** |  |
| 2 | 3 | What is **programming,** Examples of popular programming languages | **1** |  |
| 4 | Problem-Solving and Basic Coding Constructs | **1** |  |
| 3 | 5 | Introduction to **Computer Networking** | **2** |  |
| 6 | Applications and Impact of Networking | **1,2** | **Q1** |
| 4 | 7 | Introduction to **Databases** | **2** |  |
| 8 | Applications and Importance of Databases | **1,2** | **A1** |
| 5 | 9 | Introduction to **SDLC** | **1** |  |
| 10 | Phases of SDLC overview | **2** |  |
| 6 | 11 | Introduction to **Web Development** | **1** |  |
| 12 | Steps in the Web Development Process | **1,2** | **Q2** |
| **7** | 13 | **Project Discussion** | **3** | **Project** |
| 14 |
| **8** | Midterm Exam | | | |
| 9 | 15 | Fundamentals of Social Media Analysis | **1** |  |
| 16 | Techniques and Applications for **Social Media Analysis** | **1,2** | **A2** |
| 10 | 17 | Fundamentals of AI Tools (**Chat GPT**….) | **2** |  |
| 18 | Other Important AI Tools | **2** |  |
| 11 | 19 | Overview of Emerging Technologies | **2** |  |
| 20 | Applications and Impacts of **Emerging Technologies** | **2,3** | **Q3** |
| 12 | 21 | Fundamentals of **Artificial Intelligence** | **1** |  |
| 22 | Applications and Ethical Considerations | **2** |  |
| 13 | 23 | Introduction to **IoT** | **2** |  |
| 24 | Applications and Challenges of IoT | **2,3** | **A3** |
| 14 | 25 | Fundamentals of **Cloud Computing** | **2** |  |
| 26 | Applications and Future of Cloud Computing | **2** |  |
| 15 | 27 | Introduction to Augmented Reality (AR) and Virtual Reality (VR) | **2** |  |
| 28 | Applications and Future of **AR** and **VR** | **1** |  |
| 16 | 29 | **Presentation / Viva / Project Submission** | **3** |  |
| 30 | **3** |  |
| **17** | **Final Exam** | | | |

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| 1. **IU Assessment / grading Policy** | **Instructor grading for course \*** |
| Quizzes 10-15%  Assignments 10-15%  Projects/Presentation/CCP 0-10%  Mid Semester Examination/ 20-30%  End Semester Examination 40-50% | 10%  15%  10%  25%  40% |

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| **IQRA University (IU)** | | |
| **Faculty of Engineering Sciences and Technology (FEST)** | | |
| **Computer Science Department (CS)** | | |
| **Course Code** | **Course Name** | **Credit Hr** |
| **GER111-L** | Application of Information & Communication Technologies LAB | **2+1** |

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| 1. **Basic Information** | | | |
| **Instructor** |  | **Designation** |  |
| **Prerequisite(s)** | None | **Semester** |  |
| **Email** |  | **Phone** |  |
| **Consulting Hours** |  | **Office Location** |  |

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| 1. **Course Objective(s)** |
| As we live in the Computer Age, most of our day-to-day activities are being influenced by the use of computers. While in some areas like Science & Technology improvements cannot be achieved without computer, it has become necessary for everyone to have knowledge of computers. This course, intended for new students without a computer science background, covers the core components seen in a computer science undergraduate curriculum on which other computer science courses. |

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| 1. **Course Contents** |
| This course provides an in-depth exploration of advanced topics in Microsoft Word, Excel, PowerPoint, and Access, alongside foundational programming concepts. Students will master advanced document formatting and styles in Word, including custom styles and automation through macros and VBA. In Excel, they will delve into complex formulas, PivotTables, and automation techniques. The PowerPoint segment focuses on creating professional presentations with advanced design elements, including animations, custom transitions, and media embedding, as well as engaging interactive presentations using action buttons and hyperlinks. The essential programming concepts through hands-on labs covering Basic Programming and Basic Web Development with HTML and CSS. Additionally, students will explore computer networks, learning network fundamentals and device configuration in a simulated environment. In Access, learners will manage databases and perform SQL queries. |

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| 1. **Course Learning Outcomes** | | | | | | |
| **CLOs** | **CLO Statement** | **BT Level** | **Mapping** | | | **% Weight** |
| **GAs** | **ACM KA** | **SGDs** |
| CLO1 | **Shows** desire to learn a new technology (motivation) | P2 | GA7 | #14  PL | 9 | 25% |
| CLO2 | **Understand** basic concepts of programming related to software development. | C2 | GA2 | 25% |
| CLO3 | **Perform** applications of programming related to software development, database systems and Web to develop experience for higher levels. | A2 | GA6 | 50% |
| ***Note: On successful completion of course GA 1 (Academic Education) will automatically attain.*** | | | | | | |

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| 1. **Course Textbook / Reference Books and Supplementary Reading Material** | | | |
| **S No** | **Book Title** | **Author(s)** | **Edition/ publication year/publisher** |
|  | **Discovering Computers: Digital Technology, Data, and Devices,** | Misty E. Vermaat, Susan L. Sebok, Steven M. Freund, Jennifer T. Campbell, and Mark Frydenberg | 17th edition, 2021, Cengage Learning, 2022 |
|  | **Fundamentals of Information and Communication Technologies** | Shun-Ping Chen | Cambridge Scholars Publishing, 2020 |

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| 1. **CLO Outcome Based Assessment (OBA)** | | | | | | |
| **Assessment Tool** | | **CLO Mapped** | **CLO Marks** | **% Weight** | **Total Marks** | **Assessment Date** |
| **Quizzes**  **0** |  |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
| **Total Quizzes %** | | | **0** | 0 |  |
|  | | | | | | |
| **Lab Manual Task**  **15** | Lab task | **CLO 1/2/3** | 15 | **100%** | 15 | TBD |
| **Total Assignments %** | | | **100%** | 15 |  |
|  | | | | | | |
| **Midterm**  **25** | Midterm Q#1 | CLO 1 | **10** | 40% | **10** | TBD |
| Midterm Q#2 | CLO 1 | **10** | 40% | **10** | TBD |
| Midterm Q#3 | CLO 2 | 5 | 20% | **5** | TBD |
|  | **Total Midterm %** | | | **100%** | **25** |  |
|  | | | | | | |
| **Project/OEL**  **20** | Project/OEL | CLO 3 | 20 | **100%** | **20** | **TBD** |
|  | **Total Project /CCP %** | | | **100%** | **20** |  |
|  | | | | | | |
| **Final Exam**  **40** | Final Exam Q#1 | CLO2 | 10 | 25% | 10 | TBD |
| Final Exam Q#2 | CLO2 | 10 | 25% | **10** | TBD |
| Final Exam Q#3 | CLO3 | 20 | 50% | **20** | TBD |
|  | **Total Final Exam %** | | | **100%** | **40** |  |
| **100** | **Total Marks** | | | | **100** |  |
| **Note: Please make sure every CLO must be assessed at least 3 time.** | | | | | | |

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| 1. **Weekly Plan** | | | | |
| **Week**  **No** | **Lab No** | **Lab Description** | **Contact**  **Hr** | **CLO** |
| 1 | 1 | Basic Document Formatting and Styles | 3 | **1/2/3** |
| 2 | 2 | Using Macros and Automation in Word | 3 | **1/2/3** |
| 3 | 3 | Basic Formulas and Functions in Excel | 3 | **1/2/3** |
| 4 | 4 | PivotTables and PivotChart in Excel | 3 | **1/2/3** |
| 5 | 5 | Excel Macros and VBA Automation | 3 | **1/2/3** |
| 6 | 6 | Advanced Presentation Design and Animation | 3 | **1/2/3** |
| 7 |  | **Open Ended Lab/Project Assigned** | 3 | **1/2/3** |
| 8 | Midterm Exam | | | |
| 9 | 7 | Interactive Presentations with Action Buttons and Hyperlinks | 3 | **1/2/3** |
| 10 | 8 | Basic Programming Concepts | 3 | **1/2/3** |
| 11 | 9 | Flow Chart and Pseudo Code understandings | 3 | **1/2/3** |
| 12 | 10 | Database Management and Querying in MS Access | 3 | **1/2/3** |
| 13 | 11 | Introduction to Web Development. | 3 | **1/2/3** |
| 14 | 12 | Basic Web Page Development using HTML and CSS | 3 | **1/2/3** |
| 15 | 13 | Revision / Open Ended Lab/Project Assessment | 3 | **1/2/3** |
| 16 | 14 | **Open Ended Lab/Project Assessment** | 3 | **1/2/3** |
| 17 | **Final Exam** | | | |

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| 1. **IU Assessment / grading Policy** | **Instructor grading for course \*** |
| Quizzes 0-10%  Labs Task Assessment 10-20%  Projects/OEL/PBL 5-20%  Mid Semester Examination/ 20-30%  End Semester Examination 40-50% | 0  15%  20%  25%  40% |

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| **IQRA University (IU)** | | |
| **Faculty of Engineering Sciences and Technology (FEST)** | | |
| **Computer Science Department (CS)** | | |
| **Course Code** | **Course Name** | **Credit Hr** |
| **GER 121** | Functional English | **3+0** |

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| 1. **Basic Information** | | | |
| **Instructor** |  | **Designation** | Senior Lecturer |
| **Prerequisite(s)** | - | **Semester** | Fall 2024 |
| **Email** | @iqra.edu.pk | **Phone** | 0300-xxxxxxx |
| **Consulting Hours** | Fri 09:30 PM to 10:30 PM | **Office Location** | X Floor Faculty Room (X Cubicle) |

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| **2. Course Objective(s)** |
| The objectives of the course are to equip students with the ability to use basic language skills accurately and effectively. It aims to develop their understanding of how to create academic presentations, enhancing their ability to communicate complex ideas. The course also focuses on employing reading strategies to improve comprehension and expand vocabulary. Additionally, students will learn to develop coherent paragraphs in their writing and produce well-structured essays on assigned topics. A key component of the course is the review of grammar concepts to strengthen both speech and writing. Finally, the course emphasizes vocabulary development as an essential tool for effective communication. |

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| **3. Course Contents** |
| The course covers a wide range of topics aimed at improving both spoken and written communication skills. It begins with speaking activities and explores the difference between listening and hearing, focusing on active listening strategies. Students will study the parts of speech, as well as sentence and clause structures, and learn about the different types of clauses and sentences. The course also includes lessons on homophones, homonyms, and homographs, along with exercises on synonyms, antonyms, and the usage and structure of tenses. Vocabulary building is emphasized through various exercises, including phrasal verbs. Students will also engage in reading comprehension activities and summary writing, as well as learn the writing process, including planning, drafting, revising, and editing. |

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| **4. Course Learning Outcomes** | | | | | | | |
| **CLOs** | **CLO Statement** | **Mapping** | | | | | **% Weight** |
| **BT Level** | **GAs** | | **ACM KA** | **SGDs** |
| CLO1 | **Use** and recognize the pre-acquired grammatical rules to construct clear and coherent rules. | C3 | | GA7 |  | 10 | 36% |
| CLO2 | **Demonstrate** well-structured and organized paragraphs to write essays effectively. | A3 | | GA7 | 29% |
| CLO3 | **Present** well-organized thoughts orally to an audience in a formal environment | A2 | | GA7 | 35% |
| **Note: On successful completion of course GA 1 (Academic Education) will automatically attain.** | | | | | | | |

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| **5. Course Textbook / Reference Books and Supplementary Reading Material** | | | |
| **S No** | **Book Title** | **Author(s)** | **Edition/ publication year/publisher** |
|  | College Writing Skills with Readings | John Langan | 5th edition, Publisher McGraw-Hil |
|  | From great paragraphs to great essays | Folse, K. S., Solomon, E. V., & Clabeaux | 3rd edition, Publisher Cengage |
|  | English Grammar in use | Murphy, R | 5th edition, Publisher Cambridge |

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| **6. CLO Outcome Based Assessment (OBA) Tentative** | | | | | | |
| **Assessment Tool** | | **CLO Mapped** | **CLO Marks** | **% Weight** | **Total Marks** | **Assessment Date** |
| **Quizzes**  **10** | Quiz #1 | CLO 1 | 3 | 30% | 3 | TBD |
| Quiz #2 | CLO 2 | 3 | 30% | 3 | TBD |
| Quiz #3 | CLO 3 | 4 | 40% | 4 | TBD |
| **Total Quizzes %** | | | **100%** | 10 |  |
|  | | | | | | |
| **Assignments**  **15** | Assignment #1 | CLO 1 | 5 | 33% | 5 | TBD |
| Assignment #2 | CLO 2 | 5 | 33% | 5 | TBD |
| Assignment #3 | CLO 3 | 5 | 33% | 5 | TBD |
| **Total Assignments %** | | | **100%** | 15 |  |
|  | | | | | | |
| **Midterm**  **25** | Midterm Q#1 | CLO 1 | 5 | **24** | 6 | TBD |
| Midterm Q#2 | CLO 1 | 5 | **8** | 2 | TBD |
| Midterm Q#3 | CLO 1 | 5 | **12** | 3 | TBD |
| Midterm Q#4 | CLO 1 | 5 | **16** | 4 | TBD |
| Midterm Q#5 | CLO 2 | 5 | **40** | 10 | TBD |
|  | **Total Midterm %** | | | **100%** | 25 |  |
|  | | | | | | |
| **Project/Presentation**  **10** | Presentation | CLO3 | 10 | **100%** | **10** | **TBD** |
|  | **Total Project /CCP %** | | | **100%** | **10** |  |
|  | | | | | | |
| **Final Exam**  **40** | Final Exam Q#1 | CLO1 | 8 | 20% | 8 | TBD |
| Final Exam Q#2 | CLO2 | 8 | 20% | 8 | TBD |
| Final Exam Q#3 | CLO2 | 8 | 20% | 8 | TBD |
| Final Exam Q#4 | CLO3 | 8 | 20% | 8 | TBD |
| Final Exam Qn5 | CLO3 | 8 | 20% | 8 | TBD |
|  | **Total Final Exam %** | | | **100%** | **40** |  |
| **100** | **Total Marks** | | | | **100** |  |
| **Note: Please make sure every CLO must be assessed at least 3 time.** | | | | | | |

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| **7. Weekly Plan** | | | | |
| **Week** | **Lecture No** | **Topic Covered** | **CLO** | **Assessment Tool** |
| 1 | 1 | Introduction to Course | **1** |  |
| 2 | Speaking Activity**-** Introductions – Getting to know each other -Introduction to Communication Skills-The Importance of Speaking and Listening-How speaking and listening complement each other Understanding the communication process | **1** |  |
|  | 3 | Listening vs Hearing & Active Listening Strategies | **1** |  |
| 2 | 4 | Listening Comprehension: Listening for the Main Idea/Specific Information Exercise | **1** |  |
| 5 | Grammar- Parts of Speech | **1** |  |
|  | 6 | Practice Exercise |  |  |
| 3 | 7 | Grammar - Sentence & Types of Sentences, Clause, Types of Clauses, Vocabulary Building Homophones, Homonyms and Homographs, Synonyms & Antonyms | **2** |  |
| 8 | Articles, Homophones &Homonyms | **1,2** | **Q1** |
|  | 9 | Paragraph Writing & Phrasal Verbs |  |  |
| 4 | 10 | Introduction to Reading- Effective Reading Strategies | **2** |  |
| 11 | Previewing & Predicting | **1,2** | **A1** |
|  | 12 | Skimming & Scanning |  |  |
| 5 | 13 | -Critical Reading | **1** |  |
| 14 | Barriers to Effective Reading | **2** |  |
|  | 15 | Reading strategy-Inference |  |  |
| 6 | 16 | Grammar-The Structure of Regular and Irregular Verbs**,** Structure of the tense , Past Tenses: Past Simple, Past Continuous, Past Perfect & Perfect Continuous, usage of the tense | **1** |  |
| 17 | Present Simple, Present Continuous, Present Perfect & Perfect Continuous | **1,2** | **Q2** |
|  | 18 | Usage of the tense -Comparing All Four Past Tenses |  |  |
| **7** | 19 | Summary Writing - Identifying the key points, Making notes & Writing concisely, Reading Comprehension & Practice Exercise | **3** |  |
| 20 | Summary vs Paraphrase | **3** | **A2** |
|  | 21 | Writing concisely |  |  |
| **8** | **Midterm Exam** | | | |
| **9** | 22 | Basics of Academic Presentations- Purpose & audience of presentations, Choosing suitable topics for presentations, Do’s and don’t of presentation | **1** |  |
| 23 | Structure of Presentations - Verbal and Non-verbal communication | **1,2** |  |
|  | 24 | Overcoming nervousness and speaking activity Vocabulary Building -Prefixes & Suffixes |  |  |
| **10** | 25 | Grammar -Future Tenses: Future Simple, Future Continuous, Future Perfect & Perfect Continuous Structure of the tense & usage of the tense | **2** |  |
| 26 | Structure of the tense & usage of the tense | **2** |  |
|  | 27 | Vocabulary Building Idioms |  |  |
| **11** | 28 | Grammar -The usage of Punctuation Marks (comma, inverted commas, colon, semicolon & apostrophe) | **2** |  |
| 29 | Reading Comprehension - Inference techniques | **2,3** | **Q3** |
|  | 30 | Reading Comprehension Practice Exercise |  |  |
| **12** | 31 | Grammar - Active & Passive Voice, Rules for changing active into passive voice | **1** |  |
| 32 | Form and usage of active and passive voice | **2** |  |
| **13** | 33 | Process Essay Writing - Features of Process Essays Language used in process essays & Organization of information | **2** |  |
| 34 | Types of essays & Language used in process essays | **2,3** |  |
|  | 35 | Organization of information &Topic sentence |  |  |
| **14** | 36 | Writing - Essay Structure & Thesis statement | **2** | **A3** |
| 37 | Writing effective introductions and conclusions | **2** |  |
|  | 38 | Writing a Narrative Essay |  |  |
| **15** | 39 | Argumentative essay-coherence in writing | **2** |  |
| 40 | Essay organization - Creating an Outline | **1** |  |
|  | 41 | Revising, Editing, and Proofreading |  |  |
| **16** | 42 | Formal Presentation Week- Presentation | **3** |  |
| 43 | Presentation | **3** |  |
|  | 44 | Presentation | **3** |  |
| **17** | **Final Exam** | | | |

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| **8. IU Assessment / grading Policy** | **Instructor grading for course \*** |
| Quizzes 10-15% Assignments 10-15%  Projects/Presentation/ 0-10%  Mid Semester Examination/ 20-30%  End Semester Examination 40-50% | 10%  15%  10%  25%  40% |

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| **IQRA University (IU)** | | |
| **Faculty of Engineering Sciences and Technology (FEST)** | | |
| **Computer Science Department (CS)** | | |
| **Course Code** | **Course Name** | **Credit Hr** |
| **GER131** | Calculus and Analytical Geometry | **3+0** |

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| 1. **Basic Information** | | | |
| **Instructor** |  | **Designation** |  |
| **Prerequisite(s)** | None | **Semester** | Fall 2024 |
| **Email** |  | **Phone** |  |
| **Consulting Hours** |  | **Office Location** |  |

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| 1. **Course Objective(s)** |
| The objective of this course is to provide foundation and basic ground for calculus and analytical geometry concepts and its applications. |

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| 1. **Course Contents** |
| 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 Normal 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. |

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| 1. **Course Learning Outcomes** | | | | | | |
| **CLOs** | **CLO Statement** | **BT Level** | **Mapping** | | | **% Weight** |
| **GAs** | **ACM KA** | **SDGs** |
| CLO1 | ***Understand*** and compute the limits and continuity of functions. | C2 | GA2 | #4  DS | 4 | 30% |
| CLO2 | ***Apply*** the concept of derivatives, to find extreme values, approximate series, and indeterminate forms. | C3 | GA3 | 30% |
| CLO3 | ***Apply*** techniques of integration for improper integrals, area under the curve. | C3 | GA3 | 40% |
| ***Note: On successful completion of course GA 1 (Academic Education) will automatically attain.*** | | | | | | |

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| 1. **Course Textbook / Reference Books and Supplementary Reading Material** | | | |
| **S No** | **Book Title** | **Author(s)** | **Edition/ publication year/publisher** |
|  | Thomas’ Calculus | Joel R. Hass, Christopher E. Heil, Maurice D. Weir, Przemyslaw Bogacki | 15th Edition 2023, Pearson |
|  | Calculus | James Stewart | 9th Edition 2020, Cengage Learning |
|  | Calculus | Anton, Bivens, Davis | 12th Edition 2021, Wiley |

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| 1. **CLO Outcome Based Assessment (OBA)** | | | | | | |
| **Assessment Tool** | | **CLO Mapped** | **CLO Marks** | **% Weight** | **Total Marks** | **Assessment Date** |
| **Quizzes**  **15** | Quiz #1 | *CLO1* | 5 | 33.33% | 5 | TBD |
| Quiz #2 | *CLO2* | 5 | 33.33% | 5 | TBD |
| Quiz #3 | *CLO3* | 5 | 33.33% | 5 | TBD |
| **Total Quizzes %** | | | **100%** | **15** |  |
|  | | | | | | |
| **Assignments**  **15** | Assignment #1 | *CLO1* | 5 | 33.33% | 5 | TBD |
| Assignment #2 | *CLO2* | 5 | 33.33% | 5 | TBD |
| Assignment #3 | *CLO3* | 5 | 33.33% | 5 | TBD |
|  | **Total Assignments %** | | | **100%** | **15** |  |
|  | | | | | | |
| **Midterm**  **25** | Midterm Q#1 | *CLO1* | 10 | 40% | 10 | TBD |
| Midterm Q#2 | *CLO2* | 15 | 60% | 15 |  |
|  | **Total Midterm %** | | | **100%** | **25** |  |
|  | | | | | | |
| **Final Exam**  **45** | Final Exam Q#1 | *CLO1* | 10 | 22.22% | 10 | TBD |
| Final Exam Q#2 | *CLO2* | 15 | 33.33% | 15 |  |
| Final Exam Q#3 | *CLO3* | 20 | 44.44% | 20 |  |
|  | **Total Final Exam %** | | | **100%** | **45** |  |
| **100** | **Total Marks** | | | | **100** |  |
| ***Note: Please make sure every CLO must be assessed at least 3 times.*** | | | | | | |

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| 1. **Weekly Plan** | | | | |
| **Week** | **Lecture No** | **Topic Covered** | **CLO** | **Assessment Tool** |
| 1 | 1 | Introduction, course contents, text and ref books; motivation | **1** |  |
| 2 | Introduction to function, Domain, Range | **1** |  |
| 3 | Vertical line test & Plotting. | **1** |  |
| 2 | 4 | Introduction to limits, notation, graphs | **1** |  |
| 5 | Limit using tables | **1** |  |
| 6 | Substitution to Find Limits | **1** |  |
| 3 | 7 | Rationalization to Find Limits | **1** |  |
| 8 | Continuity of functions | **1** |  |
| 9 | Discontinuity of functions | **1** | **A1** |
| 4 | 10 | Applications of continuity & discontinuity of functions. | **1** | **Q1** |
| 11 | Differential calculus: Concept and idea of differentiation, Geometrical and Physical meaning of derivatives. | **2** |  |
| 12 | Rules of differentiation, Techniques of differentiation. | **2** |  |
| 5 | 13 | Rates of change, Tangents and Normal lines | **2** |  |
| 14 | Chain rule | **2** |  |
| 15 | Implicit differentiation | **2** |  |
| 6 | 16 | Applications of differentiation: Indeterminate form (7 forms) | **2** |  |
| 17 | L ’Hospital Rule (0/0, ∞/∞, 0×∞, ∞-∞, 00, ∞0,1∞) | **2** |  |
| 18 | Applications of differentiation: Increasing and decreasing function | **2** | **A2** |
| 7 | 19 | Concavity and inflection points | **2** | **Q2** |
| 20 | Mean value theorems, Rolle’s theorem | **2** |  |
| 21 | Applications of differentiation: Extreme value functions, Maxima and Minima of a function for single- variable | **2** |  |
| **8** | **Midterm Exam** | | | |
| 9 | 22 | Power series representations of function | **2** |  |
| 23 | Taylor series | **2** |  |
| 24 | McLaurin Series | **2** |  |
| 10 | 25 | Integral Calculus: Concept and idea of Integration | **3** |  |
| 26 | Indefinite Integrals | **3** |  |
| 27 | Techniques of integration | **3** |  |
| 11 | 28 | Integration by substitution method & formula | **3** |  |
| 29 | Integration by parts | **3** |  |
| 30 | Integration by parts | **3** |  |
| 12 | 31 | Integration by partial fractions (Linear factor) | **3** |  |
| 32 | Integration by partial fractions (Linear and repeated) | **3** |  |
| 33 | Integration by partial fractions (Quadratic and repeated) | **3** |  |
| 13 | 34 | Definite integrals | **3** |  |
| 35 | Area under the curve | **3** |  |
| 36 | Evaluation of area of simple plain figures | **3** | **A3** |
| 14 | 37 | Improper integrals, (infinite limits) | **3** | **Q3** |
| 38 | Improper integrals (discontinuity in interval) | **3** |  |
| 39 | Improper integrals (infinite limit and discontinuity) | **3** |  |
| 15 | 40 | The definition of area as a limit; sigma notation | **3** |  |
| 41 | Riemann sums and definite integrals | **3** |  |
| 42 | Integration as limit of a sum. | **3** |  |
| 16 | 43 | Straight line in R3 | **3** |  |
| 44 | Equation of planes | **3** |  |
| 45 | Revision | **3** |  |
| **17** | **Final Exam** | | | |

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| 1. **IU Assessment / grading Policy** | **Instructor grading for course** |
| Quizzes 10-15%  Assignments 10-15%  Projects/Presentation/CCP 0-10%  Mid Semester Examination/ 20-30%  End Semester Examination 40-50% | 15  15  0  25  45 |

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| **IQRA University (IU)** | | |
| **Faculty of Engineering Sciences and Technology (FEST)** | | |
| **Computer Science Department (CS)** | | |
| **Course Code** | **Course Name** | **Credit Hr** |
| **GRE152** | Applied Physics | **2+1** |

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| 1. **Basic Information** | | | |
| **Instructor** |  | **Designation** |  |
| **Prerequisite(s)** | None | **Semester** | Fall 2024 |
| **Email** |  | **Phone** |  |
| **Office Hours** |  | **Office Location** |  |

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| 1. **Course Objective(s)** |
| 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. |

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| 1. **Course Contents** |
| Basic Units, Physical Quantities, and Vector, Motion along a straight line, Linear Momentum, Work, power and Energy, Thermodynamics, Uniform Circular Motion, Electric force and its applications and related problems, conservation of charge, Electric fields due to point charge and lines of force, A point charge in an electric field, Gauss’ Law, Application of Gauss’ Law, A charge isolated conductor, Electric potential energy, Electric potentials, Calculating the potential from the field and related problem, Calculating the field from the potential , Electric current, Current density, Resistance, Resistivity and conductivity, Ohm’s law and its applications, The magnetic force on a current, Two parallel conductors, Amperes’ s Law, Solenoid, Faraday’s experiments, Faraday’s Law of Induction, Lenz’s law, Induced electric field, The basic equation of electromagnetism, Induced Magnetic field, The displacement current, Reflection and Refraction of light waves, Total internal reflection, Diffraction and the wave theory, related problems, Single-Slit Diffraction, related problems, Polarization of electromagnetic waves. |

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| 1. **Course Learning Outcomes** | | | | | | |
| **CLOs** | **CLO Statement** | **BT Level** | **Mapping** | | | **% Weight** |
| **GAs** | **ACM KA** | **SGDs** |
| CLO1 | **Describe** the fundamental laws of physics relevant to the computational sciences. | C2 | GA2 | - | 4 | 30% |
| CLO2 | **Applying** knowledge of basic physical laws to solve various problems related to Light and motion of the body. | C3 | GA2 | 35% |
| CLO3 | **Solve** a variety of problems related to electricity, Light by applying the principles of electric potential, current, resistance, inductance. | C3 | GA2 | 35% |
| ***Note: On successful completion of course GA 1 (Academic Education) will automatically attain.*** | | | | | | |

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| 1. **Course Textbook / Reference Books and Supplementary Reading Material** | | | |
| **S No** | **Book Title** | **Author(s)** | **Edition/ publication year/publisher** |
|  | Fundamentals of Physics | David Halliday, Robert Resnick, and Jearl Walker | 10th edition. 2010, Wiley Publisher. |
|  | Schum’s Outline of Applied Physics | Arthur Beiser | 8th edition, 2009. McGraw-Hill  Publishers |

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| 1. **CLO Outcome Based Assessment (OBA)** | | | | | | |
| **Assessment Tool** | | **CLO Mapped** | **CLO Marks** | **% Weight** | **Total Marks** | **Assessment Date** |
| **Quizzes**  **15** | Quiz #1 | *CLO1/2/3* | 5 | 30% | 5 |  |
| Quiz #2 | *CLO1/2/3* | 5 | 30% | 5 |  |
| Quiz #3 | *CLO1/2/3* | 5 | 40% | 5 |  |
| **Total Quizzes %** | | | **100%** | 15 |  |
|  | | | | | | |
| **Assignments**  **20** | Assignment #1 | *CLO1/2/3* | 5 | 30% | 5 |  |
| Assignment #2 | *CLO1/2/3* | 5 | 30% | 5 |  |
| Assignment #3 | *CLO1/2/3* | 10 | 40% | 10 |  |
|  |  | | | **100%** | 20 |  |
|  | | | | | | |
| **Midterm**  **25** | Midterm Q# | *CLO1/2/3* | 20 |  |  |  |
| Midterm Q# | *CLO1/2/3* | 5 |  |  |  |
|  | …. | *CLO1/2/3* |  |  |  |  |
|  | Midterm Qn | *CLO1/2/3* |  |  |  |  |
|  | **Total Midterm %** | | | **100%** | **25** |  |
|  | | | | | | |
| **Project/CCP**  **-** | Project/CCP | *CLO1/2/3* | 5 |  |  |  |
|  | **Total Project /CCP %** | | | **100%** |  |  |
|  | | | | | | |
| **Final Exam**  **40** | Final Exam Q# | *CLO1/2/3* | 10 |  |  |  |
| Final Exam Q# | *CLO1/2/3* | 10 |  |  |  |
| …. | *CLO1/2/3* |  |  |  |  |
|  | Final Exam Qn | *CLO1/2/3* |  |  |  |  |
|  | **Total Final Exam %** | | | **100%** |  |  |
| **100** | **Total Marls** | | | | **100** |  |
| ***Note: Please make sure every CLO must be assessed at least 3 time.*** | | | | | | |

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| 1. **Weekly Plan** | | | | |
| **Week** | **Lecture No** | **Topic Covered** | **CLO** | **Assessment Tool** |
| 1 | 1 | Introduction to Physics, Fundamental Units | **1** |  |
| 2 | Conversions and Significant figures, Scalar & Vectors, Examples | **1** |  |
| 2 | 3 | Types and properties of Vectors. | **1** |  |
| 4 | Rectangular Components of Vectors, Multiplication of Vectors, Dot Product and Cross Product. | **1** | Quiz 1 |
| 3 | 5 | Motion in One Dimension, Displacement, Velocity, and Speed | **2** |  |
| 6 | Acceleration, Motion with Constant Acceleration | **2** |  |
| 4 | 7 | Linear Momentum, Conservations of Momentum. | **2** | Assignment 1 |
| 8 | Types of Momentum | **2** |  |
| 5 | 9 | Work and Energy, Power, Kinetic Energy. | **2** |  |
| 10 | Kinetic Energy, Potential Energy | **2** |  |
| 6 | 11 | Thermodynamics, System and surrounding. | **2** |  |
| 12 | Uniform Circular Motion | **2** | Quiz 2 |
| **7** | 13 | Derivation for the acceleration and force in uniform circular motion. | **2** |  |
|  | 14 | Problems related to uniform circular motion. | **2** |  |
| **8** | **Midterm Exam** | | | |
| 9 | 15 | Electric force and its applications and related problems | **3** |  |
| 16 | Coulomb’s Law and related problems | **3** |  |
| 10 | 17 | Electric field intensity, Gauss’s Law | **3** |  |
| 18 | Electric potentials, Calculating the potential from the field and related problem | **3** | Assignment 2 |
| 11 | 19 | Electric current, Current density, Resistance, Resistivity and conductivity | **3** |  |
| 20 | Ohm’s law and its applications | **3** |  |
| 12 | 21 | Series Circuit and Parallel Circuit | **3** | Quiz 3 |
| 22 | Hybrid Circuit and related problems | **3** |  |
| 13 | 23 | Amperes’ s Law and its Application | **3** |  |
| 24 | Faraday’s Law of Induction, Lenz’s law | **3** |  |
| 14 | 25 | The basic equation of electromagnetism, Induced Magnetic field | **3** |  |
| 26 | Introduction to transformers and its types | **3** | Assignment 3 |
| 15 | 27 | Reflection and Refraction of light waves. | **2** |  |
| 28 | Total internal reflection | **2** |  |
| 16 | 29 | Diffraction and the wave theory, related problems | **2** |  |
| 30 | Polarization of electromagnetic waves | **2** |  |
| **17** | **Final Exam** | | | |

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| 1. **IU Assessment / grading Policy** | **Instructor grading for course \*** |
| Quizzes 10-15%  Assignments 15-20%  Projects/Presentation/CCP 0-10%  Mid Semester Examination/ 20-30%  End Semester Examination 40-50% | 15%  20%  -  25%  40% |

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| **IQRA University (IU)** | | |
| **Faculty of Engineering Sciences and Technology (FEST)** | | |
| **Computer Science Department (CS)** | | |
| **Course Code** | **Course Name** | **Credit Hr** |
| **GRE152-L** | Applied Physics Lab | **2+1** |

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| 1. **Basic Information** | | | |
| **Instructor** |  | **Designation** |  |
| **Prerequisite(s)** | None | **Semester** | Fall 2024 |
| **Email** |  | **Phone** |  |
| **Office Hours** |  | **Office Location** |  |

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| 1. **Course Objective(s)** |
| 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. |

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| 1. **Course Contents** |
| Basic Units, Physical Quantities, and Vector, Motion along a straight line, Linear Momentum, Work, power and Energy, Thermodynamics, Uniform Circular Motion, Electric force and its applications and related problems, conservation of charge, Electric fields due to point charge and lines of force, A point charge in an electric field, Gauss’ Law, Application of Gauss’ Law, A charge isolated conductor, Electric potential energy, Electric potentials, Calculating the potential from the field and related problem, Calculating the field from the potential , Electric current, Current density, Resistance, Resistivity and conductivity, Ohm’s law and its applications, The magnetic force on a current, Two parallel conductors, Amperes’ s Law, Solenoid, Faraday’s experiments, Faraday’s Law of Induction, Lenz’s law, Induced electric field, The basic equation of electromagnetism, Induced Magnetic field, The displacement current, Reflection and Refraction of light waves, Total internal reflection, Diffraction and the wave theory, related problems, Single-Slit Diffraction, related problems, Polarization of electromagnetic waves. |

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| 1. **Course Learning Outcomes** | | | | | | |
| **CLOs** | **CLO Statement** | **BT Level** | **Mapping** | | | **% Weight** |
| **GAs** | **ACM KA** | **SGDs** |
| CLO1 | **Follow** the instructions to perform the experiments in order to verify the laws, theories and principle of Physics. | P3 | GA2 | - | 4 | 30% |
| CLO2 | **Answer** regarding experiments, theories and laws of physics and present designed project for the course. | A2 | GA7 | 35% |
| ***Note: On successful completion of course GA 1 (Academic Education) will automatically attain.*** | | | | | | |

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| 1. **Course Textbook / Reference Books and Supplementary Reading Material** | | | |
| **S No** | **Book Title** | **Author(s)** | **Edition/ publication year/publisher** |
|  | Fundamentals of Physics | David Halliday, Robert Resnick, and Jearl Walker | 10th edition. 2010, Wiley Publisher. |
|  | Schum’s Outline of Applied Physics | Arthur Beiser | 8th edition, 2009. McGraw-Hill  Publishers |

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| 1. **CLO Outcome-Based Assessment (OBA)** | | | | | | |
| **Assessment Tool** | | **CLO Mapped** | **CLO Marks** | **% Weight** | **Total Marks** | **Assessment Date** |
| **Quizzes**  **0** | Quiz #1 | *CLO1/2* | 0 | 0% | 0 |  |
| Quiz #2 | *CLO1/2* | 0 | 0% | 0 |  |
| Quiz #3 | *CLO1/2* | 0 | 0% | 0 |  |
| **Total Quizzes %** | | | **0%** | 0 |  |
|  | | | | | | |
| **Lab Manual**  **20** | Lab Task #1 | *CLO1/2* | 10 | 10% | 0 |  |
| Lab Task #2 | *CLO1/2* | 10 | 10% | 0 |  |
| Lab Task #n | *CLO1/2* | 0 |  | 0 |  |
|  | **Total Lab Manual %** | | | **20%** | 20 |  |
|  | | | | | | |
| **Midterm**  **25** | Midterm Q#1, 2 | *CLO1* | 20 |  |  |  |
| Midterm Q#3 | *CLO1* | 5 |  |  |  |
|  |  |  |  |  |  |  |
|  | **Total Midterm %** | | | **25%** | **25** |  |
|  | | | | | | |
| **Project/OEL**  **15** | Project/CCP | *CLO1/2* | 15 |  |  |  |
|  | **Total Project /CCP %** | | | **15%** | **15** |  |
|  | | | | | | |
| **Final Exam**  **40** | Final Exam Q# | *CLO1/2* | 10 |  |  |  |
| Final Exam Q# | *CLO1/2* | 10 |  |  |  |
|  | Final Exam Qn | *CLO1/2* |  |  |  |  |
|  | **Total Final Exam %** | | | **40%** | **40** |  |
| **100** | **Total Marls** | | | | **100** |  |
| ***Note: Please make sure every CLO must be assessed at least 3 times.*** | | | | | | |

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| 1. **Weekly Plan** | | | | |
| **Week**  **No.** | **Lab No.** | **Lab Description** | **Contact**  **Hr.** | **CLO** |
| 1 | 1 | To study and analysis basic units of conversion. | 3 | 1-2 |
| 2 | 2 | To find the volume of cylinder & volume of cube by using Vernier calliper. To find the diameter of a wire using a screw gauge | 3 | 1-2 |
| 3 | 3 | To find out the moment of inertia using the flywheel apparatus | 3 | 1-2 |
| 4 | 4 | To find out spring constant ‘k’ of a spring using Hooke’s law | 3 | 1-2 |
| 5 | 5 | To measure the coefficient of friction of an inclined plane and study the equilibrium and non-equilibrium of a body on an inclined plane | 3 | 1-2 |
| 6 | 6 | To find the mass of an unknown object using equilibrium method. | 3 | 1-2 |
| 7 |  | **Open Ended Lab/Project Assigned** |  | 1-2 |
| 8 | **Midterm Exam** | | | |
| 9 | 7 | To become familiar with basic electronics measuring equipment such as Digital Multi meter. Introduction to power supply and power project board | 3 | 1-2 |
| 10 | 8 | To learn the operation of function generator to vary the  amplitude, frequency and shape of waveforms. To familiarize with the handling and option of an oscilloscope and learn to read the voltage frequency on it. | 3 | 1-2 |
| 11 | 9 | To determine safe voltage and safe current of a resistor from its power rating and its resistance value. To verify Ohm’s law and VI characteristics of a linear component | 3 | 1-2 |
| 12 | 10 | To study and verify Voltage divider rule in a Series DC circuit. To study and verify experimentally Kirchhoff’s Voltage Law in a single loop DC series circuit | 3 | 1-2 |
| 13 | 11 | To study and verify Current divider rule in a Parallel DC circuit. To study and verify experimentally Kirchhoff’s Current Law in single and multiple nodes DC circuit | 3 | 1-2 |
| 14 | 12 | To determine the value of Capacitance by using coding scheme. To study the series and parallel combinations of capacitors | 3 | 1-2 |
| 15 |  | Identify the voltage ratio and current ratio of the single-phase transformer |  | 1-2 |
| 16 |  | **Open Ended Lab/Project Assessment** |  | 1-2 |
| 17 | **Final Exam** | | | |

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| 1. **IU Assessment/grading Policy** | **Instructor grading for the course \*** |
| Lab Manual 10-20%  Projects/OEL/PBL 10-25%  Mid Semester Examination/ 20-30%  End Semester Examination 40-50% | 15  20  25  40 |

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| IQRA University (IU) | | |
| Faculty of Engineering Sciences and Technology (FEST) | | |
| Computer Science Department (CS) | | |
| Course Code | Course Name | Credit Hr |
| GER141 | Islamic Studies | 2+0 |

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| 1. Basic Information | | | |
| Instructor |  | Designation | Senior Lecturer |
| Prerequisite(s) | - | Semester | Fall 2024 |
| Email | @iqra.edu.pk | Phone | 0300-xxxxxxx |
| Consulting Hours | Fri 09:30 PM to 10:30 PM | Office Location | X Floor Faculty Room (X Cubicle) |

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| 1. **Course Objective(s)** |
| The objective of this course is to help students develop a deeper understanding of religion, its significance, and its role in human life. It aims to provide students with a foundational understanding of the major religions of the world and the concept of prophethood and its importance. The course also seeks to enhance students' knowledge of the life of Prophet Muhammad (PBUH) and the Islamic concept of worship (Ibadat). Furthermore, it strives to create awareness about human rights in the light of the Quran and Sunnah and to equip students with a comprehensive understanding of the Islamic code of life, including its economic, political, and social dimensions. |

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| 1. **Course Contents** |
| This course introduces the foundational concepts of civics, citizenship, and democratic governance, emphasizing rights, responsibilities, and civic identity. Students will analyze community challenges such as inequality, environmental issues, and social justice while learning strategies for effective community engagement and ethical decision-making. The course highlights civic leadership and advocacy, focusing on practical tools for mobilizing social change. Through a hands-on community engagement project, students design and implement initiatives to address real-world issues. By the end, students will develop critical skills and values for active citizenship and meaningful community participation. |

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| 1. **Course Learning Outcomes** | | | | | | |
| **CLOs** | **CLO Statement** | **BT Level** | **Mapping** | | | **% Weight** |
| **GAs** | **ACM KA** | **SGDs** |  |
| CLO1 | **Describe** ethical and moral values of Islam in the light of verses of Quran and Hadith to become civilized Muslim who can maintain balance between religious and social activities. | C2 | GA9 | #18  SEP | 12,16,10 | 65% |
| CLO2 | ***Discuss*** and value Islam in the context of efforts made by the prominent Muslim figures in compilation of Holy Quran, Hadith and Islamic jurisprudence. | A2 | GA6 | 35% |
| CLO 3 | ***Explain*** Scope & Significance of basic Pillars of Islam, its application and cumulative effects on society and different aspects of human life | C2 | GA10 |  |  |
| ***Note: On successful completion of course GA1 (Academic Education) will automatically attain.*** | | | | | | |

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| 1. **Course Textbook / Reference Books and Supplementary Reading Material** | | | |
| **S No** | **Book Title** | **Author(s)** | **Edition/ publication year/publisher** |
|  | Introduction to Islam | Dr. Muhammad Hamidullah | 1992, Papular Library Publishers, Lahore. |
|  | Principles of Islamic Jurisprudence | Ahmad Hassan | 1993, Islamic Research Institute, IIUI. |
|  | Muslim Jurisprudence and the Quranic Law of Crimes | Mir Waliullah | Second Edition, Islamic Book Services, [Adam Publishers](https://kitaabun.com/shopping3/index.php?cPath=189_209)*,* India. |

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| 1. **CLO Outcome Based Assessment (OBA) Tentative** | | | | | | |
| **Assessment Tool** | | **CLO Mapped** | **CLO Marks** | **% Weight** | **Total Marks** | **Assessment Date** |
| **Quizzes**  **15** | Quiz #1 | *CLO1* | 05 | 33.3 | 5 | TBD |
| Quiz #1 | *CLO2* | 05 | 33.3 | 5 | TBD |
| Quiz #2 | *CLO2* | 05 | 33.3 | 5 | TBD |
| **Total Quizzes %** | | | **100%** | **15** |  |
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| **Assignments**  **15** | Assignment #1 | *CLO1* | 05 | 33.3 | 5 | TBD |
| Assignment #2 | *CLO1* | 05 | 33.3 | 5 | TBD |
| Assignment #3 | *CLO2* | 05 | 33.3 | 5 | TBD |
|  |  | | | **100%** | **15** |  |
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| **Midterm**  **25** | Midterm Q#1 | *CLO1* | 13 | 52 | 13 | TBD |
| Midterm Q#2 | *CLO1* | 12 | 48 | 12 | TBD |
|  | **Total Midterm %** | | | **100%** | **25** |  |
|  | | | | | | |
| **Project/CCP**  **05** | Project/CCP | *CLO1* | 5 | 100 | **5** | TBD |
|  | **Total Project /CCP %** | | | **100%** | **5** |  |
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| **Final Exam**  **40** | Final Exam Q#1 | *CLO1* | 15 |  | 15 | TBD |
| Final Exam Q#2 | *CLO2* | 25 |  | 25 | TBD |
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|  | **Total Final Exam %** | | | **100%** | **40** |  |
| **100** | **Total Marks** | | | | **100** |  |
| ***Note: Please make sure every CLO must be assessed at least 3 time.*** | | | | | | |

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| 1. **Weekly Plan** | | | | |
| **Week** | **Lecture No** | **Topic Covered** | **CLO** | **Assessment Tool** |
| 1 | 1 | Introduction to Religion, Course overview and expectations of Islamic Studies. | CLO1 |  |
| 2 | Defining religion and its various dimensions Significance  and role of it in human life. Brief history of timeline of world major religions. Quran Tajweed, Tarjuma, and Tafseer | CLO1 |  |
| 2 | 3 | Introduction to the core beliefs and practices of Major Religions of the World | CLO1 |  |
| 4 | Judaism , Christianity, Quran Tajweed, Tarjuma, and Tafseer | CLO1 |  |
| 3 | 5 | Emergence of Islam: Arabian Peninsula's historical, social, and cultural context. Emergence of Islam, Introduction to the core beliefs of Islam. | CLO1 | Q1 |
| 6 | Belief in Allah Almighty, Belief in Angles, Belief in prophets, Belief in scriptures, Belief in Day of Judgment, Belief in Divine Destiny. Quran Tajweed, Tarjuma, and Tafseer | CLO1 |  |
| 4 | 7 | Concept of Worship ins Islam: Definition, meaning and dimensions of worship | CLO1 | A1 |
| 8 | Five pillars of Islam, Quran Tajweed, Tarjuma, and Tafseer | CLO1 |  |
| 5 | 9 | The Life of Prophet Muhammad (SAW), Early life and prophet hood. His life in Mecca. | CLO1 |  |
| 10 | His life in Mecca, Quran Tajweed, Tarjuma, and Tafseer | CLO1 |  |
| 6 | 11 | The Life of Prophet Muhammad (SAW), Migration to Madina and establishment of first Muslim community Conflicts with Makkans and others | CLO1 | Q2 |
| 12 | Conflicts with Makkans and others, Quran Tajweed, Tarjuma, and Tafseer | CLO1 |  |
| 7 | 13 | The Life of Prophet Muhammad (SAW), His actions as examples for Muslims individuals. His actions as examples for Muslim communities, His actions as examples for Muslim communities. | CLO1 |  |
|  | 14 | Project Discussion | CLO1 | Project Announced |
| **8** | **Midterm Exam** | | | |
| 9 | 15 | Duties and Characteristics of a Muslim in Modern Word | CLO2 |  |
| 16 | Quran Tajweed, Tarjuma, and Tafseer | CLO1 |  |
| 10 | 17 | Sources of religious and legal authority. 1. Quran. 2. Sunnah. 3. Ijma. 4. Qiyas(Analogy). 5. Other important sources. | CLO2 | A2 |
| 18 | Quran Tajweed, Tarjuma, and Tafseer | CLO1 |  |
| 11 | 19 | Recitation, Translation and Tafseer. Study of Selected Text of Holy Quran. (Part 1) Surah Al-Fatiha | CLO1 |  |
| 20 | Ayat-ui-Kursi , Surah Al-Ikhlas, Quran Tajweed, Tarjuma, and Tafseer | CLO1 |  |
| 12 | 21 | Study of Selected Text of Holy Quran. (Part 2) Surah Al-Hujurat | CLO1 |  |
| 22 | Quran Tajweed, Tarjuma, and Tafseer | CLO1 |  |
| 13 | 23 | Human Rights in Islam (Part I), Importance of Human rights, Types of human rights, Right to life, Right to Dignity, Right to Freedom of religion, Right to equality, Right to property, Right to Justice, Right to Education , Right to work | CLO2 |  |
| 24 | The Quranic Perspective on Human Rights  A comparative analysis of human rights in Islam with the Universal Declaration of Human Rights (UDHR) | CLO2 | A3 |
| 14 | 25 | Human rights in Islam. (Part 2), Parents Rights, Women’s Rights, Rights of Relatives, Rights of neighbors, Rights of Orphans, Rights of needy people | CLO2 |  |
| 26 | Rights of Non-Muslims.  Rights of animals, Rights of Spouses, Rights of children, Rights of friends.  Rights of enemies. | CLO2 |  |
| 15 | 27 | **Contemporary challenges and their solutions in the light of Islamic teachings.** Poverty, Injustice, Conflict and Violence , Environmental degradation | CLO2 | Q3 |
| 28 | **Islam is a complete code of Life,** Economic System of Islam, Social System of Islam, Political System of Islam, Education System of Islam, Military System of Islam, Judiciary System of Islam , Medical concept of Islam. | CLO2 |  |
| 16 | 29 | Project Submission | CLO1 |  |
| 30 | Project Submission | CLO1 |  |
| **17** | **Final Exam** | | | |

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| 1. **IU Assessment / grading Policy** | **Instructor grading for course \*** |
| Quizzes 10-15%  Assignments 10-15%  Projects/Presentation/CCP 0-10%  Mid Semester Examination/ 20-30%  End Semester Examination 40-50% | 15%  15%  05%  25%  40% |

## SEMESTER 2

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| **S.No** | **Course Code** | **Title** | **Cr.Hrs** |
| 1 | MTE111 | Multivariable Calculus | 3 + 0 |
| 2 | CMC112 | Object Oriented Programming | 3 + 0 |
| 3 | CMC112-L | Object Oriented Programming (Lab) | 0 + 1 |
| 4 | CMC121 | Digital Logic Design | 2 + 0 |
| 5 | CMC121-L | Digital Logic Design (Lab) | 0 + 1 |
| 6 | GER122 | Expository Writing | 3 + 0 |
| 7 | GER132 | Discrete Structures | 3 + 0 |
| 8 | GER142 | Ideology and Constitution of Pakistan | 2 + 0 |
|  |  |  | **16+2 (18)** |

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| **IQRA University (IU)** | | |
| **Faculty of Engineering Sciences and Technology (FEST)** | | |
| **Computer Science Department (CS)** | | |
| **Course Code** | **Course Name** | **Credit Hr** |
| **MTE111** | Multivariable Calculus | **3+0** |

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| 1. **Basic Information** | | | |
| **Instructor** |  | **Designation** |  |
| **Prerequisite(s)** | GER131 Calculus and Analytical Geometry | **Semester** | Fall 2024 |
| **Email** |  | **Phone** |  |
| **Consulting Hours** |  | **Office Location** |  |

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| 1. **Course Objective(s)** |
| The objective of this course is to equip students with the mathematical foundations necessary to analyze and solve complex problems involving multiple variables. The course aims to develop critical skills in understanding relationships between variables, optimizing solutions, and applying these concepts to real-world computing challenges, particularly in fields like machine learning, graphics, and simulations. |

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| 1. **Course Contents** |
| Understanding Multivariable Functions: Multivariable functions, sketching the level of curves, plotting the 3 dimensional plots. Partial Derivatives and Gradients: Partial derivatives of functions, gradient vector and its applications. Optimization Techniques: Finding extrema of multivariable functions. Multiple Integrals: Double and triple integrals over regions in two or three dimensions, apply multiple integrals in computing areas, volumes, and other physical quantities relevant to computer graphics and simulations. Vector Calculus and Applications: Vector fields and operations such as divergence, curl, and the application of the fundamental theorems of calculus (e.g., Green's theorem, Stokes' theorem). Application to Computer Science: How multivariable functions relate to real-world problems in computation, including simulations, optimization, and scientific computing. |

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| 1. **Course Learning Outcomes** | | | | | | |
| **CLOs** | **CLO Statement** | **BT Level** | **Mapping** | | | **% Weight** |
| **GAs** | **ACM KA** | **SDGs** |
| CLO1 | ***Understand*** the basic concepts and know the basic techniques of differential and integral calculus of functions of several variables**.** | C2 | GA2 | #4  DS | 4 | 40% |
| CLO2 | ***Apply*** the theory to calculate the gradients, directional derivatives, arc length of curves, area of surfaces, and volume of solids. | C3 | GA3 | 30% |
| CLO3 | ***Solve*** problems involving maxima and minima, line integral and surface integral, and vector calculus theorems. | C3 | GA3 | 30% |
| ***Note: On successful completion of course GA 1 (Academic Education) will automatically attain.*** | | | | | | |

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| 1. **Course Textbook / Reference Books and Supplementary Reading Material** | | | |
| **S No** | **Book Title** | **Author(s)** | **Edition/ publication year/publisher** |
|  | Calculus: Early Transcendentals | James Stewart | 9th edition 2020, Cengage Learning |
|  | Advanced Engineering Mathematics | H K Dass, Rajnish Verma & Rama Verma | 23th edition. 2024, S. Chand Publishing |
|  | Mathematical Methods | S.M. Yusuf, Abdul Majeed, Muhammad Amin | 2nd edition. 2004. Ilmi Kitab Khana |

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| 1. **CLO Outcome Based Assessment (OBA)** | | | | | | |
| **Assessment Tool** | | **CLO Mapped** | **CLO Marks** | **% Weight** | **Total Marks** | **Assessment Date** |
| **Quizzes**  **15** | Quiz #1 | *CLO1* | 5 | 33.33% | 5 | TBD |
| Quiz #2 | *CLO2* | 5 | 33.33% | 5 | TBD |
| Quiz #3 | *CLO3* | 5 | 33.33% | 5 | TBD |
| **Total Quizzes %** | | | **100%** | **15** |  |
|  | | | | | | |
| **Assignments**  **15** | Assignment #1 | *CLO1* | 5 | 33.33% | 5 | TBD |
| Assignment #2 | *CLO2* | 5 | 33.33% | 5 | TBD |
| Assignment #3 | *CLO3* | 5 | 33.33% | 5 | TBD |
|  | **Total Assignments %** | | | **100%** | **15** |  |
|  | | | | | | |
| **Project/CCP**  **05** | Project/CCP | *CLO1-3* | 5 | 100% | 5 | TBD |
|  | **Total Project /CCP %** | | | **100%** | **05** |  |
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| **Midterm**  **25** | Midterm Q#1 | *CLO1* | 20 | 80% | 20 | TBD |
| Midterm Q#2 | *CLO2* | 05 | 20% | 05 |  |
|  | **Total Midterm %** | | | **100%** | **25** |  |
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| **Final Exam**  **40** | Final Exam Q#1 | *CLO1* | 10 | 25% | 10 | TBD |
| Final Exam Q#2 | *CLO2* | 10 | 25% | 10 |  |
| Final Exam Q#3 | *CLO3* | 20 | 50% | 20 |  |
|  | **Total Final Exam %** | | | **100%** | **40** |  |
| **100** | **Total Marks** | | | | **100** |  |
| ***Note: Please make sure every CLO must be assessed at least 3 times.*** | | | | | | |

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| 1. **Weekly Plan** | | | | |
| **Week** | **Lecture No** | **Topic Covered** | **CLO** | **Assessment Tool** |
| 1 | 1 | Introduction | **1** |  |
| 2 | Functions of Several Variables (Level Sketching) | **1** |  |
| 3 | Domain | **1** |  |
| 2 | 4 | Limits | **1** |  |
| 5 | Continuity | **1** |  |
| 6 | Partial Differentiation | **1** |  |
| 3 | 7 | Higher derivatives | **1** |  |
| 8 | Implicit partial differentiation | **1** |  |
| 9 | Chain Rule of multivariable functions | **1** |  |
| 4 | 10 | Total differential | **1** |  |
| 11 | Total differential with one & two independent | **1** |  |
| 12 | Differentials and their applications: Tangent plane | **1** | **A1** |
| 5 | 13 | Jacobian | **1** | **Q1** |
| 14 | Taylor’s series | **1** |  |
| 15 | Maximum and minimum values of function | **1** |  |
| 6 | 16 | Lagrange method of undetermined multiplier | **2** |  |
| 17 | Multiple Integrals: Introductions to Double integration | **2** |  |
| 18 | Double integral in Cartesian coordinates (Constant limits) | **2** |  |
| 7 | 19 | Double integral in Cartesian coordinates (General limits) | **2** |  |
| 20 | Double integral in polar coordinates | **2** |  |
| 21 | **Project / CCP Discussion and Group allocation** | **1-3** |  |
| **8** | **Midterm Exam** | | | |
| 9 | 22 | Triple integral in Cartesian (Constant limits) | **2** |  |
| 23 | Triple integral in Cartesian (General limits) | **2** |  |
| 24 | Triple integral, Volume of solid bounded by cylinder (cylindrical coordinates) | **2** | **A2** |
| 10 | 25 | Triple integral, Volume of solid bounded by sphere (spherical coordinates) | **2** | **Q2** |
| 26 | Vector field, Line Integrals | **3** |  |
| 27 | Work done, conservative field | **3** |  |
| 11 | 28 | Conservative field, scalar potential | **3** |  |
| 29 | Surface Integrals | **3** |  |
| 30 | Surface of cylinder | **3** |  |
| 12 | 31 | Surface of cube bounded by plane | **3** |  |
| 32 | Green’s Theorem for plane | **3** |  |
| 33 | Application of Green’s theorem | **3** |  |
| 13 | 34 | Area of plane region by Green’s theorem | **3** |  |
| 35 | Gauss’s theorem of divergence | **3** |  |
| 36 | Applications of divergence | **3** |  |
| 14 | 37 | Cont. | **3** | **A3** |
| 38 | Stroke’s Theorem: statement and theorem | **3** | **Q3** |
| 39 | Applications of Stroke’s theorem | **3** |  |
| 15 | 40 | Relation between line and surface integral | **3** |  |
| 41 | Fourier series: periodic function, Fourier cosine & sine series | **3** |  |
| 42 | Fourier transform: Fourier sine and cosine transform | **3** |  |
| 16 | 43 | **Project / CCP presentations and submissions** | **1-3** |  |
| 44 |  |
| 45 |  |
| **17** | **Final Exam** | | | |

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| 1. **IU Assessment / grading Policy** | **Instructor grading for course** |
| Quizzes 10-15%  Assignments 10-15%  Projects/Presentation/CCP 0-10%  Mid Semester Examination/ 20-30%  End Semester Examination 40-50% | 15  15  05  25  40 |

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| **IQRA University (IU)** | | |
| **Faculty of Engineering Sciences and Technology (FEST)** | | |
| **Computer Science Department (CS)** | | |
| **Course Code** | **Course Name** | **Credit Hr** |
| **CMC112** | Object Oriented Programming | **3+1** |

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| 1. **Basic Information** | | | |
| **Instructor** |  | **Designation** |  |
| **Prerequisite(s)** | CMC 111 | **Semester** |  |
| **Email** |  | **Phone** |  |
| **Consulting Hours** |  | **Office Location** |  |

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| 1. **Course Objective(s)** |
| To understand the principles of object-oriented paradigm and introduce objects & their relationships including associations and inheritance, class hierarchy, operations on objects and use these concepts to build object-oriented solutions for real world problems. |

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| 1. **Course Contents** |
| 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 |

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| 1. **Course Learning Outcomes** | | | | | | |
| **CLOs** | **CLO Statement** | **BT Level** | **Mapping** | | | **% Weight** |
| **GAs** | **ACM KA** | **SGDs** |
| CLO1 | **Understand** the basic techniques of an object-oriented paradigm. | C2 | GA2 | #14  PL | 9 | 31% |
| CLO2 | **Examine** the objects & their relationships to build a solution for a given problem using object-oriented principles | C3 | GA2 | 34% |
| CLO3 | **Optimize** an object-oriented solution | C4 | GA4 | 35% |
| ***Note: On successful completion of course GA1 (Academic Education) will automatically attain.*** | | | | | | |

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| 1. **Course Textbook / Reference Books and Supplementary Reading Material** | | | |
| **#** | **Book Title** | **Author(s)** | **Edition/ publication year/publisher** |
| 1. 1 | Java: How to Program | Paul Deitel | 11th Edition, 2018 |
| 1. 2 | Effective Java | Joshua Bloch | 3rd Edition, 2021 |
| 1. 3 | Java for Dummies | Barry Burd | 7th Edition, 2024 |

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| 1. **CLO Outcome Based Assessment (OBA) Tentative** | | | | | | |
| **Assessment Tool** | | **CLO Mapped** | **CLO Marks** | **% Weight** | **Total Marks** | **Assessment Date** |
| **Quizzes**  **10** | Quiz #1 | CLO 1 | 3 | 30% | 3 | TBD |
| Quiz #2 | CLO 2 | 3 | 30% | 3 | TBD |
| Quiz #3 | CLO 3 | 4 | 40% | 4 | TBD |
| **Total Quizzes %** | | | **100%** | 10 |  |
|  | | | | | | |
| **Assignments**  **15** | Assignment #1 | CLO 1 | 5 | 33% | 5 | TBD |
| Assignment #2 | CLO 2 | 5 | 33% | 5 | TBD |
| Assignment #3 | CLO 3 | 5 | 33% | 5 | TBD |
|  | **Total Assignments %** | | | **100%** | 15 |  |
|  | | | | | | |
| **Midterm**  **25** | Midterm Q#1 | CLO 1 | 5 | 20% | **5** | TBD |
| Midterm Q#2 | CLO 1 | 5 | 20% | **5** | TBD |
| Midterm Q#3 | CLO 1 | 5 | 20% | **5** | TBD |
| Midterm Q#4 | CLO 2 | 5 | 20% | **5** | TBD |
| Midterm Q#5 | CLO 2 | 5 | 20% | **5** | TBD |
|  | **Total Midterm %** | | | **100%** | **25** |  |
|  | | | | | | |
| **Project/CCP**  **10** | Project/CCP | CLO3 | 10 | 100% | 10 | TBD |
|  | **Total Project /CCP %** | | | **100%** |  |  |
|  | | | | | | |
| **Final Exam**  **40** | Final Q #1 | CLO1 | 8 | 20% | 8 | TBD |
| Final Q#2 | CLO2 | 8 | 20% | 8 | TBD |
| Final Q #3 | CLO2 | 8 | 20% | 8 | TBD |
| Final Q#4 | CLO3 | 8 | 20% | 8 | TBD |
| Final Q#5 | CLO3 | 8 | 20% | 8 | TBD |
|  | **Total Final Exam %** | | | **100%** |  |  |
| **100** | **Total Marks** | | | | **100** |  |
| ***Note: Please make sure every CLO must be assessed at least 3 time.*** | | | | | | |

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| 1. **Weekly Plan** | | | | |
| **Week** | **Lecture No** | **Topic Covered** | **CLO** | **Assessment Tool** |
| 1 | 1 | Introduction to object-oriented design: History of Programming, Machine Language, | **1** |  |
| 2 | Assembly Language, High Level Language (Procedural Programming), Advantages of Object-Oriented Approach | **1** |  |
| 3 | Introducing Java: Features, Java basics, first java program, JRE, JDK, JVM | **1** |  |
| 2 | 4 | Introduction to object-oriented programming concepts: Class, Objects, Object Modeling | **1** |  |
| 5 | General Form of a Class, Declaring Objects, Relation between Class and Object | **1** |  |
| 6 | Writing program using classes and objects, Constructors, Types of Constructors | **2** |  |
| 3 | 7 | Advance OOP Concepts: Reference Type & Reference Variable | **1** |  |
| 8 | Primitive Types vs. Reference Types Variables, Java classes | **1** |  |
| 9 | Instance Variables and Methods, Static Variables and Methods | **3** | **Q1** |
| 4 | 10 | Methods: Member Method of Class, Object as Parameter, Argument Types | **1** |  |
| 11 | Passing Objects to Methods, returning objects from methods | **2** |  |
| 12 | Data Encapsulation & Data hiding | **1** | **A1** |
| 5 | 13 | Method Overloading: Overloading methods and Constructors | **1** |  |
| 14 | Method Overloading, Message Passing Between Objects, Obtaining Handles on Objects | **1** |  |
| 15 | Relationships: Identification of classes and their relationships, composition, aggregation | **2** |  |
| 6 | 16 | Inheritance: Inheritance Basics, Superclass & subclass | **1** |  |
| 17 | Multilevel Hierarchy, Super keyword, Multilevel Hierarchy | **1** |  |
| 18 | Polymorphism: Compile-time Polymorphism | **1** | **Q2** |
| **7** | 19 | Polymorphism: Run time polymorphism | **2** |  |
| 20 | Examples of Polymorphism | **3** |
| 21 | **Project / CCP Discussion and Group allocation** | **3** |
| **8** | **Midterm Exam** | | | |
| 9 | 22 | Abstract Class: Abstract methods, Final class | **1** |  |
| 23 | Interfaces: Multiple inheritance in Java, Defining an Interface, Implementing Interfaces | **2** |  |
| 24 | Abstract Classes vs Interfaces | **3** | **A2** |
| 10 | 25 | Introduction to GUI: JavaFX basics | **1** |  |
| 26 | Stage, Scene, Scene Graphs | **2** |  |
| 27 | Controls in JavaFX, Layouts, Graphs etc. | **2** |  |
| 11 | 28 | Exception Handling: Exception handling basics, exception types, uncaught exceptions, using try and catch | **2** |  |
| 29 | finally block, multiple catch clauses, nested try statements | **2** |  |
| 30 | throw clause, some useful exceptions of java class library | **2** | **Q3** |
| 12 | 31 | Collections: Ordered lists, Dictionaries, Sets | **1** |  |
| 32 | predefined Java collection types | **1** |  |
| 33 | Inventing new collections | **3** |  |
| 13 | 34 | Generics: Generic class, Generic interfaces, Generic methods | **1** |  |
| 35 | Casting using generics, raw type | **1** |  |
| 36 | Wildcards & types, restrictions on generics | **3** | **A3** |
| 14 | 37 | Serialization: File Processing & I/O operations | **1** |  |
| 38 | ObjectInputStream, ObjectOutputStream | **1** |  |
| 49 | Serializable interface, Serializing & Deserializing an Object | **2** |  |
| 15 | 40 | Inner Classes and Lambdas | **1** |  |
| 41 | Lambda Expressions in Java, Functional Interfaces | **3** |  |
| 42 | Using an anonymous inner class for an event listener. writing a sorting method with a lambda expression. | **3** |  |
| 16 | 43 | Final review of all topics covered. Revision | **1/2/3** |  |
| 44 | **Project / CCP presentations and submissions.** | **3** |  |
| 45 |  |
| **17** | **Final Exam** | | | |

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| 1. **IU Assessment / grading Policy** | **Instructor grading for course \*** |
| Quizzes 10-15%  Assignments 10-15%  Projects/Presentation/CCP 0-10%  Mid Semester Examination/ 20-30%  End Semester Examination 40-50% | 10%  15%  10%  25%  40% |

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| **IQRA University (IU)** | | |
| **Faculty of Engineering Sciences and Technology (FEST)** | | |
| **Computer Science Department (CS)** | | |
| **Course Code** | **Course Name** | **Credit Hr** |
| **CMC112-L** | Object Oriented Programming Lab | **3 +1** |

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| 1. **Basic Information** | | | |
| **Instructor** |  | **Designation** |  |
| **Prerequisite(s)** | CMC111-L | **Semester** |  |
| **Email** |  | **Phone** |  |
| **Consulting Hours** |  | **Office Location** |  |

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| 1. **Course Objective(s)** |
| The objective of this lab is to make students learn about fundamental concepts of Object-Oriented Programming and its implementation in Java language. The lab covers the concept of classes, objects, attributes, operator overloading, inheritance, virtual functions and friend functions |

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| 1. **Course Contents** |
| 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. |

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| 1. **Course Learning Outcomes** | | | | | | |
| **CLOs** | **CLO Statement** | **BT Level** | **Mapping** | | | **% Weight** |
| **GAs** | **ACM KA** | **SGDs** |
| CLO1 | **Knows** and acts upon a sequence of steps in an object-oriented process. | P2 | GA2 | #14  PL | 9 | 25% |
| CLO2 | **Manipulate** the objects & their relationships to build a solution for a given problem using object-oriented principles | C3 | GA5 | 25% |
| CLO3 | ***Participate*** in lab activities such as projects as an individual and as an effective team member utilizing the concepts of object-oriented programming to solve real-life problems. | A3 | GA6 | 50% |
| ***Note: On successful completion of course GA1 (Academic Education) will automatically attain.*** | | | | | | |

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| 1. **Course Textbook / Reference Books and Supplementary Reading Material** | | | |
| **S No** | **Book Title** | **Author(s)** | **Edition/ publication year/publisher** |
| 1. 1 | Java: How to Program | Paul Deitel | 11th Edition, 2018 |
| 1. 2 | Effective Java | Joshua Bloch | 3rd Edition, 2021 |
| 1. 3 | Java for Dummies | Barry Burd | 7th Edition, 2024 |

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| 1. **CLO Outcome Based Assessment (OBA) Tentative** | | | | | | |
| **Assessment Tool** | | **CLO Mapped** | **CLO Marks** | **% Weight** | **Total Marks** | **Assessment Date** |
| **Quizzes**  **0** |  |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
| **Total Quizzes %** | | | **0** | 0 |  |
|  | | | | | | |
| **Lab Manual Task**  **15** | Lab task | **CLO 1/2/3** | 15 | **100%** | 15 | TBD |
| **Total Assignments %** | | | **100%** | **15** |  |
|  | | | | | | |
| **Midterm**  **25** | Midterm Q#1 | CLO 1 | 10 | 40% | 10 | TBD |
| Midterm Q#2 | CLO 1 | 10 | 40% | 10 | TBD |
| Midterm Q#3 | CLO 2 | 5 | 20% | 5 | TBD |
|  | **Total Midterm %** | | | **100%** | **25** |  |
|  | | | | | | |
| **Project/OEL**  **20** | Project/OEL | CLO 3 | 20 | 100% | 20 | TBD |
|  | **Total Project /CCP %** | | | **100%** | **20** |  |
|  | | | | | | |
| **Final Exam**  **40** | Final Exam Q#1 | CLO2 | 10 | 25% | 10 | TBD |
| Final Exam Q#2 | CLO2 | 10 | 25% | 10 | TBD |
| Final Exam Q#3 | CLO3 | 20 | 50% | 20 | TBD |
|  | **Total Final Exam %** | | | **100%** | **40** |  |
| **100** | **Total Marks** | | | | **100** |  |
| **Note: Please make sure every CLO must be assessed at least 3 time.** | | | | | | |

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| 1. **Weekly Plan** | | | | | | |
| **Week**  **No** | **Lab No** | **Lab Description** | | **Contact**  **Hr** | | **CLO** |
| 1 | 1 | Introduction to Java and Programming Elements | | 3 | | **1/2/3** |
| 2 | 2 | Java Control Statement, Loops & Operators | | 3 | | **1/2/3** |
| 3 | 3 | Introducing Classes and Objects | | 3 | | **1/2/3** |
| 4 | 4 | Overloading & Access Control | | 3 | | **1/2/3** |
| 5 | 5 | Arrays & Strings | | 3 | | **1/2/3** |
| 6 | 6 | Inheritance in Java, | | 3 | | **1/2/3** |
| 7 |  | **Open Ended Lab/ Project / PBL Assignment** | | 3 | | **1/2/3** |
| 8 | Midterm Exam | | | | | |
| 9 | 7 | Abstract Classes | 3 | | **1/2/3** | |
| 10 | 8 | Packages & Interfaces | 3 | | **1/2/3** | |
| 11 | 9 | Exception Handling | 3 | | **1/2/3** | |
| 12 | 10 | Introducing JavaFX – Java GUI | 3 | | **1/2/3** | |
| 13 | 11 | Exploring JavaFX layouts and charts | 3 | | **1/2/3** | |
| 14 | 12 | JavaFX Application: Design with Event Handling | 3 | | **1/2/3** | |
| 15 | 13 | File Handling in Java | 3 | | **1/2/3** | |
| 16 | 14 | **Open Ended Lab/Project / PBL Assessment** | | 3 | | **1/2/3** |
| 17 | **Final Exam** | | | | | |

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| 1. **IU Assessment / grading Policy** | **Instructor grading for course \*** |
| Quizzes 0-10%  Labs Task Assessment 10-20%  Projects/OEL/PBL 5-20%  Mid Semester Examination/ 20-30%  End Semester Examination 40-50% | 0  15%  20%  25%  40% |

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| **IQRA University (IU)** | | |
| **Faculty of Engineering Sciences and Technology (FEST)** | | |
| **Computer Science Department (CS)** | | |
| **Course Code** | **Course Name** | **Credit Hr** |
| **CMC123** | Digital Logic Design | **2+1** |

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| 1. **Basic Information** | | | |
| **Instructor** |  | **Designation** |  |
| **Prerequisite(s)** | GER 152 | **Semester** | Fall 2024 |
| **Email** |  | **Phone** |  |
| **Office Hours** |  | **Office Location** |  |

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| 1. **Course Objective(s)** |
| Digital Logic Design is a foundational, one-semester course designed for first-year Computer Science students in their program. This course introduces fundamental logic operators and gates, providing the groundwork for understanding the basic building blocks of computers. It covers both combinational and sequential circuits, including key components such as arithmetic circuits, comparators, decoders, encoders, multiplexers, tristate gates, latches, flip-flops, counters, and registers. The knowledge gained in this course serves as a stepping stone for advanced studies in Computer Organization and Assembly Language (COAL) and Computer Architecture, which are offered in subsequent semesters. In this course students will learn principles of Digital Logic Design. They will combine classical design methodologies with a series of laboratory assignments in which they will demonstrate their ability to successfully design, implement, and debug digital systems using Computer Aided Design tools and physical prototyping. |

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| 1. **Course Contents** |
| The Digital Logic Design theory course covers the foundational principles of digital systems, beginning with an introduction to number systems, binary arithmetic, and Boolean algebra. It explores logic gates and their applications in the design of combinational circuits, including adders, subtractors, decoders, encoders, multiplexers, and demultiplexers. The course also delves into sequential circuits, focusing on flip-flops, latches, counters, and shift registers. Students learn about the design and analysis of arithmetic circuits, such as comparators and multipliers, and study the behavior of tri-state gates. Emphasis is placed on minimizing logic expressions using Karnaugh maps and understanding circuit timing, hazards, and glitches. Through these topics, the course lays the groundwork for advanced subjects in computer architecture and system design. |

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| 1. **Course Learning Outcomes** | | | | | | |
| **CLOs** | **CLO Statement** | **BT Level** | **Mapping** | | | **% Weight** |
| **GAs** | **ACM KA** | **SGDs** |
| CLO1 | **Explain** the Digital principles, arithmetic operations, and different simplification techniques required to model any computing system. | C2 | GA2 | #02  AR | 4 | 31.25 % |
| CLO2 | **Apply** Boolean algebra, Karnaugh maps, logic gates, and other techniques to simplify and optimize logic expressions and to design combinational logic circuits to perform specific functional requirements. | C3 | GA2 | 37.7% |
| CLO3 | **Investigate** the functionality and timing characteristics of sequential circuits, including flip-flops, counters, and shift registers, to assess their role in designing reliable digital systems. | C4 | GA3 | 31.25% |
| ***Note: On successful completion of course GA1 (Academic Education) will automatically attain.*** | | | | | | |

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| 1. **Course Textbook / Reference Books and Supplementary Reading Material** | | | |
| **S No** | **Book Title** | **Author(s)** | **Edition/ publication year/publisher** |
|  | Digital Fundamentals | Thomas L Floyd | 11th Edition, 2015, Pearson Education Limited |
|  | Digital Logic & Computer Design | M. Morris Mano, Charles Kime | 4th Edition, 2014, Pearson Education Limited |
|  | Digital Systems: Principles and Applications | Ronald J. Tocci,  Neal S. Widmer,  Gregory L. Moss | 10th Edition, 2007, Pearson Education Limited |

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| 1. **CLO Outcome Based Assessment (OBA)** | | | | | | |
| **Assessment Tool** | | **CLO Mapped** | **CLO Marks** | **% Weight** | **Total Marks** | **Assessment Date** |
| **Quizzes**  **15** | Quiz #1 | *CLO1* | 05 | 33.33% | 5 | TBD |
| Quiz #2 | *CLO2* | 05 | 33.33% | 5 |  |
| Quiz #3 | *CLO3* | 05 | 33.33% | 5 |  |
| **Total Quizzes %** | | | **100%** | **15** |  |
|  | | | | | | |
| **Assignments**  **15** | Assignment #1 | *CLO1* | 05 | 33.33% | 5 |  |
| Assignment #2 | *CLO2* | 05 | 33.33% | 5 |  |
| Assignment #3 | *CLO3* | 05 | 33.33% | 5 |  |
|  |  | | | **100%** | **15** |  |
|  | | | | | | |
| **Midterm**  **25** | Midterm Q#1 | *CLO1* | 12 | 48% | **12** |  |
| Midterm Q#2 | *CLO2* | 13 | 52% | **13** |  |
|  | **Total Midterm %** | | | **100%** | **25** |  |
|  | | | | | | |
| **Project/CCP**  **05** | Project/CCP | *CLO3* | 5 | 100% | **5** |  |
|  | **Total Project /CCP %** | | | **100%** | **5** |  |
|  | | | | | | |
| **Final Exam**  **40** | Final Exam Q#1 | *CLO1* | 10 | 25% | **10** |  |
| Final Exam Q#2 | *CLO1* | 10 | 25% | **10** |  |
| Final Exam Q#3 | *CLO3* | 20 | 50% | **20** |  |
|  | **Total Final Exam %** | | | **100%** | **40** |  |
| **100** | **Total Marks** | | | | **100** |  |
| ***Note: Please make sure every CLO must be assessed at least 3 time.*** | | | | | | |

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| 1. **Weekly Plan** | | | | |
| **Week** | **Lecture No** | **Topic Covered** | **CLO** | **Assessment Tool** |
| 1 | 1 | Introduce the significance of digital systems, differentiate them from analog systems using basic terminology, and explain number systems, including binary, decimal, octal, and hexadecimal. | **CLO1** |  |
| 2 | Explain binary arithmetic operations, including addition, subtraction, multiplication, and division, with examples. | **CLO1** |  |
| 2 | 4 | Introduce AND, OR, and NOT gates with their truth tables and circuit symbols, and explain combinational circuits in detail based on these gates. | **CLO1** |  |
| 5 | Introduce NAND, NOR, XOR, and XNOR gates with their truth tables and circuit symbols, and explain combinational circuits in detail based on these gates. | **CLO1** | **Quiz 1** |
| 3 | 7 | Explore Boolean algebra properties like commutative, associative, distributive laws, and De Morgan's theorems. | **CLO1** |  |
| 7 | Practice simplifying Boolean expressions using the laws of Boolean algebra. | **CLO2** | **Assignment 1** |
| 4 | 10 | Define SOP (Sum of Products) and POS (Product of Sums) with examples. | **CLO2** |  |
| 11 | Build small circuits using SOP and POS forms and implement logic expressions with basic gates. | **CLO2** |  |
| 5 | 13 | Explain the purpose of K-Maps and their application in minimizing Boolean functions. | **CLO2** |  |
| 14 | Plot and simplify using 2-variable and 3-variable K-Maps with examples. | **CLO2** |  |
| 6 | 16 | Extend to 4-variable K-Maps, demonstrating simplification techniques, identifying prime implicants, and finding minimal expressions. | **CLO2** |  |
| 17 | Handle "don't-care" conditions in K-Maps to simplify logic functions and design simplified combinational circuits. | **CLO2** | **Quiz 2** |
| **7** | 19 | Explain the operation, truth tables, and circuit design of half adders and full adders, along with the design and functionality of multiplexers and demultiplexers with practical examples. | **CLO1** | **Assignment 2** |
| 20 | **Discuss and assign CCP tasks.** | **CLO1/2/3** |  |
| **8** | **Midterm Exam** | | | |
| 9 | 22 | The design and functionality of Comparators, encoders and decoder with practical examples. | **CLO1** |  |
| 23 | Introduction to SR and D flip-flops, their operations, truth tables, and timing diagrams. | **CLO3** |  |
| 10 | 25 | Explore JK and T flip-flops, their characteristics, and practical applications. | **CLO3** |  |
| 26 | Define asynchronous (ripple) counters and analyze their operation with examples. | **CLO3** |  |
| 11 | 28 | Explore synchronous counters, including design and timing analysis. | **CLO2** |  |
| 29 | Design and implement counters that increment and decrement based on input and Decade Counter. | **CLO3** |  |
| 12 | 31 | Differentiate asynchronous and synchronous counters, highlighting benefits of synchronous design. | **CLO3** | **Quiz 3** |
| 32 | Design Up, Down, and Mod-N synchronous counters with timing analysis. | **CLO2** |  |
| 13 | 34 | Registers (Memory Unit), Serial-in Serial-out Shift Register | **CLO3** |  |
| 35 | Serial-in parallel-out Shift Register, Parallel-in serial-out Shift Register, Parallel-in Parallel-out Shift Register. | **CLO3** |  |
| 14 | 37 | Introduce Finite State Machines (FSMs). | **CLO1** | **Assignment 3** |
| 38 | Mealy machines, their structure, working principle, and examples. | **CLO2** |  |
| 15 | 40 | Moore machines, their structure, working principle, and examples. | **CLO2** |  |
| 41 | Define Verilog HDL and provide basic examples of circuits, such as counters and adders, implemented in Verilog. | **CLO3** |  |
| 16 | 43 | **CCP Submission and Assessment** | **CLO1/2/3** |  |
| 44 |  |
| **17** | **Final Exam** | | | |

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| 1. **IU Assessment / grading Policy** | **Instructor grading for course \*** |
| Quizzes 10-15%  Assignments 10-15%  Projects/Presentation/CCP 0-10%  Mid Semester Examination/ 20-30%  End Semester Examination 40-50% | 15%  15%  5%  25%  40% |

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| **IQRA University** | | |
| **Faculty of Engineering Sciences and Technology (FEST)** | | |
| **Computer Science Department (CS)** | | |
| **Course Code** | **Course Name** | **Credit Hr.** |
| **CMC123-L** | Digital Logic Design Lab | **2+1** |

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| 1. **Basic Information** | | | |
| **Instructor** |  | **Designation** |  |
| **Prerequisite(s)** | GER 152 -L | **Semester** | Fall 2024 |
| **Email** |  | **Phone** |  |
| **Office Hours** |  | **Office Location** |  |

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| 1. **Lab Objective(s)** |
| Digital Logic Design is a foundational, one-semester course designed for first-year Computer Science students in their program. This course introduces fundamental logic operators and gates, providing the groundwork for understanding the basic building blocks of computers. It covers both combinational and sequential circuits, including key components such as arithmetic circuits, comparators, decoders, encoders, multiplexers, tristate gates, latches, flip-flops, counters, and registers. The knowledge gained in this course serves as a stepping stone for advanced studies in Computer Organization and Assembly Language (COAL) and Computer Architecture, which are offered in subsequent semesters. In this course students will learn principles of Digital Logic Design. They will combine classical design methodologies with a series of laboratory assignments in which they will demonstrate their ability to successfully design, implement, and debug digital systems using Computer Aided Design tools and physical prototyping. |

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| 1. **Lab Contents** |
| The Digital Logic Design theory course covers the foundational principles of digital systems, beginning with an introduction to number systems, binary arithmetic, and Boolean algebra. It explores logic gates and their applications in the design of combinational circuits, including adders, subtractors, decoders, encoders, multiplexers, and demultiplexers. The course also delves into sequential circuits, focusing on flip-flops, latches, counters, and shift registers. Students learn about the design and analysis of arithmetic circuits, such as comparators and multipliers, and study the behavior of tri-state gates. Emphasis is placed on minimizing logic expressions using Karnaugh maps and understanding circuit timing, hazards, and glitches. Through these topics, the course lays the groundwork for advanced subjects in computer architecture and system design. |

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| 1. **Course Learning Outcomes** | | | | | | |
| **CLOs** | **CLO Statement** | **BT Level** | **Mapping** | | | **% Weight** |
| **GAs** | **ACM KA** | **SDGs** |
| CLO1 | **Measure** the different parameters/outputs of various sequential and combinational circuits using key concepts of digital logic design. | P3 | GA5 | #2  AR | 4 | 65% |
| CLO2 | **Discuss** the optimist approach to fulfill the requirement of digital combinational or sequential circuits. | A3 | GA3 | 35% |
| **Note: On successful completion of course GA 1 (Academic Education) will automatically attain.** | | | | | | |

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| 1. **Course Textbook / Reference Books and Supplementary Reading Material** | | | |
| **S No** | **Book Title** | **Author(s)** | **Edition/ publication year/publisher** |
|  | Digital Fundamentals | Thomas L Floyd | Eleventh Edition |
|  | Digital Logic & Computer Design | M. Morris Mano | Fourth Edition |

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| 1. **CLO Outcome-Based Assessment (OBA)** | | | | | | |
| **Assessment Tool** | | **CLO Mapped** | **CLO Marks** | **% Weight** | **Total Marks** | **Assessment Date** |
| **Quizzez**  **0** | Quiz #1 | *CLO1/2* | 0 | 0% | 0 |  |
| Quiz #2 | *CLO1/2* | 0 | 0% | 0 |  |
| Quiz #3 | *CLO1/2* | 0 | 0% | 0 |  |
| **Total Quizzes %** | | | **0%** | 0 |  |
|  | | | | | | |
| **Lab Manual**  **20** | Lab Task #1 | *CLO1/2* | 10 | 10% | 0 |  |
| Lab Task #2 | *CLO1/2* | 10 | 10% | 0 |  |
| Lab Task #n | *CLO1/2* | 0 |  | 0 |  |
|  | **Total Lab Manual %** | | | **20%** | 20 |  |
|  | | | | | | |
| **Midterm**  **25** | Midterm Q#1, 2 | *CLO1* | 20 |  |  |  |
| Midterm Q#3 | *CLO1* | 5 |  |  |  |
|  |  |  |  |  |  |  |
|  | **Total Midterm %** | | | **25%** | **25** |  |
|  | | | | | | |
| **Project/OEL**  **15** | Project/CCP | *CLO1/2* | 15 |  |  |  |
|  | **Total Project /CCP %** | | | **15%** | **15** |  |
|  | | | | | | |
| **Final Exam**  **40** | Final Exam Q# | *CLO1/2* | 10 |  |  |  |
| Final Exam Q# | *CLO1/2* | 10 |  |  |  |
|  | Final Exam Qn | *CLO1/2* |  |  |  |  |
|  | **Total Final Exam %** | | | **40%** | **40** |  |
| **100** | **Total Marls** | | | | **100** |  |
| ***Note: Please make sure every CLO must be assessed at least 3 times.*** | | | | | | |

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| 1. **Weekly Plan** | | | | |
| **Week**  **No.** | **Lab No.** | **Lab Description** | **Contact**  **Hr.** | **CLO** |
| 1 | 1 | Study and observe the logic gates & familiarize yourself with Combinational logic. | 3 | 1-2 |
| 2 | 2 | Observe and Execute De-Morgan’s laws and verification of Boolean Laws and Rules. | 3 | 1-2 |
| 3 | 3 | Observe and execute the 4 variables Karnaugh-Map. | 3 | 1-2 |
| 4 | 4 | Assemble and Observe Half and Full Adder Circuits | 3 | 1-2 |
| 5 | 5 | 1. Execute and Observe of Comparator and experiment with 74HC85IC. 2. Execute and observe a 4x2 Priority Encoder and Experiment with 74148IC. | 3 | 1-2 |
| 6 | 6 | 1. Observe and Execute an Odd Parity Generator and Checker for 3-bit Data. 2. Assemble and execute to convert given binary numbers to gray codes. | 3 | 1-2 |
| 7 |  | **Open Ended Lab/Project Assigned** |  | 1-2 |
| 8 | **Midterm Exam** | | | |
| 9 | 7 | Observe and execute a 4x1 Multiplexer and Experimenting with 74151 IC | 3 | 1-2 |
| 10 | 8 | 1. Assemble and execute a 2x4 Decoder / 1x4 De-multiplexer and experimenting with 74138IC. 2. Observe and execute a seven-segment display by using 7448 driver IC. | 3 | 1-2 |
| 11 | 9 | Construct and Execute the RS Latch and Flip-flop using the universal gate | 3 | 1-2 |
| 12 | 10 | Construct and Execution of JK flip-flop, and develop D- Flip-flop using JK FF. | 3 | 1-2 |
| 13 | 11 | Observe and exercise the working of a 4-bit Up/Down counter using IC 74193. | 3 | 1-2 |
| 14 | 12 | Observe and Construct the Serial in Serial out shift register using JK Flip Flop and implement it using 74273 IC. | 3 | 1-2 |
| 15 |  | **Revision / Open Ended Lab/Project Assessment** |  | 1-2 |
| 16 |  | **Open Ended Lab/Project Assessment** |  | 1-2 |
| 17 | **Final Exam** | | | |

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| 1. **IU Assessment/grading Policy** | **Instructor grading for the course \*** |
| Lab Manual 10-20%  Projects/OEL/PBL 10-25%  Mid Semester Examination/ 20-30%  End Semester Examination 40-50% | 15  20  25  40 |

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| IQRA University (IU) | | |
| Faculty of Engineering Sciences and Technology (FEST) | | |
| Computer Science Department (CS) | | |
| Course Code | Course Name | Credit Hr |
| GER122 | Expository Writing | 3+0 |

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| 1. Basic Information | | | |
| Instructor | Maham Abid | Designation | Instructor |
| Prerequisite(s) | GER121 | Semester | Fall 2024 |
| Email | maham.abid@iqra.edu.pk | Phone |  |
| Consulting Hours |  | Office Location | Faculty Cubicle, 8th Floor |

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| 1. **Course Objective(s)** |
| The course is designed to develop advanced communicative skills, preparing students for real-life contexts beyond the classroom. It focuses on refining students' critical thinking abilities while offering opportunities to express ideas and opinions through both written and oral communication. Throughout various modules, students will learn to analyze their audience, understand the purpose of communication, and plan their work accordingly. A key goal of the course is to enhance effective oral communication, which is achieved through group discussions, individual presentations, and mock interviews. Additionally, students will develop professional writing skills by practicing the composition of letters, emails, and memos. |

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| 1. **Course Contents** |
| The course covers the principles of writing good English, understanding the composition process, focusing on writing clearly, and developing skills in words, sentences, and paragraphs. It emphasizes comprehension and expression, with a strong focus on the correct use of grammar and punctuation. Students will learn the entire process of writing, including observing, understanding the audience, collecting information, composing, drafting, and revising. Persuasive writing techniques, along with reading, listening, and comprehension skills, are also key components. Additionally, the course covers skills for taking notes in class and preparing for exams. Business communication is another important area, focusing on planning messages and writing concise, impactful content. Students will also learn business letter formats. The course further develops presentation skills, teaching strategies such as defining the objective, scope, and audience, organizing material, managing time, and delivering effective presentations using audio-visual aids. |

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| 1. **Course Learning Outcomes** | | | | | | |
| **CLOs** | **CLO Statement** | **BT Level** | **Mapping** | | | **% Weight** |
| **GAs** | **ACM KA** | **SDGs** |
| CLO1 | **Demonstrate** in well-articulated way the importance of using communication and its different channels in one’s personal and professional life. | A3 | GA6 | #18  SP | 8,10 | 31% |
| CLO2 | **Select** an appropriate medium of communication for a smooth and effective official correspondence | C3 | GA7 | 34% |
| CLO3 | **Present** well-organized thoughts orally to an audience in a formal environment | A2 | GA7 | 35% |
| ***Note: On successful completion of course GA 1 (Academic Education) will automatically attain.*** | | | | | | |

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| 1. **Course Textbook / Reference Books and Supplementary Reading Material** | | | |
| **S No** | **Book Title** | **Author(s)** | **Edition/ publication year/publisher** |
|  | Essentials of Business Communication. | Mary Ellen Guffey | 10 th edition Publisher Cenage Learning |
|  | College Writing Skills with Reading | John Langan | 5th edition Publisher McGraw-Hill |

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| 1. **CLO Outcome Based Assessment (OBA)** | | | | | | |
| **Assessment Tool** | | **CLO Mapped** | **CLO Marks** | **% Weight** | **Total Marks** | **Assessment Date** |
| **Quizzes**  **10** | Quiz #1 | *CLO1* | 3 | 30% | 3 | TBD |
| Quiz #2 | *CLO2* | 3 | 30% | 3 | TBD |
| Quiz #3 | *CLO3* | 4 | 40% | 4 | TBD |
| **Total Quizzes %** | | | **100%** | **15** |  |
|  | | | | | | |
| **Assignments**  **15** | Assignment #1 | *CLO1* | 5 | 33.33% | 5 | TBD |
| Assignment #2 | *CLO2* | 5 | 33.33% | 5 | TBD |
| Assignment #3 | *CLO3* | 5 | 33.33% | 5 | TBD |
|  | **Total Assignments %** | | | **100%** | **15** |  |
|  | | | | | | |
| **Project/CCP**  **10** | Project/CCP | *CLO3* | 10 | 100% | 10 | TBD |
|  | **Total Project /CCP %** | | | **100%** | **10** |  |
|  | | | | | | |
| **Midterm**  **25** | Midterm Q#1 | *CLO1* | 5 | 20% | 05 | TBD |
| Midterm Q#2 | *CLO1* | 5 | 20% | 05 | TBD |
| Midterm Q#3 | *CLO1* | 5 | 20% | 05 | TBD |
| Midterm Q#4 | *CLO2* | 5 | 20% | 05 | TBD |
| Midterm Q#5 | *CLO2* | 5 | 20% | 05 | TBD |
|  | **Total Midterm %** | | | **100%** | **25** |  |
|  | | | | | | |
| **Final Exam**  **40** | Final Exam Q#1 | *CLO1* | 8 | 20% | 8 | TBD |
| Final Exam Q#2 | *CLO2* | 8 | 20% | 8 | TBD |
| Final Exam Q#3 | *CLO2* | 8 | 20% | 8 | TBD |
| Final Exam Q#4 | *CLO3* | 8 | 20% | 8 | TBD |
| Final Exam Q#5 | *CLO3* | 8 | 20% | 8 | TBD |
|  | **Total Final Exam %** | | | **100%** | **40** |  |
| **100** | **Total Marks** | | | | **100** |  |
| ***Note: Please make sure every CLO must be assessed at least 3 times.*** | | | | | | |

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| 1. **Weekly Plan** | | | | |
| **Week** | **Lecture No** | **Topic Covered** | **CLO** | **Assessment Tool** |
| 1 | 1 | Introduction to Communication Skills Types of Communication | 1 |  |
| 2 | The Communication Process | 1 |  |
| 3 | Audience Centered Approach | 1 |  |
| 2 | 4 | Verbal Communication | 1 | Q1 |
| 5 | Non-verbal Communication | 2 |  |
| 6 | Barriers to Communication, Improving Listening Skills | 2 |  |
| 3 | 7 | 3\*3 Writing Process | 2 | A1 |
| 8 | Completeness, Conciseness | 2 |  |
| 9 | Consideration | 2 |  |
| 4 | 10 | Clarity, Courtesy | 2 |  |
| 11 | Concreteness, Correctness | 2 |  |
| 12 | Practice Exercise | 1 & 2 | Q2 |
| 5 | 13 | Understanding Email Communication, Components of Effective Emails | 1 |  |
| 14 | Writing Clear and Concise Subject Lines, Structuring Email Content | 2 |  |
| 15 | Tone and Professionalism in Email Communication | 2 |  |
| 6 | 16 | Introduction to Letter Writing, Types of Letters | 2 |  |
| 17 | Structure and Format of Letters | 2 |  |
| 18 | Writing Clear and Engaging Content | 2 |  |
| 7 | 19 | Introduction to Memo Writing, Types of Memos | 1 |  |
| 20 | The Memo Writing Process | 2 | A2 |
| 21 | Audience-Centered Approach to Memo Writing | 2 |  |
| **8** | **Midterm Exam** | | | |
| 9 | 22 | Structuring Presentations Effectively, Giving Interesting Introductions & Proper Conclusion | 3 |  |
| 23 | Designing Effective PowerPoint Presentations | 3 | Q3 |
| 24 | Body Language for Successful Presenters | 3 |  |
| 10 | 25 | POSITIVE AND ROUTINE MESSAGES: Introduction & Strategy, Routine Requests for Information/Claims | 1 |  |
| 26 | Granting Claims | 2 |  |
| 27 | Practice Exercise | 2 |  |
| 11 | 28 | NEGATIVE NEWS/REFUSALS:The Use of Buffers | **1** |  |
| 29 | Tactful Reasoning, Delivering the Bad News | 2 |  |
| 30 | Positive Close | 2 |  |
| 12 | 31 | PERSUASIVE MESSAGES Understanding Persuasion. What are the effective persuasion techniques? | **1** |  |
| 32 | Understanding the writing plan for persuasive requests. | 2 |  |
| 33 | How to plan a sales message? | 2 |  |
| 13 | 34 | Meeting Etiquettes. Writing Meeting Notice | 1 |  |
| 35 | Writing Meeting Agenda | 2 |  |
| 36 | Writing Minutes of the Meeting | 2 |  |
| 14 | 37 | Resume Writing | 2 |  |
| 38 | Tips for Resume Writing | 1 |  |
| 39 | Types of Resumes, Format of Resume | 2 |  |
| 15 | 40 | What is a cover letter? Types of Cover Letters | 2 |  |
| 41 | Writing effective cover letters? | 2 |  |
| 42 | Types of Interviews & Dos & Don’ts of Interviewing | 1 |  |
| 16 | 43 | Presentations | 3 |  |
| 44 | Presentations | 3 | A3 |
| 45 | Revision | 1, 2 &3 |  |
| **17** | **Final Exam** | | | |

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| 1. **IU Assessment / grading Policy** | **Instructor grading for course** |
| Quizzes 10-15%  Assignments 10-15%  Projects/Presentation/CCP 0-10%  Mid Semester Examination/ 20-30%  End Semester Examination 40-50% | 10%  15%  10%  25%  40% |

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| **IQRA University (IU)** | | |
| **Faculty of Engineering Sciences and Technology (FEST)** | | |
| **Computer Science Department (CS)** | | |
| **Course Code** | **Course Name** | **Credit Hr** |
| **GER132** | Discrete Structures | **3+0** |

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| 1. **Basic Information** | | | |
| **Instructor** |  | **Designation** |  |
| **Prerequisite(s)** | GER131 Calculus and Analytical Geometry | **Semester** | Fall 2024 |
| **Email** |  | **Phone** |  |
| **Consulting Hours** |  | **Office Location** |  |

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| 1. **Course Objective(s)** |
| 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, tree and graph structures. In this course more emphasis shall be given to statistical and probabilistic formulation with respect to computing aspects. |

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| 1. **Course Contents** |
| Mathematical reasoning, propositional and predicate logic, proof by induction, proof by contraposition, proof by contradiction, proof by implication, set theory, relations, equivalence relations and partitions, partial orderings, 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 algorithms, Euler graph, Hamiltonian path, and their applications. |

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| 1. **Course Learning Outcomes** | | | | | | |
| **CLOs** | **CLO Statement** | **BT Level** | **Mapping** | | | **% Weight** |
| **GAs** | **ACM KA** | **SDGs** |
| CLO1 | ***Understand*** the basic concepts of Logics, set theory, functions and relations. | C2 | GA2 | #4  DS | 4 | 40% |
| CLO2 | ***Apply*** the concepts of mathematical induction, sequences and series, and counting principle to solve computational problems efficiently. | C3 | GA2 | 20% |
| CLO3 | ***Apply*** the concepts of graphs, trees, and searching algorithms for their use in modeling networks, optimizing problem-solving techniques, and efficiently navigating data structures. | C3 | GA3 | 40% |
| ***Note: On successful completion of course GA 1 (Academic Education) will automatically attain.*** | | | | | | |

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| 1. **Course Textbook / Reference Books and Supplementary Reading Material** | | | |
| **S No** | **Book Title** | **Author(s)** | **Edition/ publication year/publisher** |
|  | Discrete Mathematics and Applications | Kevin Ferland | 2nd Edition / 2023 / Chapman and Hall/CRC |
|  | Discrete Mathematics with Applications | Susanna S. Epp | 5th Edition / 2019 / Cengage Learning |
|  | Discrete Mathematics and Its Applications | Kenneth H. Rosen | 8th Edition / 2019 / McGraw Hill |
|  | Discrete Mathematics for Computer Science: An Example-Based Introduction | Jon Pierre Fortney | 1st Edition / 2020 / Chapman and Hall/CRC |

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| 1. **CLO Outcome Based Assessment (OBA)** | | | | | | |
| **Assessment Tool** | | **CLO Mapped** | **CLO Marks** | **% Weight** | **Total Marks** | **Assessment Date** |
| **Quizzes**  **15** | Quiz #1 | *CLO1* | 5 | 33.33% | 5 | TBD |
| Quiz #2 | *CLO2* | 5 | 33.33% | 5 | TBD |
| Quiz #3 | *CLO3* | 5 | 33.33% | 5 | TBD |
| **Total Quizzes %** | | | **100%** | **15** |  |
|  | | | | | | |
| **Assignments**  **15** | Assignment #1 | *CLO1* | 5 | 33.33% | 5 | TBD |
| Assignment #2 | *CLO2* | 5 | 33.33% | 5 | TBD |
| Assignment #3 | *CLO3* | 5 | 33.33% | 5 | TBD |
|  | **Total Assignments %** | | | **100%** | **15** |  |
|  | | | | | | |
| **Project/CCP**  **05** | Project/CCP | *CLO1-3* | 5 | 100% | 5 | TBD |
|  | **Total Project /CCP %** | | | **100%** | **05** |  |
|  | | | | | | |
| **Midterm**  **25** | Midterm Q#1 | *CLO1* | 20 | 80% | 20 | TBD |
| Midterm Q#2 | *CLO2* | 05 | 20% | 05 |  |
|  | **Total Midterm %** | | | **100%** | **25** |  |
|  | | | | | | |
| **Final Exam**  **40** | Final Exam Q#1 | *CLO1* | 10 | 25% | 10 | TBD |
| Final Exam Q#2 | *CLO2* | 10 | 25% | 10 |  |
| Final Exam Q#3 | *CLO3* | 20 | 50% | 20 |  |
|  | **Total Final Exam %** | | | **100%** | **40** |  |
| **100** | **Total Marks** | | | | **100** |  |
| ***Note: Please make sure every CLO must be assessed at least 3 times.*** | | | | | | |

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| 1. **Weekly Plan** | | | | |
| **Week** | **Lecture No** | **Topic Covered** | **CLO** | **Assessment Tool** |
| 1 | 1 | Introduction to the Discrete Structure | **1** |  |
| 2 | Proposition, Simple and Compound proposition | **1** |  |
| 3 | Connectives & Truth Tables | **1** |  |
| 2 | 4 | Definition of Sets & Set Notations Type of Sets (equal, subset, null, infinite etc.) | **1** |  |
| 5 | Set Operations (Unions, Intersections, Set difference Etc.) | **1** |  |
| 6 | Algebraic Properties of Set Operations | **1** |  |
| 3 | 7 | Diagrammatic representation of sets by Venn diagram | **1** |  |
| 8 | Venn Diagrams for Multiple Operations | **1** |  |
| 9 | Inclusion and Exclusion principle and its applications & Problem-solving based on the Inclusion/Exclusion principle | **1** |  |
| 4 | 10 | Inclusion and Exclusion principle for two sets, for three sets, and for four sets applications | **1** |  |
| 11 | Problem-solving based on the Inclusion/Exclusion principle | **1** |  |
| 12 | Ordered n-tuples & Cartesian product | **1** |  |
| 5 | 13 | Relations and their properties and closures | **1** |  |
| 14 | Problem solving based on Relations and Closures | **1** |  |
| 15 | Introduction to Functions & Domains and range of Binary functions | **1** |  |
| 6 | 16 | Domains and range of Algebraic Functions, Relations and Functions | **1** |  |
| 17 | Binary Functions & ONTO Functions and One-to-One Functions | **1** |  |
| 18 | Algebraic Functions, Inverse and Composites of Binary & Algebraic functions | **1** | **A1** |
| 7 | 19 | Introduction Mathematical Induction & Mathematical Induction for Equations and Expressions | **2** | **Q1** |
| 20 | Induction for Inequalities | **2** |  |
| 21 | **Project / CCP Discussion and Group allocation** | **1-3** |  |
| **8** | **Midterm Exam** | | | |
| 9 | 22 | Sequence, Series and nth terms of the Series, Arithmetic Sequence, nth term & Series | **2** |  |
| 23 | Geometric Sequence, nth term & Series | **2** |  |
| 24 | Nth term when difference b/w terms of series is not same | **2** | **A2** |
| 10 | 25 | The basics of Counting: Factorial, Permutation & Combination | **2** | **Q2** |
| 26 | The basics of Counting: Factorial, Permutation & Combination 2 | **2** |  |
| 27 | Pigeonhole principle | **2** |  |
| 11 | 28 | Introduction to Graphs, Graph models | **3** |  |
| 29 | Graph Terminology, Special type of Graphs & Representing Graph | **3** |  |
| 30 | Adjacent Matrix, Incident Matrix | **3** |  |
| 12 | 31 | Graph Isomorphism & Connectivity | **3** |  |
| 32 | Introduction to trees & Trees terminology | **3** |  |
| 33 | Special types of trees | **3** |  |
| 13 | 34 | Trees Representation | **3** |  |
| 35 | Spanning Trees, Binary Trees | **3** |  |
| 36 | Trees Searching Algorithm | **3** |  |
| 14 | 37 | Traversing Tree Algorithm | **3** |  |
| 38 | Euler and Hamilton Paths | **3** |  |
| 39 | Shortest Path Problem | **3** | **A3** |
| 15 | 40 | Bellman Ford's Algorithm | **3** | **Q3** |
| 41 | Dijkstra Shortest Path Algorithm | **3** |  |
| 42 | Revision | **3** |  |
| 16 | 43 | **Project / CCP presentations and submissions** | **1-3** |  |
| 44 |  |
| 45 |  |
| **17** | **Final Exam** | | | |

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| 1. **IU Assessment / grading Policy** | **Instructor grading for course** |
| Quizzes 10-15%  Assignments 10-15%  Projects/Presentation/CCP 0-10%  Mid Semester Examination/ 20-30%  End Semester Examination 40-50% | 15  15  05  25  40 |

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| **IQRA University (IU)** | | |
| **Faculty of Engineering Sciences and Technology (FEST)** | | |
| **Computer Science Department (CS)** | | |
| **Course Code** | **Course Name** | **Credit Hr** |
| **GER142** | Ideology and constitution of Pakistan | **2+ 0** |

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| 1. **Basic Information** | | | |
| **Instructor** |  | **Designation** | Senior Lecturer |
| **Prerequisite(s)** | - | **Semester** | Fall 2024 |
| **Email** | @iqra.edu.pk | **Phone** | 0300-xxxxxxx |
| **Consulting Hours** | Fri 09:30 PM to 10:30 PM | **Office Location** | X Floor Faculty Room (X Cubicle) |

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| **2. Course Objective(s)** |
| This course aims to help students develop a comprehensive understanding of the ideology of Pakistan while providing them with a foundational knowledge of the country's geophysical features and strategic significance. It focuses on enabling students to appreciate and understand the rich culture of Pakistan and its diverse natural resources. Additionally, the course emphasizes developing a solid understanding of the political history of Pakistan and equipping students with the knowledge to analyze the major problems faced by present-day Pakistan. Furthermore, it seeks to foster awareness of Pakistan's relations with the global community and its strategic position in the world. |

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| **3. Course Contents** |
| The course covers the ideology of Pakistan, offering students a deeper understanding of its foundational principles. It explores the geophysical features and strategic significance of the country while highlighting the unique aspects of its culture. Students will gain insights into Pakistan's natural resources and political history, providing them with a strong contextual foundation. The course also delves into the critical challenges faced by Pakistan today and examines its relationships with the international community, equipping students with the knowledge needed to understand the country's role in global affairs. |

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| **4. Course Learning Outcomes** | | | | | | |
| **CLOs** | **CLO Statement** | **BT**  **Level** | **Mapping** | | | **%**  **Weigh t** |
| **GAs** | **ACM KA** | **SGDs** |
| CLO1 | ***Discuss*** the historical, ideological, socio-economic, and political aspects of Pakistan as a nation and state. | A2 | GA8 | #18  SP | 12,16 | 33% |
| CLO2 | ***Explain*** the importance of ethical values and societal contribution, drawing inspiration from the ideals of Pakistan’s founders. | C2 | GA9 | 33% |
| CLO3 | ***Describe*** Pakistan ‘s culture, issues, and challenges through appropriate actions and advocacy. | C2 | GA10 | 34% |
| **Note: On successful completion of course, GA 1 (Academic Education) will automatically attain.** | | | | | | |

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| **5. Course Textbook / Reference Books and Supplementary Reading Material** | | | |
| **S No** | **Book Title** | **Author(s)** | **Edition/ publication year/publisher** |
| 1. | **The Emergence of Pakistan** | Chaudry M, | 1st Edition, 1967, Columbia University Press. ISBN: 978-0231029339. |
| 2. | **The making of Pakistan** | Aziz, | 3rd Edition, 2002, Sang-e-Meel Publications. ISBN: 978-9693508703. |
| 3. | **A Short History of Pakistan** | I.H,Qureshi,ed, Karachi, | 2nd Edition, 2000, University of Karachi |

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| **6. CLO Outcome Based Assessment (OBA) Tentative** | | | | | | |
| **Assessment Tool** | | **CLO**  **Mapped** | **CLO**  **Marks** | **% Weight** | **Total Marks** | **Assessment Date** |
| **Quizzes**  **10** | Quiz #1 | CLO 1 | 5 | 33.3% | 5 | TBD |
| Quiz #2 | CLO 1 | 5 | 33.3% | 5 | TBD |
| Quiz #3 | CLO 2 | 5 | 33.3% | 5 | TBD |
| **Total Quizzes %** | | | **100%** | 15 |  |
|  | | | | | | |
| **Assignments**  **15** | Assignment #1 | CLO 1 | 4 | 40% | 4 | TBD |
| Assignment #2 | CLO 2 | 3 | 30% | 3 | TBD |
| Assignment #3 | CLO 2 | 3 | 30% | 3 | TBD |
| **Total Assignments %** | | | **100%** | 10 |  |
|  | | | | | | |
| **Midterm**  **25** | Midterm Q#1 | CLO 1 | **10** | 40% | **10** | TBD |
| Midterm Q#2 | CLO 2 | 15 | 60% | **15** | TBD |
|  | **Total Midterm %** | | | **100%** | **25** |  |
|  | | | | | | |
| **Project/CCP 10** | Project/CCP | CLO2 | 10 | **100%** | **10** | **TBD** |
|  | **Total Project /CCP %** | | | **100%** | **10** |  |
|  | | | | | | |
| **Final Exam**  **40** | Final Exam Q#1 | CLO1 | **23** | 57% | **23** | TBD |
| Final Exam Q#2 | CLO2 | **12** | 30% | **12** | TBD |
| Final Exam Q#3 | CLO2 | **5** | 13% | **5** | TBD |
|  | **Total Final Exam %** | | | **100%** | **40** |  |
| **100** | **Total Marks** | | | | **100** |  |
| **Note: Please make sure every CLO must be assessed at least 3 time.** | | | | | | |

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| 1. **Weekly Plan** | | | | |
| **Week** | **Lecture No** | **Topic Covered** | **CLO** | **Assessment Tool** |
| 1 | 1 | Aligarh and Khilafat Movement. | CLO1 |  |
| 2 | Aligarh Achievements (AMU) | CLO1 |  |
| 2 | 3 | Colonial Roots to Independence (part 1) | CLO1 |  |
| 4 | Colonial Roots to Independence (part 2) | CLO1 | **A1** |
| 3 | 5 | Post Pakistan Resolution Path. Major Events and movements to independence (continued).. | CLO1 |  |
| 6 | Post Pakistan Resolution path; Major events and  movements to independence. | CLO1 | **Q1** |
| 4 | 7 | Negative impact of congress rule after 1936 election on Muslim. | CLO1 |  |
| 8 | Negative impact of congress rule after 1936 election on Muslim. | CLO1 |  |
| 5 | 9 | Political and Administrative Marginalization of Muslims | CLO1 | **Q2** |
| 10 | Formative struggle of Pakistan. | CLO1 |  |
| 6 | 11 | Ideological and Political Foundations | CLO1 |  |
| 12 | Culture of Pakistan (part 1) | CLO2 |  |
| 7 | 13 | Demographic of Pakistan trend challenges, and solution. | CLO2 |  |
| 14 | **Project Discussion** | CLO1 | **Project Announced** |
| **8** | Midterm Exam | | | |
| 9 | 15 | Components of ideology. | CLO1 |  |
| 16 | **Challenges within the Indian National Congress** | CLO1 |  |
| 10 | 17 | Evolution of Pakistan's Political System and Institutions | CLO1 | **A2** |
| 18 | Contemporary Political Challenges and Dynamics | CLO1 |  |
| 11 | 19 | Climatic zones of Pakistan | CLO2 |  |
| 20 | Natural Resources of Pakistan: Potential and Challenges | CLO2 | **Q3** |
| 12 | 21 | Environment and Resources of Pakistan | CLO2 |  |
| 22 | Historical Evolution of Pakistan's Foreign Policy | CLO2 |  |
| 13 | 23 | Contemporary Challenges and Strategic Directions in Pakistan's Foreign Policy | CLO2 |  |
| 24 | Pakistan’s culture economic landscape | CLO2 |  |
| 14 | 25 | The Diversity and Richness of Pakistan's Cultural Landscape | CLO2 |  |
| 26 | Pakistan's Economic Landscape: Opportunities and Challenges | CLO2 | **A3** |
| 15 | 27 | Impact of constitutional amendments | CLO1 |  |
| 28 | Stability and Continuity in Governance | CLO1 |  |
| 16 | 29 | **Project Submission** | CLO2 |  |
| 30 | **Project Submission** | CLO2 |  |
| **17** | **Final Exam** | | | |

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| 1. **IU Assessment / grading Policy** | **Instructor grading for course \*** |
| Quizzes 10-15%  Assignments 10-15%  Projects/Presentation/CCP 0-10%  Mid Semester Examination/ 20-30%  End Semester Examination 40-50% | 15 Marks  10 Marks  10 Marks  25 Marks  40 Marks |

## SEMESTER 3

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| **S.No** | **Course Code** | **Title** | **Cr.Hrs** |
| 1 | MTE212 | Probability & Statistics | 3 + 0 |
| 2 | CMC222 | Computer Organization & Assembly Language | 3 + 0 |
| 3 | CMC222-L | Computer Organization & Assembly Language (Lab) | 0 + 1 |
| 4 | CMC251 | Data Structures | 3 + 0 |
| 5 | CMC251-L | Data Structures (Lab) | 0 + 1 |
| 6 | CSC252 | Theory of Automata | 3 + 0 |
| 7 | CMC261 | Computer Networks | 3 + 0 |
| 8 | CMC261-L | Computer Networks (Lab) | 0 + 1 |
|  |  |  | **15+3 (18)** |

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| **IQRA University (IU)** | | |
| **Faculty of Engineering Sciences and Technology (FEST)** | | |
| **Computer Science Department (CS)** | | |
| **Course Code** | **Course Name** | **Credit Hr** |
| **MTE212** | Probability & Statistics | **3+0** |

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| 1. **Basic Information** | | | |
| **Instructor** |  | **Designation** |  |
| **Prerequisite(s)** | MTE111 Multivariable Calculus | **Semester** | Fall 2024 |
| **Email** |  | **Phone** |  |
| **Consulting Hours** |  | **Office Location** |  |

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| 1. **Course Objective(s)** |
| The objective of this course is to provide students with a foundational understanding of probability theory and statistical methods, which are essential for analyzing and interpreting data, making informed decisions, and solving problems in various areas of computer science. |

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| 1. **Course Contents** |
| Introduction to Statistics and Data Analysis: Samples, Populations, Role of Probability, Sampling Procedures, Discrete and Continuous Data, Statistical Modeling, Types of Statistical Studies, Statistical Inference. 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: Mean and Variance of a Random Variable, Covariance 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, Probability Plots, Mean Estimation Problems, Z and T Tests of Hypotheses, The Use of PValues for Decision Making in Testing Hypotheses. Linear Regression and Correlation: Scatter plots, Least Squares and the Fitted Model, Hypothesis testing for Correlation. |

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| 1. **Course Learning Outcomes** | | | | | | |
| **CLOs** | **CLO Statement** | **BT Level** | **Mapping** | | | **% Weight** |
| **GAs** | **ACM KA** | **SDGs** |
| CLO1 | ***Demonstrate*** an ability to use descriptive techniques to describe the statistical data. | C3 | GA2 | #4  DS | 4 | 30% |
| CLO2 | Define and ***illustrate*** the concepts and methods of probability theory. | C3 | GA2 | 20% |
| CLO3 | ***Use*** inferential statistical methods to solve problems in engineering sciences. | C3 | GA3 | 50% |
| ***Note: On successful completion of course GA 1 (Academic Education) will automatically attain.*** | | | | | | |

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| 1. **Course Textbook / Reference Books and Supplementary Reading Material** | | | |
| **S No** | **Book Title** | **Author(s)** | **Edition/ publication year/publisher** |
|  | Probability & Statistics for Engineers & Scientists, Global Edition | Walpole | 9th Edition / 2016 / Pearson |
|  | Introductory Statistics | Prem S. Mann | 10th Edition / 2020 / Wiley |
|  | An Introduction to Probability and Statistical Inference | George G. Roussas | 3rd Edition / 2024 / Elsevier |
|  | Probability and Statistics: Theory and Exercises | Horimek Abderrahmane | 2024 / Bentham Books |

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| 1. **CLO Outcome Based Assessment (OBA)** | | | | | | |
| **Assessment Tool** | | **CLO Mapped** | **CLO Marks** | **% Weight** | **Total Marks** | **Assessment Date** |
| **Quizzes**  **15** | Quiz #1 | *CLO1* | 5 | 33.33% | 5 | TBD |
| Quiz #2 | *CLO2* | 5 | 33.33% | 5 | TBD |
| Quiz #3 | *CLO3* | 5 | 33.33% | 5 | TBD |
| **Total Quizzes %** | | | **100%** | **15** |  |
|  | | | | | | |
| **Assignments**  **15** | Assignment #1 | *CLO1* | 5 | 33.33% | 5 | TBD |
| Assignment #2 | *CLO2* | 5 | 33.33% | 5 | TBD |
| Assignment #3 | *CLO3* | 5 | 33.33% | 5 | TBD |
|  | **Total Assignments %** | | | **100%** | **15** |  |
|  | | | | | | |
| **Project/CCP**  **05** | Project/CCP | *CLO1-3* | 5 | 100% | 5 | TBD |
|  | **Total Project /CCP %** | | | **100%** | **05** |  |
|  | | | | | | |
| **Midterm**  **25** | Midterm Q#1 | *CLO1* | 15 | 60% | 15 | TBD |
| Midterm Q#2 | *CLO2* | 10 | 40% | 10 |  |
|  | **Total Midterm %** | | | **100%** | **25** |  |
|  | | | | | | |
| **Final Exam**  **40** | Final Exam Q#1 | *CLO1* | 5 | 12.5% | 5 | TBD |
| Final Exam Q#2 | *CLO2* | 10 | 25% | 10 |  |
| Final Exam Q#3 | *CLO3* | 25 | 62.5% | 25 |  |
|  | **Total Final Exam %** | | | **100%** | **40** |  |
| **100** | **Total Marks** | | | | **100** |  |
| ***Note: Please make sure every CLO must be assessed at least 3 times.*** | | | | | | |

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| 1. **Weekly Plan** | | | | |
| **Week** | **Lecture No** | **Topic Covered** | **CLO** | **Assessment Tool** |
| 1 | 1 | Introduction to Probability and Statistics, Samples and Populations, Role of Probability in Statistics, Variables and Types of Data | **1** |  |
| 2 | Data Sampling, Descriptive and Inferential Statistics, Statistical Modeling, Statistical measures, Ungrouped/Grouped Data | **1** |  |
| 3 | Raw data analysis (Ungrouped Data), Measure of Central tendency of Ungrouped data | **1** |  |
| 2 | 4 | Measure of Variation of Ungrouped data, Measure of Positions of Ungrouped data | **1** |  |
| 5 | Frequency Distributions (Grouped Data), Grouping of Data | **1** |  |
| 6 | Graphical representations of Frequency Distributions | **1** |  |
| 3 | 7 | Grouped data analysis, Measure of Central tendency of grouped data | **1** |  |
| 8 | Measure of Positions of grouped data | **1** |  |
| 9 | Measure of Variation of grouped data | **1** | **A1** |
| 4 | 10 | Symmetry and Skewness of Frequency Distribution, Box Plot | **1** | **Q1** |
| 11 | Probability, Sample space and events | **2** |  |
| 12 | Operations with events, Venn Diagrams | **2** |  |
| 5 | 13 | Probability of an Event | **2** |  |
| 14 | Counting Rules, Probability Problems using counting rules | **2** |  |
| 15 | Permutations, Combinations, Probability problems using combinations | **2** |  |
| 6 | 16 | Laws of Probability | **2** |  |
| 17 | Conditional Probability | **2** |  |
| 18 | Law of total probability | **2** | **A2** |
| 7 | 19 | Bayes Theorem | **2** | **Q2** |
| 20 | Random variable and Probability Distribution, Graphical representation of Probability Distribution | **3** |  |
| 21 | **Project / CCP Discussion and Group allocation** | **1-3** |  |
| **8** | **Midterm Exam** | | | |
| 9 | 22 | Mean, Variance and Standard Deviation of PDs, Expectation of PDs | **3** |  |
| 23 | Covariance of Random Variables, Chebyshev’s theorem | **3** |  |
| 24 | Discrete Probability Distribution: Binomial, Poisson, | **3** |  |
| 10 | 25 | Discrete Probability Distribution: Hypergeometric, Geometric | **3** |  |
| 26 | Normal Distribution, Standard Normal Distribution | **3** |  |
| 27 | Applications of the Normal Distribution | **3** |  |
| 11 | 28 | Determining Normality, Central Limit Theorem | **3** |  |
| 29 | Distributions of Sample means | **3** |  |
| 30 | Normal Approximation to the Binomial Distribution | **3** |  |
| 12 | 31 | Confidence Intervals for the Mean: When S.D Is Known | **3** |  |
| 32 | Confidence Intervals for the Mean: When S.D Is Known | **3** |  |
| 33 | Confidence Intervals for the Mean: When S.D Is Unknown | **3** |  |
| 13 | 34 | Hypothesis Testing | **3** |  |
| 35 | Z-Test Hypothesis Testing | **3** |  |
| 36 | P-Value Method for Hypothesis Testing (Z-Test) | **3** | **A3** |
| 14 | 37 | T-Test Hypothesis Testing | **3** | **Q3** |
| 38 | P-Value Method for Hypothesis Testing (T-Test) | **3** |  |
| 39 | Scatter Plots and Correlation | **3** |  |
| 15 | 40 | Hypothesis testing for Correlation | **3** |  |
| 41 | Regression | **3** |  |
| 42 | Revision | **3** |  |
| 16 | 43 | **Project / CCP presentations and submissions** | **1-3** |  |
| 44 |  |
| 45 |  |
| **17** | **Final Exam** | | | |

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| 1. **IU Assessment / grading Policy** | **Instructor grading for course** |
| Quizzes 10-15%  Assignments 10-15%  Projects/Presentation/CCP 0-10%  Mid Semester Examination/ 20-30%  End Semester Examination 40-50% | 15  15  05  25  40 |

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| **IQRA University (IU)** | | |
| **Faculty of Engineering Sciences and Technology (FEST)** | | |
| **Computer Science Department (CS)** | | |
| **Course Code** | **Course Name** | **Credit Hr** |
| **CMC 222** | Computer Organization & Assembly Language | **3+1** |

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| 1. **Basic Information** | | | |
| **Instructor** |  | **Designation** |  |
| **Prerequisite(s)** | CMC 123 | **Semester** | Fall 2024 |
| **Email** |  | **Phone** |  |
| **Office Hours** |  | **Office Location** |  |

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| 1. **Course Objective(s)** |
| This course provides a thorough understanding of computer systems, focusing on organization, structure, and instruction cycles. It covers memory management, cache memory, and arithmetic operations, along with the Intel x86 instruction set. Students will learn assembly language programming, including data representation, addressing modes, and control flow. The course also explores integrating assembly with high-level languages and real-world applications. |

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| 1. **Course Contents** |
| This course covers computer system organization, including functional and structural views, instruction cycles, program flow control, and interrupts. It explores interconnection structures like bus hierarchies, arithmetic and logic operations, and memory management, including cache memory principles and mapping functions. The course also delves into machine instruction characteristics, x86 data types, addressing modes, and instruction formats. Additionally, it focuses on assembly programming, including syntax, data representation, control flow, memory segmentation, and integration with high-level languages. |

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| 1. **Course Learning Outcomes** | | | | | | |
| **CLOs** | **CLO Statement** | **BT Level** | **Mapping** | | | **% Weight** |
| **GAs** | **ACM KA** | **SGDs** |
| CLO1 | **Explain** the organization and functional components of computer systems, including instruction cycles and addressing modes, to demonstrate a clear understanding of fundamental concepts. | C2 | GA2 | #2  AR | 4 | 20.66% |
| CLO2 | **Apply** assembly programming techniques to perform arithmetic operations, memory manipulation, and control flow operations effectively using the x86 instruction set. | C3 | GA2 | 46% |
| CLO3 | **Analyze** memory and cache management systems, along with their mapping functions, to evaluate performance and design efficient solutions for computational tasks. | C4 | GA3 | 33.33% |
| ***Note: On successful completion of course GA1 (Academic Education) will automatically attain.*** | | | | | | |

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| 1. **Course Textbook / Reference Books and Supplementary Reading Material** | | | |
| **S No** | **Book Title** | **Author(s)** | **Edition/ publication year/publisher** |
|  | Computer Organization and Architecture: Designing for Performance | William Stallings | 11th Edition, 2019, Pearson |
|  | Computer System Architecture | M. Morris Morris Mano | 3rd Edition, 2017, Pearson Education |

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| 1. **CLO Outcome Based Assessment (OBA)** | | | | | | |
| **Assessment Tool** | | **CLO Mapped** | **CLO Marks** | **% Weight** | **Total Marks** | **Assessment Date** |
| **Quizzes**  **12.5** | Quiz #1 | *CLO1* | 5 | 40% | 5 | TBD |
| Quiz #2 | *CLO2* | 5 | 40% | 5 |  |
| Quiz #3 | *CLO3* | 2.5 | 20% | 2.5 |  |
| **Total Quizzes %** | | | **100%** | 12.5 |  |
|  | | | | | | |
| **Assignments**  **12.5** | Assignment #1 | *CLO1* | 5 | 40% | 5 |  |
| Assignment #2 | *CLO2* | 5 | 40% | 5 |  |
| Assignment #3 | *CLO3* | 2.5 | 20% | 2.5 |  |
|  |  | | | **100%** | 12.5 |  |
|  | | | | | | |
| **Midterm**  **25** | Midterm Q#1 | *CLO1* | 5 | 20% | **5** |  |
| Midterm Q#2 | *CLO1* | 10 | 40% | **10** |  |
|  | Midterm Q#3 | *CLO2* | 5 | 20% | **5** |  |
|  | Midterm Q#4 | *CLO2* | 5 | 20% | **5** |  |
|  | **Total Midterm %** | | | **100%** | **25** |  |
|  | | | | | | |
| **Project/CCP**  **10** | Project/CCP | *CLO2* | **5** | **50%** | **5** |  |
|  | Project/CCP | CLO3 | 5 | 50% | **5** |  |
|  | **Total Project /CCP %** | | | **100%** | **10** |  |
|  | | | | | | |
| **Final Exam**  **40** | Final Exam Q#1 | *CLO1* | 10 |  |  |  |
| Final Exam Q#2 | *CLO2* | 10 |  |  |  |
| Final Exam Q#3 | *CLO3* | 10 |  |  |  |
|  | Final Exam Q#4 | *CLO3* | 10 |  |  |  |
|  | **Total Final Exam %** | | | **100%** | **40** |  |
| **100** | **Total Marls** | | | | **100** |  |
| ***Note: Please make sure every CLO must be assessed at least 3 time.*** | | | | | | |

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| 1. **Weekly Plan** | | | | |
| **Week** | **Lecture No** | **Topic Covered** | **CLO** | **Assessment Tool** |
| 1 | 1 | Introduction to Computer Architecture focuses on organization, structure, function, and functional and structural views. | **CLO 1** |  |
| 2 | A Top-Level View of Computer Function and Interconnection discusses components, instruction fetch and execute, basic instruction cycles, and program execution with a state diagram. | **CLO 1** |  |
| 2 | 3 | Program flow control, instruction cycles with and without interrupts, and state diagrams. | **CLO 1** |  |
| 4 | Sequential interrupts and nested interrupts. | **CLO 1** |  |
| 3 | 5 | Discusses interconnection structures, including bus interconnections and multiple bus hierarchies. | **CLO 1** | **Assignment #1** |
| 6 | Bus configurations and arbitration methods. | **CLO 1** |  |
| 4 | 7 | Arithmetic and Logic Unit, sign and magnitude method, 1’s complement, and 2’s complement, including sign overflow detection and sign extension. | **CLO 2** | **Quiz #1** |
| 8 | Explains addition and subtraction of two’s complement numbers and the design of adder and subtractor circuits. | **CLO 2** |  |
| 5 | 9 | Unsigned multiplication in computer arithmetic. | **CLO 2** |  |
| 10 | Memory organization, memory hierarchy, RAM, ROM, memory address map, and cache memory principles. | **CLO 3** |  |
| 6 | 11 | Explains cache memory management and elements of cache design. | **CLO 3** | **Assignment #2** |
| 12 | Mapping functions, including direct mapping, associative mapping, and related examples. | **CLO 3** |  |
| **7** | 13 | **CCP Discussion and Announcement** | **CLO 2/3** |  |
|  | 14 | **CLO 2/3** |
| **8** | **Midterm Exam** | | | |
| 9 | 15 | Explains machine instruction characteristics, types of operands, and Intel x86 data types. | **CLO 3** |  |
| 16 | Types of operations and Intel x86 operation types. | **CLO 3** |  |
| 10 | 17 | Addressing modes and x86 addressing modes. | **CLO 3** | **Quiz #2** |
| 18 | Instruction formats and x86 instruction formats. | **CLO 3** |  |
| 11 | 19 | Discusses assembly language concepts, motivation for assembly language programming, and assembly language elements with examples. | **CLO 2** |  |
| 20 | Covers assemblers, and the processes of loading and linking in assembly programming. | **CLO 2** |  |
| 12 | 22 | Introduction to the x86 instruction set, data movement, arithmetic, and logical operations. | **CLO 2** | **Assignment #3** |
| 23 | Learn about memory segmentation, data segments, and how to access and manipulate memory. | **CLO 2** |  |
| 13 | 34 | Understanding the structure, syntax, and tools required to write and execute assembly programs. | **CLO 2** |  |
| 35 | Learn about data representation (binary, hexadecimal), registers, addressing modes, and basic operations. | **CLO 2** |  |
| 14 | 37 | Explore control flow instructions like jumps, loops, and conditional branches in assembly language. | **CLO 2** | **Quiz #3** |
| 38 | Understand procedures, stack operations, local variables, and how to manage function calls. | **CLO 2** |  |
| 15 | 40 | Study string manipulation, array operations, and implementing algorithms like searching and sorting. | **CLO 2** |  |
| 41 | Explore how to integrate assembly with high-level languages and real-world applications of assembly programming. | **CLO 3** |  |
| 16 | 43 | **CCP Submission, Assessments and Presentation** | **CLO 2/3** |  |
| 44 | **CLO 2/3** |
| **17** | **Final Exam** | | | |

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| 1. **IU Assessment / grading Policy** | **Instructor grading for course \*** |
| Quizzes 10-15%  Assignments 10-15%  Projects/Presentation/CCP 0-10%  Mid Semester Examination/ 20-30%  End Semester Examination 40-50% | Quizzes 12.5%  Assignments 12.5%  Projects/Presentation/CCP 10%  Mid Semester Examination/ 25%  End Semester Examination 40% |

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| IQRA University | | |
| Faculty of Engineering Sciences and Technology (FEST) | | |
| Computer Science Department (CS) | | |
| Course Code | Course Name | Credit Hr. |
| CMC222-L | Computer Organization and Assembly Language Lab | 3+1 |

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| 1. Basic Information | | | |
| Instructor |  | Designation |  |
| Prerequisite(s) | CMC 123-L | Semester | Fall 2024 |
| Email |  | Phone |  |
| Office Hours |  | Office Location |  |

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| 1. **Course Objective(s)** |
| This course provides a thorough understanding of computer systems, focusing on organization, structure, and instruction cycles. It covers memory management, cache memory, and arithmetic operations, along with the Intel x86 instruction set. Students will learn assembly language programming, including data representation, addressing modes, and control flow. The course also explores integrating assembly with high-level languages and real-world applications. |

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| 1. **Course Contents** |
| This course covers computer system organization, including functional and structural views, instruction cycles, program flow control, and interrupts. It explores interconnection structures like bus hierarchies, arithmetic and logic operations, and memory management, including cache memory principles and mapping functions. The course also delves into machine instruction characteristics, x86 data types, addressing modes, and instruction formats. Additionally, it focuses on assembly programming, including syntax, data representation, control flow, memory segmentation, and integration with high-level languages. |

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| 1. **Course Learning Outcomes** | | | | | | |
| **CLOs** | **CLO Statement** | **BT Level** | **Mapping** | | | **% Weight** |
| **GAs** | **ACM KA** | **SDGs** |
| CLO1 | **Follow** the guided steps to apply assembly language instructions for loading, transferring, manipulating, and storing data between registers and memory, as well as for performing arithmetic and logical operations. | P3 | GA5 | #2  AR | 4 | 65% |
| CLO2 | **Investigate** and implement memory operations, such as arithmetic, division, and parity checks, using assembly language and flags. | A3 | GA3 | 35% |
| **Note: On successful completion of course GA 1 (Academic Education) will automatically attain.** | | | | | | |

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| 1. **Course Textbook / Reference Books and Supplementary Reading Material** | | | |
| **S No** | **Book Title** | **Author(s)** | **Edition/ publication year/publisher** |
|  | Computer Organization and Architecture: Designing for Performance | William Stallings | 11th Edition, 2019, Pearson |
|  | Computer System Architecture | M. Morris Morris Mano | 3rd Edition, 2017, Pearson Education |

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| 1. **CLO Outcome-Based Assessment (OBA)** | | | | | | |
| **Assessment Tool** | | **CLO Mapped** | **CLO Marks** | **% Weight** | **Total Marks** | **Assessment Date** |
| **Quizzes**  **0** | Quiz #1 | *CLO1/2* | 0 | 0% | 0 |  |
| Quiz #2 | *CLO1/2* | 0 | 0% | 0 |  |
| Quiz #3 | *CLO1/2* | 0 | 0% | 0 |  |
| **Total Quizzes %** | | | **0%** | 0 |  |
|  | | | | | | |
| **Lab Manual**  **20** | Lab Task #1 | *CLO1/2* | 10 | 10% | 0 |  |
| Lab Task #2 | *CLO1/2* | 10 | 10% | 0 |  |
| Lab Task #n | *CLO1/2* | 0 |  | 0 |  |
|  | **Total Lab Manual %** | | | **20%** | 20 |  |
|  | | | | | | |
| **Midterm**  **25** | Midterm Q#1, 2 | *CLO1* | 20 |  |  |  |
| Midterm Q#3 | *CLO1* | 5 |  |  |  |
|  |  |  |  |  |  |  |
|  | **Total Midterm %** | | | **25%** | **25** |  |
|  | | | | | | |
| **Project/OEL**  **15** | Project/CCP | *CLO1/2* | 15 |  |  |  |
|  | **Total Project /CCP %** | | | **15%** | **15** |  |
|  | | | | | | |
| **Final Exam**  **40** | Final Exam Q# | *CLO1/2* | 10 |  |  |  |
| Final Exam Q# | *CLO1/2* | 10 |  |  |  |
|  | Final Exam Qn | *CLO1/2* |  |  |  |  |
|  | **Total Final Exam %** | | | **40%** | **40** |  |
| **100** | **Total Marls** | | | | **100** |  |
| ***Note: Please make sure every CLO must be assessed at least 3 times.*** | | | | | | |

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| 1. **Weekly Plan** | | | | |
| **Week**  **No.** | **Lab No.** | **Lab Description** | **Contact**  **Hr.** | **CLO** |
| 1 | 1 | Loading values into registers, copying data between registers, memory to register transfer. | 3 | 1-2 |
| 2 | 2 | Memory manipulation, addition of 8-bit numbers, and storing results in memory. | 3 | 1-2 |
| 3 | 3 | Adding contents of memory locations, multiplying two numbers without MUL instruction. | 3 | 1-2 |
| 4 | 4 | Multiplying two 8-bit numbers from memory and storing result, performing division of two numbers, subtracting two 8-bit numbers and displaying flag status. | 3 | 1-2 |
| 5 | 5 | Storing ten bytes of data at consecutive memory locations, incrementing sixteen bytes of data by 01, adding ten bytes from memory and storing the result. | 3 | 1-2 |
| 6 | 6 | Interchanging data bytes using indirect and direct addressing, comparing two numbers in memory and storing result. | 3 | 1-2 |
| 7 |  | **Open Ended Lab/Project Assigned** |  | 1-2 |
| 8 | **Midterm Exam** | | | |
| 9 | 7 | Counting the number of ones and zeros in a byte, and determining the one's and two's complement of a given byte. | 3 | **1-2** |
| 10 | 8 | Performing division without using DIV instruction, dividing a number by 2 without DIV and SUB instructions. | 3 | **1-2** |
| 11 | 9 | Finding the smallest number from eight bytes in memory, and finding the largest number from eight bytes in memory. | 3 | **1-2** |
| 12 | 10 | Clearing the carry flag using five different methods. | 3 | **1-2** |
| 13 | 11 | Checking if a number is even or odd and storing the result, finding odd numbers from eight bytes in memory and storing them at consecutive memory locations. | 3 | **1-2** |
| 14 | 12 | Checking even or odd parity in a given data byte. | 3 | **1-2** |
| 15 | 13 | Finding numbers with even parity from eight bytes in memory and storing them at consecutive memory locations. | 3 | **1-2** |
| 16 |  | **Open Ended Lab/Project Assessment** |  | 1-2 |
| 17 | **Final Exam** | | | |

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| 1. **IU Assessment/grading Policy** | **Instructor grading for the course \*** |
| Lab Manual 10-20%  Projects/OEL/PBL 10-25%  Mid Semester Examination/ 20-30%  End Semester Examination 40-50% | 15  20  25  40 |

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| **IQRA University (IU)** | | |
| **Faculty of Engineering Sciences and Technology (FEST)** | | |
| **Computer Science Department (CS)** | | |
| **Course Code** | **Course Name** | **Credit Hr** |
| **CMC251** | Data Structures | **3+1** |

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| 1. **Basic Information** | | | |
| **Instructor** |  | **Designation** |  |
| **Prerequisite(s)** | CMC112 | **Semester** |  |
| **Email** |  | **Phone** |  |
| **Consulting Hours** |  | **Office Location** |  |

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| 1. **Course Objective(s)** |
| 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. |

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| 1. **Course Contents** |
| 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 |

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| 1. **Course Learning Outcomes** | | | | | | |
| **CLOs** | **CLO Statement** | **BT Level** | **Mapping** | | | **% Weight** |
| **GAs** | **ACM KA** | **SGDs** |
| CLO1 | **Understand** various data structures and their algorithms | C2 | GA2 | #1  AL | 4 | 31% |
| CLO2 | **Apply** data structures in implementing simple applications | C3 | GA5 | 34% |
| CLO3 | **Analyze** simple algorithms and determine their complexities**.** | C4 | GA3 | 35% |
| ***Note: On successful completion of course GA1 (Academic Education) will automatically attain.*** | | | | | | |

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| 1. **Course Textbook / Reference Books and Supplementary Reading Material** | | | |
| **#** | **Book Title** | **Author(s)** | **Edition/ publication year/publisher** |
| 1. 1 | Data Structures and Algorithms in Java | Robert Lafore | 8th Edition, 2023 |
| 1. 2 | Data Structures and Algorithms in Java | Michael T. Goodrich, Roberto Tamassia, and Michael H. Goldwasser | 7th Edition, 2022 |
| 1. 3 | Algorithms For Dummies | John Paul Mueller , Luca Massaron | 2nd Edition, 2022 |

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| 1. **CLO Outcome Based Assessment (OBA) Tentative** | | | | | | |
| **Assessment Tool** | | **CLO Mapped** | **CLO Marks** | **% Weight** | **Total Marks** | **Assessment Date** |
| **Quizzes**  **10** | Quiz #1 | CLO 1 | 3 | 30% | 3 | TBD |
| Quiz #2 | CLO 2 | 3 | 30% | 3 | TBD |
| Quiz #3 | CLO 3 | 4 | 40% | 4 | TBD |
| **Total Quizzes %** | | | **100%** | 10 |  |
|  | | | | | | |
| **Assignments**  **15** | Assignment #1 | CLO 1 | 5 | 33% | 5 | TBD |
| Assignment #2 | CLO 2 | 5 | 33% | 5 | TBD |
| Assignment #3 | CLO 3 | 5 | 33% | 5 | TBD |
|  | **Total Assignments %** | | | **100%** | 15 |  |
|  | | | | | | |
| **Midterm**  **25** | Midterm Q#1 | CLO 1 | 5 | 20% | **5** | TBD |
| Midterm Q#2 | CLO 1 | 5 | 20% | **5** | TBD |
| Midterm Q#3 | CLO 1 | 5 | 20% | **5** | TBD |
| Midterm Q#4 | CLO 2 | 5 | 20% | **5** | TBD |
| Midterm Q#5 | CLO 2 | 5 | 20% | **5** | TBD |
|  | **Total Midterm %** | | | **100%** | **25** |  |
|  | | | | | | |
| **Project/CCP**  **10** | Project/CCP | CLO3 | 10 | **100%** | **10** | **TBD** |
|  | **Total Project /CCP %** | | | **100%** |  |  |
|  | | | | | | |
| **Final Exam**  **40** | Final Q #1 | CLO1 | 8 | 20% | 8 | TBD |
| Final Q#2 | CLO2 | 8 | 20% | 8 | TBD |
| Final Q #3 | CLO2 | 8 | 20% | 8 | TBD |
| Final Q#4 | CLO3 | 8 | 20% | 8 | TBD |
| Final Q#5 | CLO3 | 8 | 20% | 8 | TBD |
|  | **Total Final Exam %** | | | **100%** |  |  |
| **100** | **Total Marks** | | | | **100** |  |
| ***Note: Please make sure every CLO must be assessed at least 3 time.*** | | | | | | |

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| 1. **Weekly Plan** | | | | |
| **Week** | **Lecture No** | **Topic Covered** | **CLO** | **Assessment Tool** |
| 1 | 1 | Introduction, Basic Terminology, Elementary Data Organization | **1** |  |
| 2 | Data Structures, Data Structures Operations | **1** |  |
| 3 | Algorithm: Complexity, Time-Space Tradeoff | **1** |  |
| 2 | 4 | Complexity of Algorithms | **3** |  |
| 5 | Frequency Count Method Time and Space Functions | **3** |  |
| 6 | Big-Oh or Big O notation | **3** |  |
| 3 | 7 | The Array: Anatomy of Array, Linear Array and its representation in Memory, Traversing Linear Arrays, Inserting and Deleting | **1** |  |
| 8 | Sorting: Bubble Sort | **2** |  |
| 9 | Insertion Sort | **2** | **Q1** |
| 4 | 10 | Searching: Linear Search Binary Search | **1** |  |
| 11 | Multidimensional Arrays | **2** |  |
| 12 | Selection Sort, Quick and Merge Sort | **1** | **A1** |
| 5 | 13 | Introduction to Linked List, Representation in Memory, Traversing a Linked List | **1** |  |
| 14 | Searching a Linked list, Memory Allocation: Garbage Collection | **1** |  |
| 15 | Insertion into a Linked List, Deletion from a Linked list | **2** |  |
| 6 | 16 | Header Linked Lists, Two-way Lists/Doubly Linked Lists | **1** |  |
| 17 | Arithmetic Expressions; Polish Notation | **1** |  |
| 18 | Quick Sort an application of Stacks | **2** | **Q2** |
| **7** | 19 | Recursion | **1** |  |
| 20 | Difference between a recursive function and loops, Towers of Hanoi | **2** |
| 21 | **Project / CCP Discussion and Group allocation** | **3** |
| **8** | **Midterm Exam** | | | |
| 9 | 22 | Queues and Its Linked Representation | **1** |  |
| 23 | Deques | **1** |  |
| 24 | Priority Queues | **1** | **A2** |
| 10 | 25 | Non-Linear Data Structures: Introduction to Trees, Binary Trees and its Memory Representation | **1** |  |
| 26 | m-branching trees (non-binary trees) | **2** |  |
| 27 | Traversing Binary Trees, Traversing Using Stacks | **2** |  |
| 11 | 28 | Binary Search Trees (Searching, Inserting and Deleting in Binary Tree) | **2** |  |
| 29 | Concept of balanced tree, complete tree, full tree and perfect tree | **2** |  |
| 30 | AVL (Searching, Inserting and Deleting in AVL Tree) | **1** | **Q3** |
| 12 | 31 | B-Tree (Searching, Inserting and Deleting in B-Tree) | **1** |  |
| 32 | B+ Tree (Searching, Inserting and Deleting in B+ Tree) (Continued) | **2** |  |
| 33 | B+ Tree (Searching, Inserting and Deleting in B+ Tree) | **2** |  |
| 13 | 34 | Queues and Its Linked Representation | **1** |  |
| 35 | Deques | **1** |  |
| 36 | Priority Queues | **2** | **A3** |
| 14 | 37 | Introduction to Graphs and Their Applications | **1** |  |
| 38 | Theory of Graphs | **1** |  |
| 49 | Sequential Representation, Traversing, Searching | **2** |  |
| 15 | 40 | Concept of Hashing | **1** |  |
| 41 | Hash table, insertion, deletion, searching | **2** |  |
| 42 | Collision in Hash table and resolutions of collision | **2** |  |
| 16 | 43 | **Project / CCP presentations and submissions.** | **3** |  |
| 44 |  |
| 45 |  |
| **17** | **Final Exam** | | | |

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| 1. **IU Assessment / grading Policy** | **Instructor grading for course \*** |
| Quizzes 10-15%  Assignments 10-15%  Projects/Presentation/CCP 0-10%  Mid Semester Examination/ 20-30%  End Semester Examination 40-50% | 10%  15%  10%  25%  40% |

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| **IQRA University (IU)** | | |
| **Faculty of Engineering Sciences and Technology (FEST)** | | |
| **Computer Science Department (CS)** | | |
| **Course Code** | **Course Name** | **Credit Hr** |
| **CMC251-L** | Data Structures Lab | **3+1** |

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| 1. **Basic Information** | | | |
| **Instructor** |  | **Designation** |  |
| **Prerequisite(s)** | CMC112-L | **Semester** |  |
| **Email** |  | **Phone** |  |
| **Consulting Hours** |  | **Office Location** |  |

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| 1. **Course Objective(s)** |
| 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. |

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| 1. **Course Contents** |
| 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 |

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| 1. **Course Learning Outcomes** | | | | | | |
| **CLOs** | **CLO Statement** | **BT Level** | **Mapping** | | | **% Weight** |
| **GAs** | **ACM KA** | **SGDs** |
| CLO1 | **Performs** a Lab Task as demonstrated. Follow instructions to build a solution. Responds to hand-signals of instructor while learning to use an IDE. | P3 | GA2 | #1  AL | 4 | 25% |
| CLO2 | **Apply** data structures in implementing simple applications | C3 | GA5 | 25% |
| CLO3 | ***Participate*** in lab activities such as projects as an individual and as an effective team member utilizing the concepts of data structures to solve real-life problems. | A3 | GA10 | 50% |
| ***Note: On successful completion of course GA1 (Academic Education) will automatically attain.*** | | | | | | |

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| 1. **Course Textbook / Reference Books and Supplementary Reading Material** | | | |
| **S No** | **Book Title** | **Author(s)** | **Edition/ publication year/publisher** |
| 1. 1 | Data Structures and Algorithms in Java | Robert Lafore | 8th Edition, 2023 |
| 1. 2 | Data Structures and Algorithms in Java | Michael T. Goodrich, Roberto Tamassia, and Michael H. Goldwasser | 7th Edition, 2022 |
| 1. 3 | Algorithms For Dummies | John Paul Mueller , Luca Massaron | 2nd Edition, 2022 |

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| 1. **CLO Outcome Based Assessment (OBA) Tentative** | | | | | | |
| **Assessment Tool** | | **CLO Mapped** | **CLO Marks** | **% Weight** | **Total Marks** | **Assessment Date** |
| **Quizzes**  **0** |  |  |  |  |  |  |
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|  |  |  |  |  |  |
| **Total Quizzes %** | | | **0** | 0 |  |
|  | | | | | | |
| **Lab Manual Task**  **15** | Lab task | **CLO 1/2/3** | 15 | **100%** | 15 | TBD |
| **Total Assignments %** | | | **100%** | **15** |  |
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| **Midterm**  **25** | Midterm Q#1 | CLO 1 | 10 | 40% | 10 | TBD |
| Midterm Q#2 | CLO 1 | 10 | 40% | 10 | TBD |
| Midterm Q#3 | CLO 2 | 5 | 20% | 5 | TBD |
|  | **Total Midterm %** | | | **100%** | **25** |  |
|  | | | | | | |
| **Project/OEL**  **20** | Project/OEL | CLO 3 | 20 | 100% | 20 | TBD |
|  | **Total Project /CCP %** | | | **100%** | **20** |  |
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| **Final Exam**  **40** | Final Exam Q#1 | CLO2 | 10 | 25% | 10 | TBD |
| Final Exam Q#2 | CLO2 | 10 | 25% | 10 | TBD |
| Final Exam Q#3 | CLO3 | 20 | 50% | 20 | TBD |
|  | **Total Final Exam %** | | | **100%** | **40** |  |
| **100** | **Total Marks** | | | | **100** |  |
| **Note: Please make sure every CLO must be assessed at least 3 time.** | | | | | | |

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| 1. **Weekly Plan** | | | | | | | |
| **Week**  **No** | **Lab No** | | **Lab Description** | | **Contact**  **Hr** | | **CLO** |
| 1 | 1 | | Introduction to Data Structures & Arrays | | 3 | | **1/2/3** |
| 2 | 2 | | Searching Algorithms | | 3 | | **1/2/3** |
| 3 | 3 | | Sorting Algorithms | | 3 | | **1/2/3** |
| 4 | 4 | | Linked Lists | | 3 | | **1/2/3** |
| 5 | 5 | | Doubly Linked Lists | | 3 | | **1/2/3** |
| 6 | 6 | | Recursion | | 3 | | **1/2/3** |
| 7 |  | | **Open Ended Lab/ Project / PBL** | | 3 | | **1/2/3** |
| 8 | Midterm Exam | | | | | | |
| 9 | 7 | Stacks using Linked List | | 3 | | **1/2/3** | |
| 10 | 8 | Queues using Linked List | | 3 | | **1/2/3** | |
| 11 | 9 | Priority Queues and Heaps | | 3 | | **1/2/3** | |
| 12 | 10 | Hashing | | 3 | | **1/2/3** | |
| 13 | 11 | Binary Search Trees (BST) | | 3 | | **1/2/3** | |
| 14 | 12 | AVL Trees | | 3 | | **1/2/3** | |
| 15 | 13 | Graphs and Graph Traversal | | 3 | | **1/2/3** | |
| 16 | 14 | **Open Ended Lab/Project / PBL Assessment** | | | 3 | | **1/2/3** |
| 17 | **Final Exam** | | | | | | |

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| 1. **IU Assessment / grading Policy** | **Instructor grading for course \*** |
| Quizzes 0-10%  Labs Task Assessment 10-20%  Projects/OEL/PBL 5-20%  Mid Semester Examination/ 20-30%  End Semester Examination 40-50% | 0  15%  20%  25%  40% |

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| **IQRA University (IU)** | | |
| **Faculty of Engineering Sciences and Technology (FEST)** | | |
| **Computer Science Department (CS)** | | |
| **Course Code** | **Course Name** | **Credit Hr** |
| **CSC252** | Theory Of Automata | **3+0** |

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| 1. **Basic Information** | | | |
| **Instructor** | Muhammad Hassam Shakil Siddiqui | **Designation** | Senior Lecturer |
| **Prerequisite(s)** | GER132 – Discrete Structures | **Semester** | Fall 2024 |
| **Email** | [hassam@iqra.edu.pk](mailto:hassam@iqra.edu.pk) | **Phone** | 0333-2464877 |
| **Consulting Hours** | Friday 09:30 am to 10:30 am | **Office Location** | 6th Floor Faculty Room (2nd Cubicle) |

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| 1. **Course Objective(s)** |
| The course introduces some fundamental concepts in automata theory and formal languages including grammar, finite automaton, regular expression, formal language, pushdown automaton, and Turing machine. Not only do they form basic models of computation, they are also the foundation of many branches of computer science, e.g. compilers, software engineering, concurrent systems, etc. The properties of these models will be studied and various rigorous techniques for analyzing and comparing them will be discussed, by using both formalism and examples. |

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| 1. **Course Contents** |
| Finite State Models: Language definitions preliminaries, Regular expressions/Regular languages, Finite automata (FAs), Transition graphs (TGs), NFAs, Kleene’s theorem, Transducers (automata with output), Pumping lemma and non-regular language Grammars and PDA: CFGs, Derivations, derivation trees and ambiguity, Simplifying CFLs, Normal form grammars and parsing, Decidability, Context sensitive languages, grammars and linear bounded automata (LBA), Chomsky’s hierarchy of grammars Turing Machines Theory: Turing machines, Post machine, Variations on TM, TM encoding, Universal Turing Machine, Defining Computers by TMs. |

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| **4. Course Learning Outcomes** | | | | | | |
| **CLOs** | **CLO Statement** | **BT**  **Level** | **Mapping** | | | **%**  **Weight** |
| **GAs** | **ACM KA** | **SGDs** |  |
| CLO1 | **Explain** the principles of formal language theory, including regular, context-free, and context-sensitive languages, and describe the characteristics and functions of each language type. | C2 | GA2 | #01  AL –  Algorithms and Complexity | 4 | 33.3% |
| CLO2 | **Analyze** by applying concepts of finite automata, pushdown automata, and Turing machines to design, modify and optimize automata and to resolve computational problems. | C4 | GA3 | 33.3% |
| CLO3 | **Evaluate** automata and grammars using appropriate algorithms and techniques, including minimization, conversion, lemmas, and equivalence checking to improve computational solutions. | C5 | GA4 | 33.3% |
| ***Note: On successful completion of course GA1 (Academic Education) will automatically attain.*** | | | | | | |

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| **5. Course Textbook / Reference Books and Supplementary Reading Material** | | | |
| **S**  **No** | **Book Title** | **Author(s)** | **Edition/ publication**  **year/publisher** |
| 1. | Automata Theory, Languages and  Computation | John Hopcroft & Jeffery  Ullman | 3rd Edition / 2006 / Pearson |
| 2. | An Introduction to Formal  Languages & Automata | Peter Linz | 7th Edition / 2022 / Jones &  Bartlett Learning |
| 3. | Introduction to Automata Theory,  Formal Languages and omputation | Shyamalendu Kandar | 1st Edition / 2013 / Pearson |
| 4. | Theory of Automata, Formal  Languages and Computation | S. P. Eugene, Xavier | 1st Edition / 2008 / New Age  International Pvt Ltd |
| 5. | Automata, Computability and  Complexity: Theory and Applications | Elaine Rich | 1st Edition / 2007 / Pearson |

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| **6. CLO Outcome Based Assessment (OBA)** | | | | | | |
| **Assessment Tool** | | **CLO**  **Mapped** | **CLO**  **Marks** | **% Weight** | **Total Marks** | **Assessment Date** |
| **Quizzes 15** | Quiz #1 | *CLO1* | 05 | 33.33% | 5 | TBD |
| Quiz #2 | *CLO2* | 05 | 33.33% | 5 |  |
| Quiz #3 | *CLO3* | 05 | 33.34% | 5 |  |
| **Total Quizzes %** | | | **100%** | **15** |  |
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| **Assignments 15** | Assignment #1 | *CLO1* | 05 | 33.33% | 5 |  |
| Assignment #2 | *CLO2* | 05 | 33.33% | 5 |  |
| Assignment #3 | *CLO3* | 05 | 33.34% | 5 |  |
|  | **Total Assignments %** | | | **100%** | **15** |  |
|  | | | | | | |
| **Midterm 25** | Midterm Q#1 | *CLO1* | 13 | 52% | 13 |  |
| Midterm Q#2 | *CLO2* | 12 | 48% | 12 |  |
|  | **Total Midterm %** | | | **100%** | **25** |  |
|  | | | | | | |
| **Project/CCP 05** | Project/CCP | *CLO3* | 5 | 100% | 5 |  |
|  | **Total Project /CCP %** | | | **100%** | **5** |  |
|  | | | | | | |
| **Final Exam 40** | Final Exam Q#1 | *CLO1* | 10 | 25% | 10 |  |
| Final Exam Q#2 | *CLO2* | 10 | 25% | 10 |  |
| Final Exam Q#3 | *CLO3* | 20 | 50% | 20 |  |
|  | **Total Final Exam %** | | | **100%** | **40** |  |
| **100** | **Total Marks** | | | | **100** |  |
| ***Note: Please make sure every CLO must be assessed at least 3 time.*** | | | | | | |

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| **7. Weekly Plan** | | | | |
| **Week** | **Lecture No** | **Topic Covered** | **CLO** | **Assessment Tool** |
| 1 | 1 | Course introduction, importance of automata theory, and real-world applications. | CLO1 | **Quiz#, Mid, Final** |
| 2 | Introduction to formal languages, alphabets, strings, and languages. | CLO1 |  |
| 3 | Set theory review (union, intersection, complement) and operations on languages. | CLO1 |  |
| 2 | 4 | Introduction to Deterministic Finite Automata (DFA), Components of | CLO1 |  |

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|  |  | DFA (states, alphabet, transition function, start state, accept states), examples of DFA | | |  |  | |
| 5 | Designing DFAs for specific languages, Practice problems (string acceptance, construction of DFAs) | | | CLO2 |  | |
| 6 | Minimization of DFAs, Techniques for DFA minimization with examples | | | CLO2 |  | |
| 3 | 7 | Introduction to Non-deterministic Finite Automata (NFA), Differences between DFA and NFA, Examples of simple NFAs | | | CLO1 |  | |
| 8 | Designing NFAs for specific languages, Practice problems with NFA design | | | CLO2 |  | |
| 9 | Equivalence between DFA and NFA, Step-by-step conversion of NFA to DFA with examples | | | CLO2 |  | |
| 4 | 10 | Introduction to NFA with ε (null) transitions, Explanation of ε-transitions and how they differ from regular NFA transitions, Simple examples of NFA-ε and its role in automata design | | | CLO1 |  | |
| 11 | Conversion from NFA with ε-transitions to NFA (eliminating ε-moves), Detailed conversion process with examples and problem-solving | | | CLO2 | Quiz 1,  Assignment 1 | |
| 12 | Equivalence between NFA-ε and DFA, Practice on converting NFA-ε to DFA | | | CLO3 |  | |
| 5 | 13 | Introduction to Regular Expressions (RE), Basic operators (concatenation, union, Kleene star), Examples of simple regular expressions | | | CLO1 |  | |
| 14 | Constructing regular expressions for specific languages, Practice problems (designing REs for given languages) | | | CLO2 |  | |
| 15 | Conversion from Regular Expressions to Finite Automata (RE to FA), Step-by-step process with examples | | | CLO2 |  | |
| 6 | 16 | Conversion from Finite Automata to Regular Expressions (FA to RE), Examples and practice problems | | | CLO2 |  | |
| 17 | Properties of Regular Expressions (closure properties: union, concatenation, Kleene star), Regular languages and their properties | | | CLO1 |  | |
| 18 | Equivalence between Regular Expressions and Finite Automata, Review of proofs and problem-solving | | | CLO3 |  | |
| **7** | 19 | Introduction to the Pumping Lemma for Regular Languages, Statement of the Pumping Lemma, Explanation and examples of its use | | | CLO2 | Quiz 2,  Assignment 2 | |
|  | 20 | Applying the Pumping Lemma to prove that certain languages are not regular, Step-by-step process with examples  More practice on proving non-regularity of languages using the Pumping Lemma, Additional problem-solving and proofs | | | CLO2 |  | |
|  | 21 | **Assignment of Complex Computing Problem (CCP)** | | | CLO2 | CCP  Announced | |
| **8** | **Midterm Exam** | | | | | | |
| 9 | 22 | Introduction to Context-Free Languages (CFL), Definition of context- free languages, Examples of context-free languages | | | CLO1 |  | |
| 23 | Differences between regular and context-free languages | | | CLO1 |  | |
| 24 | Closure properties of Context-Free Languages (union, concatenation, Kleene star) | | | CLO1 |  | |
| 10 | 25 | Introduction to Context-Free Grammars (CFG), Definition of CFGs, Production rules, terminals, non-terminals, and start symbols, Examples of CFGs for basic languages | | | CLO3 |  | |
| 26 | Derivations, Parse Trees, and Ambiguity, generating strings from CFGs, Introduction to parse trees and how they relate to derivations | | | CLO3 |  | |
| 27 | Simplification of CFGs, Removing useless symbols, unit productions, and null productions, Simplification examples and practice problems | | | CLO3 |  | |
| 11 | 28 | Chomsky Normal Form (CNF), Definition and conversion of CFGs to CNF, Examples of CFGs in CNF | | | CLO1 |  | |
| 29 | | Greibach Normal Form (GNF), Definition and conversion of CFGs to GNF, Examples of CFGs in GNF | | CLO2 | |  | |
|  | 30 | | Membership Algorithm for Context-Free Grammars, CYK Algorithm for membership testing in CFGs, Step-by-step example of the CYK Algorithm | | CLO3 | |  | |
|  | 31 | | Introduction to Pushdown Automata (PDA), Definition and components of PDA, Differences between PDA and finite automata, Simple examples of PDAs | | CLO1 | |  | |
| 12 | 32 | | Designing PDAs for context-free languages, Steps for designing a  PDA, Practice problems on designing PDAs for specific languages | | CLO2 | |  | |
|  | 33 | | Equivalence between PDAs and Context-Free Languages, How PDAs recognize context-free languages, Examples of languages accepted by PDAs | | CLO3 | | Quiz 3,  Assignment 3 | |
|  | 34 | | Deterministic vs. Non-Deterministic PDAs, Differences and characteristics of deterministic and non-deterministic PDAs, Examples of each type | | CLO1 | |  | |
| 13 | 35 | | Closure properties of PDAs, Closure properties of context-free  languages concerning PDAs, Practice problems | | CLO1 | |  | |
|  | 36 | | The relationship between PDAs and CFGs, Converting PDAs to CFGs and vice versa, Example conversions and practice problems | | CLO3 | |  | |
|  | 37 | | Introduction to Turing Machines, Definition and components of Turing Machines | | CLO1 | |  | |
| Differences between Turing Machines and finite automata, Simple examples of TMs | |
| 14 | 38 | | Designing TMs for specific problems, Steps for designing TMs,  Practice problems on designing TMs for various languages | | CLO3 | |  | |
|  | 49 | | Types of Turing Machines (Deterministic vs. Non-Deterministic), Differences and characteristics of deterministic and non-deterministic TMs, Examples of each type | | CLO3 | |  | |
|  | 40 | | Introduction to Linear Bounded Automata, Definition and components of LBA, Differences between LBA and Turing | | CLO1 | |  | |
| 15 | 41 | | Designing LBAs for context-sensitive languages, Examples of LBAs  and practice problems | | CLO3 | |  | |
|  | 42 | | The relationship between LBAs and context-sensitive languages, Discussion on context-sensitive languages and LBA capabilities | | CLO3 | |  | |
| 16 | 43 | | CCP Submission and presentations | |  | | CCP | |
|  | 44 | | CCP Submission and presentations | |  | |  | |
|  | 45 | | CCP Submission and presentations |  |  | |  | |
| **17** |  | |  | **Final Exam** |  | |  | |

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| **8. IU Assessment / grading Policy** | | **Instructor grading for course \*** |
| Quizzes | 10-15% | 15% |
| Assignments | 10-15% | 15% |
| Projects/Presentation/CCP | 0-10% | 05% |
| Mid Semester Examination/ | 20-30% | 25% |
| End Semester Examination | 40-50% | 40% |

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| **IQRA University (IU)** | | |
| **Faculty of Engineering Sciences and Technology (FEST)** | | |
| **Computer Science Department (CS)** | | |
| **Course Code** | **Course Name** | **Credit Hr** |
| **CMC261** | Computer Networks | **3+1** |

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| 1. **Basic Information** | | | |
| **Instructor** | Khan Sarim Yasin | **Designation** | Lecturer |
| **Prerequisite(s)** | CMC123 | **Semester** | Fall 2024 |
| **Email** | [Khan.sarim@iqra.edu.pk](mailto:Khan.sarim@iqra.edu.pk) | **Phone** | 021-38658861 |
| **Consulting Hours** | Mon (8:30 – 11:30) | **Office Location** | EDC 1st Floor |

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| 1. **Course Objective(s)** |
| This course introduces the basic concept of computer network to the students. OSI and TCP/IP model and protocol standards are part of the course. |

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| 1. **Course Contents** |
| 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 |

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| 1. **Course Learning Outcomes** | | | | | | |
| **CLOs** | **CLO Statement** | **BT Level** | **Mapping** | | | **% Weight** |
| **GAs** | **ACM KA** | **SGDs** |
| CLO1 | **Describe** the key terminologies and technologies of computer networks and functions provided by each layer in the internet protocol stack | C2 | GA2 | #10  NC | 9 | NA |
| CLO2 | **Identify** various internetworking devices and their functions. Protocols and its variants of IP addressing and sub-netting | C4 | GA2 | NA |
| CLO3 | **Analyze** working and performance of key technologies, algorithms and their advanced features | C4 | GA3 | NA |
| ***Note: On successful completion of course GA 1 (Academic Education) will automatically attain.*** | | | | | | |

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| 1. **Course Textbook / Reference Books and Supplementary Reading Material** | | | |
| **S No** | **Book Title** | **Author(s)** | **Edition/ publication year/publisher** |
|  | Data Communication and Networking | Behrouz A. Forouzan | 5th Edition, 2012, McGraw-Hill |
|  | Computer Networks | Andrew S. Tanenbaum | 6th Edition, 2021, Prentice Hall |
|  | Data and Computer Communications | William Stallings | 10th Edition, 2014, Pearson |
|  | Computer Networking A Top Down Approach | J.F Kurose and K.W Ross | 8th Edition, 2022, Pearson |

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| 1. **CLO Outcome Based Assessment (OBA) Tentative** | | | | | | |
| **Assessment Tool** | | **CLO Mapped** | **CLO Marks** | **% Weight** | **Total Marks** | **Assessment Date** |
| **Quizzes**  **10** | Quiz #1 | *CLO1* | 3 | 30% | 3 | TBD |
| Quiz #2 | *CLO2* | 3 | 30% | 3 |  |
| Quiz #3 | *CLO3* | 4 | 40% | 4 |  |
| **Total Quizzes %** | | | **100%** | 10 |  |
|  | | | | | | |
| **Assignments**  **15** | Assignment #1 | *CLO1* | 5 | 33.3% | 5 |  |
| Assignment #2 | *CLO2* | 5 | 33.3% | 5 |  |
| Assignment #3 | *CLO3* | 5 | 33.3% | 5 |  |
|  |  | | | **100%** | 15 |  |
|  | | | | | | |
| **Midterm**  **25** | Midterm Q# | *CLO1/2/3* | 20 |  |  |  |
| Midterm Q# | *CLO1/2/3* | 5 |  |  |  |
|  | …. | *CLO1/2/3* |  |  |  |  |
|  | Midterm Qn | *CLO1/2/3* |  |  |  |  |
|  | **Total Midterm %** | | | **100%** | **25** |  |
|  | | | | | | |
| **Project/CCP**  **10** | Project/CCP | *CLO1/2/3* | 10 |  |  |  |
|  | **Total Project /CCP %** | | | **100%** |  |  |
|  | | | | | | |
| **Final Exam**  **40** | Final Exam Q# | *CLO1/2/3* | 10 |  |  |  |
| Final Exam Q# | *CLO1/2/3* | 10 |  |  |  |
| …. | *CLO1/2/3* |  |  |  |  |
|  | Final Exam Qn | *CLO1/2/3* |  |  |  |  |
|  | **Total Final Exam %** | | | **100%** |  |  |
| **100** | **Total Marls** | | | | **100** |  |
| ***Note: Please make sure every CLO must be assessed at least 3 time.*** | | | | | | |

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| 1. **Weekly Plan** | | | | |
| **Week** | **Lecture No** | **Topic Covered** | **CLO** | **Assessment Tool** |
| 1 | 1 | Introduction to networks, Network characteristics, components of data communication | 1 |  |
| 2 | Network topologies, Mesh, Ring, Bus and Star | 1 |  |
| 3 | Types of network, LAN, MAN, WAN | 1 |  |
| 2 | 4 | OSI Model overview | 1 |  |
| 5 | Transmission media, Classes of transmission media | 1 |  |
| 6 | Design factors, Guided vs Unguided | 1 |  |
| 3 | 7 | STP, UTP and Fiber Optic pros and cons | 1 |  |
| 7 | Structured cabling, Wireless Medium | 1 |  |
| 9 | Connecting devices, HUB, types of Hubs | 2 |  |
| 4 | 10 | How Hub works, Collision domain | 2 |  |
| 11 | Drawbacks of Hubs and solution | 2 |  |
| 12 | Packet vs Circuit switching, Network Switch | 2 |  |
| 5 | 13 | MAC table, How switch works | 2 |  |
| 14 | Switch redundancy, Connecting multiple switches | 2 |  |
| 15 | Switching Loop broadcast storm | 2 |  |
| 6 | 16 | Network Layer IP addressing, Subnet Mask, IP classes | 2 |  |
| 17 | FLSM and VLSM sub-netting | 2 |  |
| 18 | Sub-netting examples, IPv6 | 2 |  |
| **7** | 19 | Project/CCP assignment | 3 |  |
|  | 20 | Project/CCP assignment | 3 |  |
|  | 21 | Project/CCP assignment | 3 |  |
| **8** | **Midterm Exam** | | | |
| 9 | 22 | Data Link Layer, MAC, LLC, Framing, Flow and error control | 2 |  |
| 23 | Stop and Wait protocol ARQ, Sliding Window, Go Back-N, Selective repeat | 2 |  |
| 24 | Bandwidth – Delay product numerical | 2 |  |
| 10 | 25 | Error detection and correction, Single Bit and Burst error | 3 |  |
| 26 | FEC vs Retransmission, Block coding | 3 |  |
| 27 | Hamming Code, Cyclic Redundancy Check (CRC) | 3 |  |
| 11 | 28 | Network layer protocols, ARP, ICMP, Routing Basics | 3 |  |
| 29 | IGP/EGP, Static route vs Dynamic route | 3 |  |
| 30 | Routing Information Protocol (RIP), Routing Loop | 3 |  |
| 12 | 31 | Link State Protocol, OSPF basics, Dijkstra Algorithm | 3 |  |
| 32 | Software Defined Network (SDN), Open Flow | 3 |  |
| 33 | SDN Architecture, Centralized vs. Distributed | 3 |  |
| 13 | 34 | Transport Layer Protocol, Connectionless vs Connection oriented protocols | 3 |  |
| 35 | UDP | 3 |  |
| 36 | TCP, TCP 3-Way Handshake | 3 |  |
| 14 | 37 | TCP Congestion Control | 3 |  |
| 38 | HTTP | 3 |  |
| 39 | HTTP | 3 |  |
| 15 | 40 | DNS | 3 |  |
| 41 | Application Layer Protocols, SMTP, IMAP4 vs POP3, | 3 |  |
| 42 | Peer to Peer Application | 3 |  |
| 16 | 43 | Project/CCP Assessment | 3 |  |
| 44 | Project/CCP Assessment | 3 |  |
| 45 | Project/CCP Assessment | 3 |  |
| **17** | **Final Exam** | | | |

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| 1. **IU Assessment / grading Policy** | **Instructor grading for course \*** |
| Quizzes 10-15%  Assignments 10-15%  Projects/Presentation/CCP 0-10%  Mid Semester Examination/ 20-30%  End Semester Examination 40-50% | 10  15  10  25  40 |

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| **IQRA University (IU)** | | |
| **Faculty of Engineering Sciences and Technology (FEST)** | | |
| **Computer Science Department (CS)** | | |
| **Course Code** | **Course Name** | **Credit Hr** |
| **CMC261-L** | Computer Networks Lab | **3+1** |

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| 1. **Basic Information** | | | |
| **Instructor** | Ammar Ali Qazi | **Designation** | Lecturer |
| **Prerequisite(s)** | CMC123-L | **Semester** | Fall 2024 |
| **Email** | [Ammar.ali01@iqra.edu.pk](mailto:Ammar.ali01@iqra.edu.pk) | **Phone** | 03103460745 |
| **Office Hours** | Mon (8:30 – 10:30) | **Office Location** | EDC 1st Floor Faculty Area |

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| 1. **Course Objective(s)** |
| The course aims to equip students with the practical skills needed to establish console sessions and configure network devices using Hyper Terminal. Students will learn to construct and utilize different types of network cables and command line fundamentals to manage and troubleshoot network issues effectively |

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| 1. **Course Contents** |
| The lab sessions include constructing crossover and straight-through cables, fundamental command line operations, and troubleshooting techniques using Ping and Telnet. Students will practice IP addressing, configure various routing protocols such as RIP and OSPF, and manage IOS images with TFTP. Additionally, the course covers VLAN configuration and the use of routing tables to understand and implement effective network routing strategies. |

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| 1. **Course Learning Outcomes** | | | | | | |
| **CLOs** | **CLO Statement** | **BT Level** | **Mapping** | | | **% Weight** |
| **GAs** | **ACM KA** | **SGDs** |
| CLO1 | **Apply** the concepts of computer networks and communication protocols to design, configure, and simulate network topologies. | P1 | GA2 | #10  NC | 9 | NA |
| CLO2 | **Practice** problem-solving and network troubleshooting skills by configuring and testing network devices (routers, switches, and hosts) in Cisco Packet Tracer | A2 | GA6 | NA |
| CLO3 | **Analyze** and optimize the performance of network configurations by implementing advanced features such as VLANs, routing protocols (RIP, OSPF), and network security measures. | C4 | GA4 | NA |
| ***Note: On successful completion of course GA 1 (Academic Education) will automatically attain.*** | | | | | | |

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| 1. **Course Textbook / Reference Books and Supplementary Reading Material** | | | |
| **S No** | **Book Title** | **Author(s)** | **Edition/ publication year/publisher** |
| 1 | Data Communication and Networking | Behrouz A. Forouzan | 5th Edition, McGraw-Hill, 2012 |
| 2 | Computer Networks | Andrew S. Tanenbaum | 6th Edition, Prentice Hall, 2021 |
| 3 | Data and Computer Communications | William Stallings | 10th Edition, Pearson, 2014 |
| 4 | Computer Networking A Top Down Approach | J.F Kurose and K.W Ross | 8th Edition, Pearson, 2022 |

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| 1. **CLO Outcome Based Assessment (OBA) Tentative** | | | | | | |
| **Assessment Tool** | | **CLO Mapped** | **CLO Marks** | **% Weight** | **Total Marks** | **Assessment Date** |
| **Quizzes** |  |  |  |  |  | TBD |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
| **Total Quizzes %** | | | **0%** |  |  |
|  | | | | | | |
| **Lab Manual Tasks**  **15** | Lab Tasks | *CLO1/2/3* | 15 | **100%** |  |  |
|  |
|  |
|  |  | | | **100%** | 15 |  |
|  | | | | | | |
| **Midterm**  **25** | Midterm Q# | *CLO1/2/3* | 20 |  |  |  |
| Midterm Q# | *CLO1/2/3* | 5 |  |  |  |
|  | …. | *CLO1/2/3* |  |  |  |  |
|  | Midterm Qn | *CLO1/2/3* |  |  |  |  |
|  | **Total Midterm %** | | | **100%** | **25** |  |
|  | | | | | | |
| **Project/OEL**  **20** | Project/OEL/PBL | *CLO1/2/3* | 20 |  |  |  |
|  | **Total Project /CCP %** | | | **100%** | **20** |  |
|  | | | | | | |
| **Final Exam**  **40** | Final Exam Q# | *CLO1/2/3* | 10 |  |  |  |
| Final Exam Q# | *CLO1/2/3* | 10 |  |  |  |
| …. | *CLO1/2/3* |  |  |  |  |
|  | Final Exam Qn | *CLO1/2/3* |  |  |  |  |
|  | **Total Final Exam %** | | | **100%** |  |  |
| **100** | **Total Marls** | | | | **100** |  |
| ***Note: Please make sure every CLO must be assessed at least 3 time.*** | | | | | | |

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| 1. **Weekly Plan** | | | | |
| **Week**  **No** | **Lab No** | **Lab Description** | **Contact**  **Hr** | **CLO** |
| 1 | 1 | Establishing a Console Session with Hyper Terminal | 3 | 1,2,3 |
| 2 | 2 | Transmission Media  Crossover Cable Construction  Straight Through Cable Construction | 3 | 1,2,3 |
| 3 | 3 | Command Line Fundamentals | 3 | 1,2,3 |
| 4 | 4 | Troubleshooting Using Ping and Telnet | 3 | 1,2,3 |
| 5 | 5 | IP Addressing Basics, Gateway of Last Resort | 3 | 1,2,3 |
| 6 | 6 | Basic Switch Configuration, Configuring Static VLANS | 3 | 1,2,3 |
| 7 |  | **Open Ended Lab/Project Assigned** | 3 | 1,2,3 |
| 8 | Midterm Exam | | | |
| 9 | 7 | Using Show IP Route to Examine Routing Tables | 3 | 1,2,3 |
| 10 | 8 | Calculating VLSM Subnets | 3 | 1,2,3 |
| 11 | 9 | Configuring RIP and Rip V2 | 3 | 1,2,3 |
| 12 | 10 | Troubleshooting RIP v2 using Debug | 3 | 1,2,3 |
| 13 | 11 | Network Layer Protocols(ARP, IPv4, IPv6, ICMP)Symmetry | 3 | 1,2,3 |
| 14 | 12 | Configuring the OSPF Routing Process | 3 | 1,2,3 |
| 15 | 13 | Configuring EIGRP Routes | 3 | 1,2,3 |
| 16 |  | **Open Ended Lab/Project Assessment** | 3 | 1,2,3 |
| 17 | **Final Exam** | | | |

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| 1. **IU Assessment / grading Policy** | **Instructor grading for course \*** |
| Quizzes 0-10%  Labs Task Assessment 10-20%  Projects/OEL/PBL 5-20%  Mid Semester Examination/ 20-30%  End Semester Examination 40-50% | 0  15  20  25  40 |

## SEMESTER 4

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| **S.No** | **Course Code** | **Title** | **Cr.Hrs** |
| 1 | MTE213 | Linear Algebra | 3 + 0 |
| 2 | MTE221 | Technical & Business Writing | 3 + 0 |
| 3 | CSC223 | Computer Architecture | 2 + 0 |
| 4 | CSC223-L | Computer Architecture (Lab) | 0 + 1 |
| 5 | CMC241 | Operating Systems | 3 + 0 |
| 6 | CMC241-L | Operating Systems (Lab) | 0 + 1 |
| 7 | CMC253 | Analysis of Algorithms | 3 + 0 |
| 8 | GERXXX | Social Science I | 2 + 0 |
|  |  |  | **16+2 (18)** |

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| **IQRA University (IU)** | | |
| **Faculty of Engineering Sciences and Technology (FEST)** | | |
| **Computer Science Department (CS)** | | |
| **Course Code** | **Course Name** | **Credit Hr** |
| **MTE213** | Linear Algebra | **3+0** |

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| 1. **Basic Information** | | | |
| **Instructor** |  | **Designation** |  |
| **Prerequisite(s)** | MTE212 Multivariable Calculus | **Semester** | Fall 2024 |
| **Email** |  | **Phone** |  |
| **Consulting Hours** |  | **Office Location** |  |

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| 1. **Course Objective(s)** |
| The objective of this course is to provide fundamentals of solution for system of linear equations, operations on system of equations, matrix properties, solutions and study of their properties. |

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| 1. **Course Contents** |
| 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. |

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| 1. **Course Learning Outcomes** | | | | | | |
| **CLOs** | **CLO Statement** | **BT Level** | **Mapping** | | | **% Weight** |
| **GAs** | **ACM KA** | **SDGs** |
| CLO1 | ***Compute*** the solutions of systems of linear equations using various methods such as matrix inversion method, Gaussian elimination, Gauss-Jordan elimination. | C2 | GA2 | #4  DS | 4 | 30% |
| CLO2 | ***Apply*** the concepts of Matrices, to solve various problems of Vector Spaces | C3 | GA3 | 40% |
| CLO3 | ***Illustrate*** the solution and applications of eigenvalues, eigenvectors, diagonalization, and relevant problems. | C3 | GA3 | 30% |
| ***Note: On successful completion of course GA 1 (Academic Education) will automatically attain.*** | | | | | | |

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| 1. **Course Textbook / Reference Books and Supplementary Reading Material** | | | |
| **S No** | **Book Title** | **Author(s)** | **Edition/ publication year/publisher** |
|  | Elementary Linear Algebra: Applications Version | Howard Anton, Chris Rorres, Anton Kaul | 12th edition 2019, Wiley Publisher. |
|  | Linear Algebra and Its Applications, Global Edition | David Lay, Steven Lay, Judi McDonald | 6th edition 2021, Pearson |
|  | Introduction to Linear Algebra | Gibert Strang | 6th edition 2023, Wellesley-Cambridge Press |

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| 1. **CLO Outcome Based Assessment (OBA)** | | | | | | |
| **Assessment Tool** | | **CLO Mapped** | **CLO Marks** | **% Weight** | **Total Marks** | **Assessment Date** |
| **Quizzes**  **15** | Quiz #1 | *CLO1* | 5 | 33.33% | 5 | TBD |
| Quiz #2 | *CLO2* | 5 | 33.33% | 5 | TBD |
| Quiz #3 | *CLO3* | 5 | 33.33% | 5 | TBD |
| **Total Quizzes %** | | | **100%** | **15** |  |
|  | | | | | | |
| **Assignments**  **15** | Assignment #1 | *CLO1* | 5 | 33.33% | 5 | TBD |
| Assignment #2 | *CLO2* | 5 | 33.33% | 5 | TBD |
| Assignment #3 | *CLO3* | 5 | 33.33% | 5 | TBD |
|  | **Total Assignments %** | | | **100%** | **15** |  |
|  | | | | | | |
| **Project/CCP**  **05** | Project/CCP | *CLO1-3* | 5 | 100% | 5 | TBD |
|  | **Total Project /CCP %** | | | **100%** | **05** |  |
|  | | | | | | |
| **Midterm**  **25** | Midterm Q#1 | *CLO1* | 15 | 60% | 15 | TBD |
| Midterm Q#2 | *CLO2* | 10 | 40% | 10 |  |
|  | **Total Midterm %** | | | **100%** | **25** |  |
|  | | | | | | |
| **Final Exam**  **40** | Final Exam Q#1 | *CLO1* | 10 | 25% | 10 | TBD |
| Final Exam Q#2 | *CLO2* | 10 | 25% | 10 |  |
| Final Exam Q#3 | *CLO3* | 20 | 50% | 20 |  |
|  | **Total Final Exam %** | | | **100%** | **40** |  |
| **100** | **Total Marks** | | | | **100** |  |
| ***Note: Please make sure every CLO must be assessed at least 3 times.*** | | | | | | |

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| 1. **Weekly Plan** | | | | |
| **Week** | **Lecture No** | **Topic Covered** | **CLO** | **Assessment Tool** |
| 1 | 1 | Introduction to System of Linear Equations, Augmented matrix | **1** |  |
| 2 | Elementary row operations | **1** |  |
| 3 | Inverse of matrix, using elementary row operation | **1** |  |
| 2 | 4 | Inverse of matrix, using elementary row operation | **1** |  |
| 5 | Echelon form | **1** |  |
| 6 | Reduced echelon form | **1** |  |
| 3 | 7 | Rank of a matrix. | **1** |  |
| 8 | Consistency criteria: cases of solutions, unique, infinite solutions and no solution, Gaussian Elimination | **1** |  |
| 9 | Consistency criteria: cases of solutions, unique, infinite solutions and no solution, Gauss-Jordan | **1** | **A1** |
| 4 | 10 | Gaussian Elimination | **1** | **Q1** |
| 11 | Homogenous system: Trivial and non-trivial solution, Gaussian Elimination | **1** |  |
| 12 | Homogenous system: Trivial and non-trivial solution, Gauss-Jordan | **1** |  |
| 5 | 13 | Linear combination | **2** |  |
| 14 | Linearly dependent and independent vectors | **2** |  |
| 15 | Vector Spaces: Subspaces | **2** |  |
| 6 | 16 | Vector Spaces: Spanning | **2** |  |
| 17 | Vector Spaces: Basis and dimension | **2** |  |
| 18 | Row space | **2** |  |
| 7 | 19 | Column Space | **2** |  |
| 20 | Null space | **2** |  |
| 21 | **Project / CCP Discussion and Group allocation** | **1-3** |  |
| **8** | **Midterm Exam** | | | |
| 9 | 22 | Rank, nullity | **2** |  |
| 23 | Triangular matrices: Upper, Lower & Diagonal | **2** |  |
| 24 | LU factorization method | **2** |  |
| 10 | 25 | LU factorization method | **2** |  |
| 26 | Linear Transformation | **2** |  |
| 27 | Matrix of Transformation | **2** | **A2** |
| 11 | 28 | Matrix of Transformation, Applications | **2** | **Q2** |
| 29 | The geometry of linear systems: line & plane | **2** |  |
| 30 | The geometry of linear systems: Vector and parametric equations of line | **2** |  |
| 12 | 31 | The geometry of linear systems: Vector and parametric equations of plane | **2** |  |
| 32 | Eigenvalues and characteristic equation (2×2) & (3×3) | **3** |  |
| 33 | Non-repeated and repeated Eigen value (2×2) & (3×3) | **3** |  |
| 13 | 34 | Eigen basis and Eigen space (2×2) & (3×3) | **3** |  |
| 35 | Diagonalization of a matrix | **3** |  |
| 36 | Diagonalization of a matrix | **3** |  |
| 14 | 37 | Diagonalization of a matrix | **3** |  |
| 38 | Inner Product | **3** |  |
| 39 | Norm, Length | **3** | **A3** |
| 15 | 40 | Orthogonality | **3** | **Q3** |
| 41 | Orthonormality | **3** |  |
| 42 | Gram- Schmidt process, orthonormal basis | **3** |  |
| 16 | 43 | **Project / CCP presentations and submissions** | **1-3** |  |
| 44 |  |
| 45 |  |
| **17** | **Final Exam** | | | |

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| 1. **IU Assessment / grading Policy** | **Instructor grading for course** |
| Quizzes 10-15%  Assignments 10-15%  Projects/Presentation/CCP 0-10%  Mid Semester Examination/ 20-30%  End Semester Examination 40-50% | 15  15  05  25  40 |

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| **IQRA University (IU)** | | |
| **Faculty of Engineering Sciences and Technology (FEST)** | | |
| **Computer Science Department (CS)** | | |
| **Course Code** | **Course Name** | **Credit Hr** |
| **MTE221** | Technical and Business Writing | **3+0** |

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| 1. **Basic Information** | | | |
| Instructor | Maham Abid | Designation | Instructor |
| Prerequisite(s) | GER122 | Semester | Fall 2024 |
| Email | [mahamabid@iqra.edu.pk](mailto:mahamabid@iqra.edu.pk) | Phone | 0331-2240525 |
| Office Hours | 3+0 | Office Location | Faculty Cubicle, 8th Floor |

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| 1. **Course Objective(s)** |
| Upon successful completion of this course, students should be able to examine the purpose, audience, and tone of an academic text. They will be able to analyze the requirements of various academic writing tasks and explain the writing process. The course will equip students with the skills to demonstrate rhetorical strategies in their writing and develop effective arguments. Students will learn how to write well-structured paragraphs and essays, as well as analyze and evaluate research writing. They will gain the ability to write an abstract, problem statement, and literature review for research writing, and effectively incorporate material from different sources through quoting, paraphrasing, and summarizing. Additionally, students will learn to use different citation styles accurately in their work. |

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| 1. **Course Contents** |
| The course provides an overview of technical reporting, emphasizing the use of library resources and effective information gathering methods, such as administering questionnaires and reviewing gathered information. It covers various aspects of technical exposition, including topical arrangement, exemplification, definition, classification and division, causal analysis, and effective exposition. The course also explores technical narration, description, and argumentation, with a focus on persuasive strategies. Students will learn how to organize information and generate solutions through brainstorming, material organization, and the construction of a formal outline, while adhering to outlining conventions. The course further covers electronic communication and solution generation techniques. It emphasizes polishing writing style, focusing on paragraph structure, sentence clarity, length, order, avoiding pomposity and empty words, and eliminating pompous vocabulary. Additionally, students will learn about document design, including document structure, preambles, summaries, abstracts, tables of contents, footnotes, glossaries, cross-referencing, and the importance of avoiding plagiarism while correctly citing sources and creating bibliographies. |

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| 1. **Course Learning Outcomes** | | | | | | |
| **CLOs** | **CLO Statement** | **BT Level** | **Mapping** | | | **% Weight** |
| **GAs** | **ACM KA** | **SGDs** |
| CLO1 | **Prepare** to write technical documents and research articles | C3 | GA7 | #18  SP | 8 | 31% |
| CLO2 | **Illustrate** integrity in documentation by imparting responsibility and ethics in official  practice. | C3 | GA9 | 34% |
| CLO3 | **Demonstrate** Apply effective presentation techniques to communicate technical information clearly and confidently. | C3 | GA7 | 35% |
| **Note: On successful completion of course GA 1 (Academic Education) will automatically attain.** | | | | | | |

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| 1. **Course Textbook / Reference Books and Supplementary Reading Material** | | | |
| **S No** | **Book Title** | **Author(s)** | **Edition/ publication year/publisher** |
|  | **Academic Writing: A handbook for international students** | Stephen Bailey | 5th edition  Publisher Cengage Learning, |
|  | **Technical Report Writing** | Pauley and Riordan | 8th edition  Publisher Houghton Mifflin Company |

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| 1. **CLO Outcome Based Assessment (OBA)** | | | | | | | |
| **Assessment Tool** | | **CLO Mapped** | **CLO Marks** | **% Weight** | **Total Marks** | **Assessment Date** | |
| **Quizzes**  **10** | Quiz #1 | CLO 1 | 3 | 30% | 3 | TBD | |
| Quiz #2 | CLO 2 | 3 | 30% | 3 | TBD | |
| Quiz #3 | CLO 3 | 4 | 40% | 4 | TBD | |
| **Total Quizzes %** | | | **100%** | 10 |  | |
|  | | | | | | | |
| **Assignments**  **15** | Assignment #1 | CLO 1 | 5 | 33% | 5 | TBD | |
| Assignment #2 | CLO 2 | 5 | 33% | 5 | TBD | |
| Assignment #3 | CLO 3 | 5 | 33% | 5 | TBD | |
| **Total Assignments %** | | | **100%** | 15 |  | |
|  | | | | | | | |
| **Midterm**  **25** | Midterm Q#1 | CLO 1 | 5 | 25% | **5** | TBD | |
| Midterm Q#2 | CLO 2 | 5 | 25% | **5** | TBD | |
| Midterm Q#3 | CLO 1 | 5 | 25% | **5** | TBD | |
| Midterm Q#4 | CLO 2 | 5 | 25% | **5** | TBD | |
|  | | | | | |  |
|  | **Total Midterm %** | | | **100%** | **25** |  | |
|  | | | | | | | |
| **Project/CCP**  **10** | Project/Presentation | CLO3 | 10 | **100%** | **10** | **TBD** | |
|  | **Total Project /CCP %** | | | **100%** | **10** |  | |
|  | | | | | | | |
| **Final Exam**  **40** | Final Exam Q#1 | CLO1 | 8 | 20% | 8 | TBD | |
| Final Exam Q#2 | CLO2 | 8 | 20% | 8 | TBD | |
| Final Exam Q#3 | CLO2 | 8 | 20% | 8 | TBD | |
| Final Exam Q#4 | CLO3 | 8 | 20% | 8 | TBD | |
| Final Exam Qn5 | CLO3 | 8 | 20% | 8 | TBD | |
|  | **Total Final Exam %** | | | **100%** | **40** |  | |
| **100** | **Total Marks** | | | | **100** |  | |
| **Note: Please make sure every CLO must be assessed at least 3 time.** | | | | | | | |

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| 1. **Weekly Plan** | | | | |
| **Week** | **Lecture No** | **Topic Covered** | **CLO** | **Assessment Tool** |
| **1** | 1 | Overview of Technical Communication  What is technical English? Communication cycle, Defining technical English: features, purpose, and context | **1** |  |
| 2 | Levels of communication, Importance of technical communication | **1** |  |
|  | 3 | Types of technical documents |  |  |
| **2** | 4 | Critical reading and review, finding key points note making | **1** |  |
| 5 | Using dictionaries and resources for technical language | **1** |  |
|  | 6 | Academic vocabulary development, word formation and technical lexicon |  |  |
| **3** | 7 | Approaching technical texts | **2** |  |
| 8 | Technical proposals (Definition, Purpose, Types, Style and  Appearance) | **1,2** | **Q1** |
|  | 9 | Critical reading and evaluating technical content |  |  |
| **4** | 10 | Instruction manuals and technical description | **2** |  |
| 11 | Types of instructions,  user’s manuals, process, description & guidelines | **1,2** | **A1** |
|  | 12 | How to read and understand technical figures, symbols, and annotations |  |  |
| **5** | 13 | Writing well-structured essays | **1** |  |
| 14 | Organization & writing thesis statement | **2** |  |
|  | 15 | Cause and effect essay writing |  |  |
| **6** | 16 | Sentence structure for technical clarity | **1** |  |
| 17 | Argumentative Essay | **1,2** | **Q2** |
|  | 18 | Developing a thesis statement & refining and revising your thesis |  |  |
| **7** | 19 | Compare & contrast essay | **2** |  |
| 20 | Written forms of communication, Brochures and newsletters | **2** |  |
| **8** | Midterm Exam | | | |
| **9** | 21 | Written forms of communication: Report Writing (Objectives, Types,  Formats, structure, revising, editing, proofreading) | **1** |  |
| 22 | Writing problem statement | **1,2** | **A2** |
|  | 23 | Writing effective summaries and conclusions in reports |  |  |
| **10** | 24 | Introduction to scientific research paper | **2** |  |
| 25 | Writing abstracts, literature reviews, and methodology sections | **2** |  |
|  | 26 | Case studies and examples of technical writing in different sectors |  |  |
| **11** | 27 | Technical Writing for research papers | **2** |  |
| 28 | Avoiding plagiarism and ensuring academic integrity | **2** | **Q3** |
|  | 29 | Writing for new platforms (blogs, digital media, apps) |  |  |
| **12** | 30 | Research paper (literature review, methodology, discussion) | **2** |  |
| 31 | Peer review | **2** |  |
|  | 32 | literature reviews, and methodology sections |  |  |
| **13** | 33 | Plagiarism | **2** |  |
| 34 | Paraphrasing & Summarizing | **2,3** | **A3** |
| **14** | 35 | Proofreading for technical accuracy | **2** |  |
| 36 | Reviewing documents for clarity, precision, and relevance | **2** |  |
|  | 37 | Responding to peer feedback and making improvements |  |  |
| **15** | 38 | APA citation | **2** |  |
| 39 | Reference list | **1** |  |
|  | 40 | Bibliography and citation |  |  |
| **16** | 41 | Final Presentation | **3** |  |
| 42 | Presentation | **3** |  |
|  | 43 | Final Presentations | **3** |  |
| **17** | **Final Exam** | | | |

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| 1. **IU Assessment / grading Policy** | **Instructor grading for course \*** |
| Quizzes 10-15%  Assignments 10-15%  Projects/Presentation/CCP 0-10%  Mid Semester Examination/ 20-30%  End Semester Examination 40-50% | 10%  15%  10%  25%  40% |

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| **IQRA University (IU)** | | |
| **Faculty of Engineering Sciences and Technology (FEST)** | | |
| **Computer Science Department (CS)** | | |
| **Course Code** | **Course Name** | **Credit Hr** |
| **CSC 222** | Computer Architecture | **2+1** |

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| 1. **Basic Information** | | | |
| **Instructor** |  | **Designation** |  |
| **Prerequisite(s)** | CMC 123 | **Semester** | Fall 2024 |
| **Email** |  | **Phone** |  |
| **Office Hours** |  | **Office Location** |  |

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| 1. **Course Objective(s)** |
| The course aims to develop a clear understanding of computer architecture principles and their importance in modern computing systems. It seeks to enhance students' ability to analyze system performance and design efficient architectures. Students will also gain insights into advanced architectural concepts for optimized system design. |

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| 1. **Course Contents** |
| The course covers the fundamentals of computer architecture, including instruction set architectures, performance metrics, and basic processor design. Topics include memory hierarchies, cache design, virtual memory, pipeline processing, and hazard resolution techniques. The study of I/O systems, DMA, interrupts, and parallel processing introduces students to system-level interactions. Advanced topics, such as RISC and CISC architectures, are also included. |

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| 1. **Course Learning Outcomes** | | | | | | |
| **CLOs** | **CLO Statement** | **BT Level** | **Mapping** | | | **% Weight** |
| **GAs** | **ACM KA** | **SGDs** |
| CLO1 | **Understand** the principles of computer architecture, including performance metrics, instruction set architectures, and memory hierarchy designs. | C2 | GA2 | #2  AR | 4 | 23.5% |
| CLO2 | **Apply** knowledge of pipeline processing, memory systems, and I/O mechanisms to evaluate the functionality and performance of modern processors. | C3 | GA2 | 41.1% |
| CLO3 | **Design** and evaluate advanced architectures, such as RISC, CISC, and parallel systems, to determine their performance and suitability for various applications. | C6 | GA5 | 35.33% |
| ***Note: On successful completion of course GA1 (Academic Education) will automatically attain.*** | | | | | | |

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| 1. **Course Textbook / Reference Books and Supplementary Reading Material** | | | |
| **S No** | **Book Title** | **Author(s)** | **Edition/ publication year/publisher** |
|  | Computer Organization and Architecture: Designing for Performance | William Stallings | 11th Edition, 2019, Pearson |
|  | Computer System Architecture | M. Morris Morris Mano | 3rd Edition, 2017, Pearson Education |

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| 1. **CLO Outcome Based Assessment (OBA)** | | | | | | |
| **Assessment Tool** | | **CLO Mapped** | **CLO Marks** | **% Weight** | **Total Marks** | **Assessment Date** |
| **Quizzes**  **12.5** | Quiz #1 | *CLO1* | 5 | 40% | 5 | TBD |
| Quiz #2 | *CLO2* | 5 | 40% | 5 |  |
| Quiz #3 | *CLO3* | 2.5 | 20% | 2.5 |  |
| **Total Quizzes %** | | | **100%** | 12.5 |  |
|  | | | | | | |
| **Assignments**  **12.5** | Assignment #1 | *CLO1* | 5 | 40% | 5 |  |
| Assignment #2 | *CLO2* | 5 | 40% | 5 |  |
| Assignment #3 | *CLO3* | 2.5 | 20% | 2.5 |  |
|  |  | | | **100%** | 12.5 |  |
|  | | | | | | |
| **Midterm**  **25** | Midterm Q#1 | *CLO1* | 5 | 20% | **5** |  |
| Midterm Q#2 | *CLO1* | 10 | 40% | **10** |  |
|  | Midterm Q#3 | *CLO2* | 5 | 20% | **5** |  |
|  | Midterm Q#4 | *CLO2* | 5 | 20% | **5** |  |
|  | **Total Midterm %** | | | **100%** | **25** |  |
|  | | | | | | |
| **Project/CCP**  **10** | Project/CCP | *CLO2* | **5** | **50%** | **5** |  |
|  | Project/CCP | CLO3 | 5 | 50% | **5** |  |
|  | **Total Project /CCP %** | | | **100%** | **10** |  |
|  | | | | | | |
| **Final Exam**  **40** | Final Exam Q#1 | *CLO1* | 10 |  |  |  |
| Final Exam Q#2 | *CLO2* | 10 |  |  |  |
| Final Exam Q#3 | *CLO3* | 10 |  |  |  |
|  | Final Exam Q#4 | *CLO3* | 10 |  |  |  |
|  | **Total Final Exam %** | | | **100%** | **40** |  |
| **100** | **Total Marls** | | | | **100** |  |
| ***Note: Please make sure every CLO must be assessed at least 3 time.*** | | | | | | |

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| 1. **Weekly Plan** | | | | |
| **Week** | **Lecture No** | **Topic Covered** | **CLO** | **Assessment Tool** |
| 1 | 1 | An overview of Computer Architecture, including its evolution, purpose, and scope. Five components of a computer | **CLO 1** |  |
| 2 | ISA's and Introduction to MIPS | **CLO 1** |  |
| 2 | 3 | MIPS operations and Performance | **CLO 1** |  |
| 4 | Delay Modeling | **CLO 1** |  |
| 3 | 5 | Low Power Design | **CLO 1** | **Assignment #1** |
| 6 | Design Process, ALU & Adders | **CLO 1** |  |
| 4 | 7 | Multipliers & Shifters | **CLO 2** | **Quiz #1** |
| 8 | Dividers & Floating Point | **CLO 2** |  |
| 5 | 9 | Verilog | **CLO 2** |  |
| 10 | Design and testing methodologies | **CLO 2** |  |
| 6 | 11 | Single cycle Datapath and control | **CLO 2** | **Assignment #2** |
| 12 | Multiple cycle processor, controller, and microprogramming | **CLO 2** |  |
| **7** | 13 | **CCP Discussion and Announcement** | **CLO 2/3** |  |
|  | 14 | **CLO 2/3** |
| **8** | **Midterm Exam** | | | |
| 9 | 15 | Exceptions | **CLO 1** |  |
| 16 | Introduction to Pipelining | **CLO 1** |  |
| 10 | 17 | Pipelining and control | **CLO 2** | **Quiz #2** |
| 18 | Pipelining and exceptions | **CLO 2** |  |
| 11 | 19 | Advanced pipelining, Out-of-Order Execution, Branch Prediction | **CLO 2** |  |
| 20 | Intro to Memory Systems | **CLO 2** |  |
| 12 | 22 | Cache Design | **CLO 3** | **Assignment #3** |
| 23 | In-depth explanation of multi-core processors and how they improve performance by processing multiple tasks simultaneously. The role of interconnects in enabling communication between multiple processors in parallel systems. | **CLO 3** |  |
| 13 | 24 | Introduction to RISC architecture, focusing on its design principles such as simplicity and efficiency. Performance benefits and application scenarios where RISC is advantageous. | **CLO 3** |  |
| 25 | Introduction to CISC architecture, focusing on its rich instruction set and complex operations. Performance considerations and when CISC is more suitable for applications like general-purpose computing. | **CLO 3** |  |
| 14 | 26 | A comparative analysis of RISC and CISC architectures, evaluating performance metrics such as speed, code density, and hardware complexity. Discussing the strengths and weaknesses of both architectures for various applications. | **CLO 3** | **Quiz #3** |
| 27 | Introduction to GPU architecture, designed for high parallelism and large-scale data processing. | **CLO 3** |  |
| 15 | 28 | Overview of SIMD architecture, explaining how it applies a single instruction to multiple data points simultaneously. | **CLO 3** |  |
| 29 | Introduction to ARM architecture (RISC-based) and its applications. | **CLO 3** |  |
| 16 | 30 | **CCP Submission, Assessments and Presentation** | **CLO 2/3** |  |
| 31 | **CLO 2/3** |
| **17** | **Final Exam** | | | |

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| 1. **IU Assessment / grading Policy** | **Instructor grading for course \*** |
| Quizzes 10-15%  Assignments 10-15%  Projects/Presentation/CCP 0-10%  Mid Semester Examination/ 20-30%  End Semester Examination 40-50% | Quizzes 12.5%  Assignments 12.5%  Projects/Presentation/CCP 10%  Mid Semester Examination/ 25%  End Semester Examination 40% |

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| IQRA University | | |
| Faculty of Engineering Sciences and Technology (FEST) | | |
| Computer Science Department (CS) | | |
| Course Code | Course Name | Credit Hr. |
| CSC 222-L | Computer Architecture Lab | 2+1 |

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| 1. Basic Information | | | |
| Instructor |  | Designation |  |
| Prerequisite(s) | CMC 123-L | Semester | Fall 2024 |
| Email |  | Phone |  |
| Office Hours |  | Office Location |  |

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| 1. **Course Objective(s)** |
| The course aims to develop a clear understanding of computer architecture principles and their importance in modern computing systems. It seeks to enhance students' ability to analyze system performance and design efficient architectures. Students will also gain insights into advanced architectural concepts for optimized system design. |

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| 1. **Course Contents** |
| The course covers the fundamentals of computer architecture, including instruction set architectures, performance metrics, and basic processor design. Topics include memory hierarchies, cache design, virtual memory, pipeline processing, and hazard resolution techniques. The study of I/O systems, DMA, interrupts, and parallel processing introduces students to system-level interactions. Advanced topics, such as RISC and CISC architectures, are also included. |

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| 1. **Course Learning Outcomes** | | | | | | |
| **CLOs** | **CLO Statement** | **BT Level** | **Mapping** | | | **% Weight** |
| **GAs** | **ACM KA** | **SDGs** |
| CLO1 | **Apply** concepts of instruction set architecture and assembly language programming to develop solutions for x86 and MIPS systems. | P3 | GA2 | #2  AR | 4 | 65% |
| CLO2 | **Analyze** and implement system-level operations, such as procedures, macros, and memory management, using assembly language and simulators. | A3 | GA6 | 35% |
| **Note: On successful completion of course GA 1 (Academic Education) will automatically attain.** | | | | | | |
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| 1. **Course Textbook / Reference Books and Supplementary Reading Material** | | | |
| **S No** | **Book Title** | **Author(s)** | **Edition/ publication year/publisher** |
|  | Computer Organization and Architecture: Designing for Performance | William Stallings | 11th Edition, 2019, Pearson |
|  | Computer System Architecture | M. Morris Morris Mano | 3rd Edition, 2017, Pearson Education |

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| 1. **CLO Outcome-Based Assessment (OBA)** | | | | | | |
| **Assessment Tool** | | **CLO Mapped** | **CLO Marks** | **% Weight** | **Total Marks** | **Assessment Date** |
| **Quizzes**  **0** | Quiz #1 | *CLO1/2* | 0 | 0% | 0 |  |
| Quiz #2 | *CLO1/2* | 0 | 0% | 0 |  |
| Quiz #3 | *CLO1/2* | 0 | 0% | 0 |  |
| **Total Quizzes %** | | | **0%** | 0 |  |
|  | | | | | | |
| **Lab Manual**  **20** | Lab Task #1 | *CLO1/2* | 10 | 10% | 0 |  |
| Lab Task #2 | *CLO1/2* | 10 | 10% | 0 |  |
| Lab Task #n | *CLO1/2* | 0 |  | 0 |  |
|  | **Total Lab Manual %** | | | **20%** | 20 |  |
|  | | | | | | |
| **Midterm**  **25** | Midterm Q#1, 2 | *CLO1* | 20 |  |  |  |
| Midterm Q#3 | *CLO1* | 5 |  |  |  |
|  |  |  |  |  |  |  |
|  | **Total Midterm %** | | | **25%** | **25** |  |
|  | | | | | | |
| **Project/OEL**  **15** | Project/CCP | *CLO1/2* | 15 |  |  |  |
|  | **Total Project /CCP %** | | | **15%** | **15** |  |
|  | | | | | | |
| **Final Exam**  **40** | Final Exam Q# | *CLO1/2* | 10 |  |  |  |
| Final Exam Q# | *CLO1/2* | 10 |  |  |  |
|  | Final Exam Qn | *CLO1/2* |  |  |  |  |
|  | **Total Final Exam %** | | | **40%** | **40** |  |
| **100** | **Total Marls** | | | | **100** |  |
| ***Note: Please make sure every CLO must be assessed at least 3 times.*** | | | | | | |

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| 1. **Weekly Plan** | | | | |
| **Week**  **No.** | **Lab No.** | **Lab Description** | **Contact**  **Hr.** | **CLO** |
| 1 | 1 | Exploring Instruction Set Architecture (ISA) of x86 Machines | 3 | 1-2 |
| 2 | 2 | Learning to program in Assembly Language of x86 Machines | 3 | 1-2 |
| 3 | 3 | Using MACROS for Input / Output and Data Conversion | 3 | 1-2 |
| 4 | 4 | Using x86 Data Transfer Instructions. Using x86 Arithmetic Instructions | 3 | 1-2 |
| 5 | 5 | Implementing Branching in x86 Assembly Language | 3 | 1-2 |
| 6 | 6 | Implementation of Loop Structures in x86 Assembly Language | 3 | 1-2 |
| 7 |  | **Open Ended Lab/Project Assigned** |  | 1-2 |
| 8 | **Midterm Exam** | | | |
| 9 | 7 | Array Processing in x86 Assembly Language | 3 | 1-2 |
| 10 | 8 | Development of Procedures and Macros in x86 Assembly Language | 3 | 1-2 |
| 11 | 9 | Familiarization with SPIM – a MIPS simulator | 3 | 1-2 |
| 12 | 10 | Learning use of SPIM console and appreciate system calls provided by SPIM. Developing Procedures in MIPS Assembly Language | 3 | 1-2 |
| 13 | 11 | Implementing vector operations in MIPS Assembly and exploring Loop Unrolling. | 3 | 1-2 |
| 14 | 12 | Simulating Cache Read/Write using MIPS Pipes Simulator | 3 | 1-2 |
| 15 | 13 | Learning Address Translation in Virtual Memory System using MOSS simulator | 3 | 1-2 |
| 16 |  | **Open Ended Lab/Project Assessment** |  | 1-2 |
| 17 | **Final Exam** | | | |

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| 1. **IU Assessment/grading Policy** | **Instructor grading for the course \*** |
| Lab Manual 10-20%  Projects/OEL/PBL 10-25%  Mid Semester Examination/ 20-30%  End Semester Examination 40-50% | 15  20  25  40 |

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| **IQRA University (IU)** | | |
| **Faculty of Engineering Sciences and Technology (FEST)** | | |
| **Computer Science Department (CS)** | | |
| **Course Code** | **Course Name** | **Credit Hr** |
| **CMC241** | Operating Systems | **3+1** |

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| 1. **Basic Information** | | | |
| **Instructor** | Azeem Aftab | **Designation** | Senior Lecturer |
| **Prerequisite(s)** | CMC251 | **Semester** | Fall 2024 |
| **Email** | azeem.cheema@iqra.edu.pk | **Phone** |  |
| **Office Hours** | Thu-8:30 to 10:30 | **Office Location** | Faculty Cubicles, 7th floor |

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| 1. **Course Objective(s)** |
| This course introduces the essential concepts in the design and implementation of modern multiprogramming operating systems. Specific examples of such operating systems, the services provided, the way those services are implemented, and the underlying problems and solutions encountered in a multiprogramming computer system environment are covered. |

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| 1. **Course Contents** |
| 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. |

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| 1. **Course Learning Outcomes** | | | | | | |
| **CLOs** | **CLO Statement** | **BT Level** | **Mapping** | | | **% Weight** |
| **GAs** | **ACM KA** | **SGDs** |
| CLO1 | **Understand** the characteristics of different structures, and identify the core functions of the Operating Systems. | C2 | GA2 | #11  OS | 9 | 30% |
| CLO2 | ***Demonstrate*** issues of Process Management including process structure, synchronization, scheduling and communication. | C3 | GA2 | 35% |
| CLO3 | ***Analyze*** memory management techniques, file management algorithms, and I/O subsystems to gain comprehensive insights into operating system functionalities. | C4 | GA3 | 35% |
| ***Note: On successful completion of course GA1 (Academic Education) will automatically attain.*** | | | | | | |

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| 1. **Course Textbook / Reference Books and Supplementary Reading Material** | | | |
| **S No** | **Book Title** | **Author(s)** | **Edition/ publication year/publisher** |
|  | Operating Systems Concepts (T) | Abraham Silberschatz, Peter B. Galvin, and Greg Gagne | 10th Edition/2018/Wiley |
|  | Operating Systems Internals and Design Principles (R) | William Stallings | 9th Edition/2018/Pearson |
|  | Modern Operating Systems (R) | Andrew S. Tanenbaum | 4th Edition/2014/Pearson |

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| 1. **CLO Outcome Based Assessment (OBA)** | | | | | | |
| **Assessment Tool** | | **CLO Mapped** | **CLO Marks** | **% Weight** | **Total Marks** | **Assessment Date** |
| **Quizzes**  **10** | Quiz #1 | *CLO1* | 5 | 50% | 5 |  |
| Quiz #2 | *CLO2* | 2 | 20% | 2 |  |
| Quiz #3 | *CLO3* | 3 | 30% | 3 |  |
| **Total Quizzes %** | | | **100%** | 10 |  |
|  | | | | | | |
| **Assignments**  **15** | Assignment #1 | *CLO1* | 5 | 33.3% | 5 |  |
| Assignment #2 | *CLO2* | 5 | 33.3% | 5 |  |
| Assignment #3 | *CLO3* | 5 | 33.3% | 5 |  |
|  |  | | | **100%** | 15 |  |
|  | | | | | | |
| **Midterm**  **25** | Midterm Q#1 | *CLO1* | 10 | 40% | 10 |  |
| Midterm Q#2 | *CLO2* | 15 | 60% | 15 |  |
|  | **Total Midterm %** | | | **100%** | **25** |  |
|  | | | | | | |
| **Project/CCP**  **10** | Project/CCP | *CLO2/3* | 3/7=10 | 100% | 10 |  |
|  | **Total Project /CCP %** | | | **100%** | **10** |  |
|  | | | | | | |
| **Final Exam**  **40** | Final Exam Q#1 | *CLO1* | 10 | **25%** | **10** |  |
| Final Exam Q#2 | *CLO2* | 10 | **25%** | **10** |  |
| Final Exam Q#3 | *CLO3* | 20 | **50%** | **20** |  |
|  | **Total Final Exam %** | | | **100%** | **40** |  |
| **100** | **Total Marls** | | | | **100** |  |
| ***Note: Please make sure every CLO must be assessed at least 3 time.*** | | | | | | |

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| 1. **Weekly Plan** | | | | |
| **Week** | **Lecture No** | **Topic Covered** | **CLO** | **Assessment Tool** |
| 1 | 1 | Definition, purpose, and functions of an operating system (OS). | CLO-1 |  |
| 2 | Basic components of a computer system: CPU, memory, I/O devices, and storage. Overview of system architecture, including CPU, system buses, and memory. | CLO-1 |  |
| 3 | Types of OS structures: Monolithic, microkernel, and hybrid systems. Interaction of the OS with hardware, process, and memory management. | CLO-1 |  |
| 2 | 4 | Overview of essential OS services such as process management, memory management, and I/O control. The interaction between users and the OS through command-line interfaces and graphical user interfaces. | CLO-1 |  |
| 5 | Explanation of system calls as the interface between user programs and the OS. Different types of system calls: process control, file management, device management, and information maintenance. | CLO-1 |  |
| 6 | System services provided by the OS and the role of system programs in managing system operations. | CLO-1 |  |
| 3 | 7 | Definition and characteristics of a process in an operating system. Components of a process, including program counter, stack, and data sections. | CLO-1 |  |
| 8 | Role of the Process Control Block (PCB), multi-programming, and context switching in process management. | CLO-1 |  |
| 9 | Operations like process creation, scheduling, and termination. | CLO-1 |  |
| 4 | 10 | Process Scheduling, Types of Processes. | CLO-1 |  |
| 11 | Inter-process Communication | CLO-1 |  |
| 12 | Implementation of message passing | CLO-1 |  |
| 5 | 13 | Overview of Thread, Thread Structure and support | CLO-1 |  |
| 14 | Types of Threads, Benefits and Challenges | CLO-1 |  |
| 15 | Multithreading Models | CLO-1 |  |
| 6 | 16 | Process Scheduling & Optimization criteria | CLO-2 |  |
| 17 | Scheduling Algorithms | CLO-2 |  |
| 18 | Scheduling Algorithms (cont.), Algorithm evaluation | CLO-2 |  |
| **7** | 19 | Process Synchronization & The Critical-Section Problem | CLO-2 |  |
| 20 | Hardware Solution, Software Solution. Operating Solution of Synchronization: Semaphores, Classical Problems of Synchronization | CLO-2 |  |
| 21 | **Complex Computing Problem Assignment** | CLO-2/3 |  |
| **8** | Midterm Exam | | | |
| 9 | 22 | Introduction to Deadlock and its characterization, Resource Allocation Graph | CLO-2 |  |
| 23 | Methods for Handling Deadlocks, Deadlock Prevention | CLO-2 |  |
| 24 | Deadlock Avoidance, Banker’s Algorithm | CLO-2 |  |
| 10 | 25 | Memory Management Unit | CLO-3 |  |
| 26 | Memory Management Requirements | CLO-3 |  |
| 27 | Memory partitioning: Contiguous Memory Allocation | CLO-3 |  |
| 11 | 28 | Contiguous Memory Allocation: Placement Algorithms | CLO-3 |  |
| 29 | Non-Contiguous Memory Allocation: Paging and Segmentation | CLO-3 |  |
| 30 | Virtua Memory, Demand Paging | CLO-3 |  |
| 12 | 31 | Page Replacement and Thrashing | CLO-3 |  |
| 32 | Replacement Algorithms and Allocation of Frames | CLO-3 |  |
| 33 | Overview of Mass Storage Structure: Disk Structure | CLO-3 |  |
| 13 | 34 | Disk Scheduling Algorithms | CLO-3 |  |
| 35 | File System Interface: File Concept, Attributes, and Operations | CLO-3 |  |
| 36 | File Access Methods, File Allocation Methods | CLO-3 |  |
| 14 | 37 | File Directories and Structures | CLO-3 |  |
| 38 | I/O System: I/O Hardware, Polling, Interrupt | CLO-3 |  |
| 39 | DMA, Application I/O Interface, Kernel I/O Subsystem | CLO-3 |  |
| 15 | 40 | Transforming I/O Requests, Life Cycle of I/O Request | CLO-3 |  |
| 41 | Protection and Security | CLO-3 |  |
| 42 | Virtual Machines | CLO-3 |  |
| 16 | 43 | **Complex Computing Problem submission** | CLO-2/3 |  |
| 44 | **CLO-2/3** |  |
| 45 | Revision, Queries |  |  |
| **17** | **Final Exam** | | | |

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| 1. **IU Assessment / grading Policy** | **Instructor grading for course \*** |
| Quizzes 10-15%  Assignments 10-15%  Projects/Presentation/CCP 0-10%  Mid Semester Examination/ 20-30%  End Semester Examination 40-50% | 10  15  10  25  40 |

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| **IQRA University (IU)** | | |
| **Faculty of Engineering Sciences and Technology (FEST)** | | |
| **Computer Science Department (CS)** | | |
| **Course Code** | **Course Name** | **Credit Hr** |
| **CMC241-L** | Operating Systems Lab | **3+1** |

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| 1. **Basic Information** | | | |
| **Instructor** |  | **Designation** |  |
| **Prerequisite(s)** | CMC251-L | **Semester** | FALL-2024 |
| **Email** |  | **Phone** |  |
| **Office Hours** |  | **Office Location** |  |

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| 1. **Course Objective(s)** |
| This course introduces the essential concepts in the design and implementation of modern multiprogramming operating systems. Specific examples of such operating systems, the services provided, the way those services are implemented, and the underlying problems and solutions encountered in a multiprogramming computer system environment are covered. |

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| 1. **Course Contents** |
| 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. |

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| 1. **Course Learning Outcomes** | | | | | | |
| **CLOs** | **CLO Statement** | **BT Level** | **Mapping** | | | **% Weight** |
| **GAs** | **ACM KA** | **SGDs** |
| CLO1 | **Practice** Linux Shell and interact with OS Subsystems using Shell commands and Scripting also implement algorithms related to OS Subsystems | C3 | GA2 | #11  OS | 9 | 75% |
| CLO2 | **Discuss** the development of solutions using techniques practiced in operating system labs | A2 | GA6 | 25% |
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| ***Note: On successful completion of course GA1 (Academic Education) will automatically attain.*** | | | | | | |

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| 1. **Course Textbook / Reference Books and Supplementary Reading Material** | | | |
| **S No** | **Book Title** | **Author(s)** | **Edition/ publication year/publisher** |
|  | Operating Systems Concepts (T) | Abraham Silberschatz, Peter B. Galvin, and Greg Gagne | 10th Edition/2018/Wiley |
|  | Operating Systems Internals and Design Principles (R) | William Stallings | 9th Edition/2018/Pearson |
|  | Modern Operating Systems (R) | Andrew S. Tanenbaum | 4th Edition/2014/Pearson |

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| 1. **CLO Outcome Based Assessment (OBA)** | | | | | | |
| **Assessment Tool** | | **CLO Mapped** | **CLO Marks** | **% Weight** | **Total Marks** | **Assessment Date** |
| **Quizzes**  **0** | Quiz #1 | *CLO1* | 0 | 0% | 0 |  |
| Quiz #2 | *CLO2* | 0 | 0% | 0 |  |
| Quiz #3 | *CLO3* | 0 | 0% | 0 |  |
| **Total Quizzes %** | | | **100%** |  |  |
|  | | | | | | |
| **Lab Manual**  **20** | Lab Task #1 | *CLO1* | 10 | 50% | 10 |  |
| Lab Task #2 | *CLO2* | 10 | 50% | 10 |  |
|  |  |  |  | 0 |  |
|  |  | | | **100%** | 20 |  |
|  | | | | | | |
| **Midterm**  **25** | Midterm Q#1 | *CLO1* | 20 | 40% | 10 |  |
| Midterm Q#2 | *CLO2* | 5 | 60% | 15 |  |
|  | **Total Midterm %** | | | **100%** | **25** |  |
|  | | | | | | |
| **Project/OEL**  **15** | Project/OEL | *CLO1/2* | 15 | 100% | 15 |  |
|  | **Total Project /CCP %** | | | **100%** | **15** |  |
|  | | | | | | |
| **Final Exam**  **40** | Final Exam Q#1 | *CLO1* |  |  |  |  |
| Final Exam Q#2 | *CLO2* |  |  |  |  |
|  |  |  |  |  |  |
|  | **Total Final Exam %** | | | **100%** | **40** |  |
| **100** | **Total Marls** | | | | **100** |  |
| ***Note: Please make sure every CLO must be assessed at least 3 time.*** | | | | | | |

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| 1. **Weekly Plan** | | | | |
| **Week** | **Lecture No** | **Topic Covered** | **Cr. Hrs** | **CLO** |
| 1 | 1 | Introduction to UNIX/Linux Shell Environment | 3 | 1-2 |
| 2 | 2 | Understand and implement Variable, Special Variable and Arrays in Linux Shell | 3 | 1-2 |
| 3 | 3 | Understand and implement Operators in Linux Shell. | 3 | 1-2 |
| 4 | 4 | Understand and implement Decision making, Loop, and Shell function in Linux Shell. | 3 | 1-2 |
| 5 | 5 | Understand and implement shell substitution, Quoting mechanisms, I/O redirection and Man\_page Help in Linux. | 3 | 1-2 |
| 6 | 6 | To understand UNIX/Linux file management by creating, reading, editing and writing in file. | 3 | 1-2 |
| **7** | **7** | **Open Ended Lab** | 3 | 1-2 |
| **8** | Midterm Exam | | | |
| 9 | 9 | ***CPU Scheduling Algorithms****:* Simulation of FCFS, SJF, RR, Priority scheduling and multi-level queue algorithms, Calculation of Wait time, Turnaround time, Average Wait Time and Average Turnaround time. | 3 | 1-2 |
| 10 | 10 | ***Process Synchronization:*** Understanding and Simulating Producer Consumer Problem and Dinning Philosopher Problem. | 3 | 1-2 |
| 11 | 11 | ***Deadlock Management Techniques****:* Understanding and Implementing Bankers algorithm*,* | 3 | 1-2 |
| 12 | 12 | ***Memory Management Techniques:***Understanding the difference of MVT and MFT. Implementing MFT, MVT, Best fit, Worst fit and First fit Memory Management Techniques. | 3 | 1-2 |
| 13 | 13 | ***Memory Management Techniques using Paging:***Understanding the difference between physical address and logical address, Resolving page table.  **Page Replacement Algorithms:** Understanding and Implementing Page Replacement Algorithms(FIFO, LRU, LFU and OPT) | 3 | 1-2 |
| 14 | 14 | ***File Allocation Strategies****:* Understanding the difference of Indexed, Sequential and Linked File Allocation by implementing them. | 3 | 1-2 |
| 15 | 15 | Introduction to kernel development | 3 | 1-2 |
| 16 | 16 | **Open Ended Lab** | 3 | 1-2 |
| **17** | **Final Exam** | | | |

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| 1. **IU Assessment/grading Policy** | **Instructor grading for the course \*** |
| Lab Manual 10-20%  Projects/OEL/PBL 10-25%  Mid Semester Examination/ 20-30%  End Semester Examination 40-50% | 15  20  25  40 |

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| **IQRA University (IU)** | | |
| **Faculty of Engineering Sciences and Technology (FEST)** | | |
| **Computer Science Department (CS)** | | |
| **Course Code** | **Course Name** | **Credit Hr** |
| **CMC252** | Analysis of Algorithms | **3+0** |

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| 1. **Basic Information** | | | |
| **Instructor** |  | **Designation** |  |
| **Prerequisite(s)** | CMC251 | **Semester** |  |
| **Email** |  | **Phone** |  |
| **Consulting Hours** |  | **Office Location** |  |

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| 1. **Course Objective(s)** |
| The objective of this course is to study paradigms and approaches used to analyze and design algorithms and to appreciate the impact of algorithm design in practice. It also ensures that students understand how the worst-case time complexity of an algorithm is defined, how asymptotic notation is used to provide a rough classification of algorithms, how a number of algorithms for fundamental problems in computer science and engineering work and compare with one another, and how there are still some problems for which it is unknown whether there exist efficient algorithms, and how to design efficient algorithms. |

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| 1. **Course Contents** |
| 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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| 1. **Course Learning Outcomes** | | | | | | |
| **CLOs** | **CLO Statement** | **BT Level** | **Mapping** | | | **% Weight** |
| **GAs** | **ACM KA** | **SGDs** |
| CLO1 | **Understand** of the behavior and time and space complexity of simple algorithms using big O, Omega, and Theta notation | C2 | GA2 | #1  AL | 4 | 31% |
| CLO2 | **Analyze** problem class and investigate its solution via suitable algorithms | C4 | GA3 | 34% |
| CLO3 | **Design and Develop** strategies to solve a problem by mapping from similar ‘known’ problems | C6 | GA4 | 35% |
| ***Note: On successful completion of course GA1 (Academic Education) will automatically attain.*** | | | | | | |

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| 1. **Course Textbook / Reference Books and Supplementary Reading Material** | | | |
| **#** | **Book Title** | **Author(s)** | **Edition/ publication year/publisher** |
| 1. 1 | Introduction to Algorithms | Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein | 3rd Edition, 2009 |
| 1. 2 | Design and Analysis of Algorithms | J. Kleinberg and E. Tardos | 1st Edition /2006 |
| 1. 3 | Algorithms For Dummies | John Paul Mueller , Luca Massaron | 2nd Edition, 2022 |

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| 1. **CLO Outcome Based Assessment (OBA) Tentative** | | | | | | |
| **Assessment Tool** | | **CLO Mapped** | **CLO Marks** | **% Weight** | **Total Marks** | **Assessment Date** |
| **Quizzes**  **10** | Quiz #1 | CLO 1 | 3 | 30% | 3 | TBD |
| Quiz #2 | CLO 2 | 3 | 30% | 3 | TBD |
| Quiz #3 | CLO 3 | 4 | 40% | 4 | TBD |
| **Total Quizzes %** | | | **100%** | 10 |  |
|  | | | | | | |
| **Assignments**  **15** | Assignment #1 | CLO 1 | 5 | 33% | 5 | TBD |
| Assignment #2 | CLO 2 | 5 | 33% | 5 | TBD |
| Assignment #3 | CLO 3 | 5 | 33% | 5 | TBD |
|  | **Total Assignments %** | | | **100%** | 15 |  |
|  | | | | | | |
| **Midterm**  **25** | Midterm Q#1 | CLO 1 | 5 | 20% | **5** | TBD |
| Midterm Q#2 | CLO 1 | 5 | 20% | **5** | TBD |
| Midterm Q#3 | CLO 1 | 5 | 20% | **5** | TBD |
| Midterm Q#4 | CLO 2 | 5 | 20% | **5** | TBD |
| Midterm Q#5 | CLO 2 | 5 | 20% | **5** | TBD |
|  | **Total Midterm %** | | | **100%** | **25** |  |
|  | | | | | | |
| **Project/CCP**  **10** | Project/CCP | CLO3 | 10 | **100%** | **10** | **TBD** |
|  | **Total Project /CCP %** | | | **100%** |  |  |
|  | | | | | | |
| **Final Exam**  **40** | Final Q #1 | CLO1 | 8 | 20% | 8 | TBD |
| Final Q#2 | CLO2 | 8 | 20% | 8 | TBD |
| Final Q #3 | CLO2 | 8 | 20% | 8 | TBD |
| Final Q#4 | CLO3 | 8 | 20% | 8 | TBD |
| Final Q#5 | CLO3 | 8 | 20% | 8 | TBD |
|  | **Total Final Exam %** | | | **100%** |  |  |
| **100** | **Total Marks** | | | | **100** |  |
| ***Note: Please make sure every CLO must be assessed at least 3 time.*** | | | | | | |

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| 1. **Weekly Plan** | | | | |
| **Week** | **Lecture No** | **Topic Covered** | **CLO** | **Assessment Tool** |
| 1 | 1 | Introduction to Analysis of Algorithms, |  |  |
| 2 | Revision of Data structure, Growth of Function, |  |  |
| 3 | summation and its properties, related examples |  |  |
| 2 | 4 | Algorithm Complexity calculation for polynomial non-polynomial time solvable problems; |  |  |
| 5 | Calculating best case and worst case complexity of an Iterative Algorithm e.g. Insertion Sort. |  |  |
| 6 | Calculating complexity of a Recursive Algorithm e.g. Merge Sort |  |  |
| 3 | 7 | Asymptotic Notations and Basic Efficiency Classes, big theta, big O, and big Omega, |  |  |
| 8 | Lower bound and upper bound Some, related examples of lower and upper bounds sic |  |  |
| 9 | Efficiency Classes, big theta, big O, and big Omega, |  | **Q1** |
| 4 | 10 | Greedy Algorithms Coin Changing, |  |  |
| 11 | Huffman’s Algorithm, Interval Scheduling, Interval Partitioning, |  |  |
| 12 | Scheduling to minimize Lateness, Optimal Caching |  | **A1** |
| 5 | 13 | Divide and Conquer Problems, Matrix Multiplications, Examples and properties of summations; |  |  |
| 14 | Recurrence relations and recursive algorithms, construction of general recursive based algorithms, |  |  |
| 15 | analysis of recursive algorithms using the stack, analysis time and space complexity |  |  |
| 6 | 16 | Divide and Conquer Problems (continued) |  |  |
| 17 | Some related examples, factorial, Fibonacci series, construction of recursion tree; Quick Sort ; |  |  |
| 18 | Decision Tree, Radix Sort |  | **Q2** |
| **7** | 19 | Dynamic programming, Concept of overlapping sub-problem. |  |  |
| 20 | Weighted Interval Scheduling, Longest Common Sub-sequence, Maximum Subarray problem, |  |
| 21 | **Project / CCP Discussion and Group allocation** |  |
| **8** | **Midterm Exam** | | | |
| 9 | 22 | Dynamic Programming (contd). Floyd-Warshall’s algorithm for all pairs shortest path algorithms; |  |  |
| 23 | Weighted KnapSack Problem, Longest Common Sub sequence, |  |  |
| 24 | Bellman Ford, Distance Vector Algorithms |  | **A2** |
| 10 | 25 | Graph algorithms; Basic understanding the graph and trees, |  |  |
| 26 | Decrease and conquer based algorithms, construction of depth-first search and breadth-first search; |  |  |
| 27 | Space and time complexity analysis of depth-first search and breadth-first search, Matching in Bipartite graphs |  |  |
| 11 | 28 | Construction of heap tree, heap-sort algorithm; |  |  |
| 29 | Maintaining the heap property, max-heapify, |  |  |
| 30 | building heap, analysis of time and space |  | **Q3** |
| 12 | 31 | Topological sort, construction and time complexity; |  |  |
| 32 | Greedy algorithms: Minimum spanning trees MST, purpose and advantages of MST, |  |  |
| 33 | construction by using Prim’s and Kruskal's Algorithm, time and space analysis, MST construction by Prim’s algorithm; |  |  |
| 13 | 34 | Single source shortest path algorithm, |  |  |
| 35 | Dijkstra’s algorithm, space and time analysis, |  |  |
| 36 | Ford-Fulkerson Algorithm |  | **A3** |
| 14 | 37 | NP and Computational Intractability, |  |  |
| 38 | Sequencing, Partitioning, |  |  |
| 49 | Graph coloring, Numerical Problems, |  |  |
| 15 | 40 | Approximate Algorithms, Center Selection, |  |  |
| 41 | Vertex Cover, Set Cover problem |  |  |
| 42 | Local Search and Randomized Algorithms |  |  |
| 16 | 43 | **Project / CCP presentations and submissions.** |  |  |
| 44 |  |
| 45 |  |
| **17** | **Final Exam** | | | |

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| 1. **IU Assessment / grading Policy** | **Instructor grading for course \*** |
| Quizzes 10-15%  Assignments 10-15%  Projects/Presentation/CCP 0-10%  Mid Semester Examination/ 20-30%  End Semester Examination 40-50% | 10%  15%  10%  25%  40% |

## SEMESTER 5

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| **S.No** | **Course Code** | **Title** | **Cr.Hrs** |
| 1 | CMC331 | Database Systems | 3 + 0 |
| 2 | CMC331-L | Database Systems (Lab) | 0 + 1 |
| 3 | CSC354 | Compiler Construction | 2 + 0 |
| 4 | CSC354-L | Compiler Construction (Lab) | 0 + 1 |
| 5 | CMC362 | Information Security | 3 + 0 |
| 6 | CMC362-L | Information Security (Lab) | 0 + 1 |
| 7 | CMC371 | Software Engineering | 3 + 0 |
| 8 | CSEXXX | Domain Elective 1 | 3 + 0 |
|  |  |  | **14+3 (17)** |

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| **IQRA University (IU)** | | |
| **Faculty of Engineering Sciences and Technology (FEST)** | | |
| **Computer Science Department (CS)** | | |
| **Course Code** | **Course Name** | **Credit Hr** |
| **CMC331** | Database Systems | **3+1** |

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| 1. **Basic Information** | | | |
| **Instructor** |  | **Designation** |  |
| **Prerequisite(s)** | CMC241 | **Semester** |  |
| **Email** |  | **Phone** |  |
| **Consulting Hours** |  | **Office Location** |  |

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| 1. **Course Objective(s)** |
| 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 |

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| 1. **Course Contents** |
| 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. |

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| 1. **Course Learning Outcomes** | | | | | | |
| **CLOs** | **CLO Statement** | **BT Level** | **Mapping** | | | **% Weight** |
| **GAs** | **ACM KA** | **SGDs** |
| CLO1 | **Understand** fundamental database concepts. | C2 | GA2 | #8  IM | 4 | 31% |
| CLO2 | **Use** Structured Query Language (SQL) for database definition and manipulation in any DBMS | C3 | GA5 | 34% |
| CLO3 | **Analyze** conceptual, logical and physical database schemas using different data models. | C4 | GA3 | 35% |
| ***Note: On successful completion of course GA1 (Academic Education) will automatically attain.*** | | | | | | |

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| 1. **Course Textbook / Reference Books and Supplementary Reading Material** | | | |
| **#** | **Book Title** | **Author(s)** | **Edition/ publication year/publisher** |
| 1. 1 | Fundamentals of Database Management Systems | Mark L. Gillenson | 2nd Edition, 2023, John Wiley & Sons Inc |
| 1. 2 | Modern Database Management | Jeff Hoffer, Ramesh Venkataraman, and Heikki Topi | 13th edition , 2021 |

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| 1. **CLO Outcome Based Assessment (OBA) Tentative** | | | | | | |
| **Assessment Tool** | | **CLO Mapped** | **CLO Marks** | **% Weight** | **Total Marks** | **Assessment Date** |
| **Quizzes**  **10** | Quiz #1 | CLO 1 | 3 | 30% | 3 | TBD |
| Quiz #2 | CLO 2 | 3 | 30% | 3 | TBD |
| Quiz #3 | CLO 3 | 4 | 40% | 4 | TBD |
| **Total Quizzes %** | | | **100%** | 10 |  |
|  | | | | | | |
| **Assignments**  **15** | Assignment #1 | CLO 1 | 5 | 33% | 5 | TBD |
| Assignment #2 | CLO 2 | 5 | 33% | 5 | TBD |
| Assignment #3 | CLO 3 | 5 | 33% | 5 | TBD |
|  | **Total Assignments %** | | | **100%** | 15 |  |
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| **Midterm**  **25** | Midterm Q#1 | CLO 1 | 5 | 20% | **5** | TBD |
| Midterm Q#2 | CLO 1 | 5 | 20% | **5** | TBD |
| Midterm Q#3 | CLO 1 | 5 | 20% | **5** | TBD |
| Midterm Q#4 | CLO 2 | 5 | 20% | **5** | TBD |
| Midterm Q#5 | CLO 2 | 5 | 20% | **5** | TBD |
|  | **Total Midterm %** | | | **100%** | **25** |  |
|  | | | | | | |
| **Project/CCP**  **10** | Project/CCP | CLO3 | 10 | **100%** | **10** | **TBD** |
|  | **Total Project /CCP %** | | | **100%** |  |  |
|  | | | | | | |
| **Final Exam**  **40** | Final Q #1 | CLO1 | 8 | 20% | 8 | TBD |
| Final Q#2 | CLO2 | 8 | 20% | 8 | TBD |
| Final Q #3 | CLO2 | 8 | 20% | 8 | TBD |
| Final Q#4 | CLO3 | 8 | 20% | 8 | TBD |
| Final Q#5 | CLO3 | 8 | 20% | 8 | TBD |
|  | **Total Final Exam %** | | | **100%** |  |  |
| **100** | **Total Marks** | | | | **100** |  |
| ***Note: Please make sure every CLO must be assessed at least 3 time.*** | | | | | | |

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| 1. **Weekly Plan** | | | | |
| **Week** | **Lecture No** | **Topic Covered** | **CLO** | **Assessment Tool** |
| 1 | 1 | Introduction to Database: Basic Database concepts, Database applications, | 1 |  |
| 2 | Database approach vs. file-based system, DBMS, Components and Roles in DBMS Environment, | 1 |  |
| 3 | History of DB, Advantages and disadvantages, | 1 |  |
| 2 | 4 | Database Environment: Three level architecture, Data independence, | 1 |  |
| 5 | Database languages, Data Models, Network and Hierarchical models, Multi user DBMS Architectures, | 1 |  |
| 6 | Teleprocessing, File server and Client server architecture, DBMS Functions | 1 |  |
| 3 | 7 | The Relational Data Model: Relation, attributes, tuples, domains, | 3 |  |
| 8 | Relational schema, Relational database, | 3 |  |
| 9 | properties of relational data model, keys of relations, integrity constraints | 3 | **Q1** |
| 4 | 10 | Relational Algebra: Selection, Projection, | 1 |  |
| 11 | Cross-product, Set difference, Union, | 2 |  |
| 12 | Joins and Types, Aggregate & grouping operations, relational calculus | 2 | **A1** |
| 5 | 13 | Entity Relationship Model: Entity and types, Attributes and types, | 3 |  |
| 14 | Relationships and types, Keys, attributes on relationships, Entity vs. attributes, | 3 |  |
| 15 | Multiplicity, Cardinality, Participation, Entity relationship diagram (ERD) | 3 |  |
| 6 | 16 | Enhanced Entity Relationship Diagram (EERD): Superclass & subclass, generalization, | 3 |  |
| 17 | Normalization: Objective of normalization, | 3 |  |
| 18 | database anomalies, decomposition rules, | 3 | **Q2** |
| **7** | 19 | Functional dependencies and types, First Normal Form, | 3 |  |
| 20 | Second Normal Form, Third Normal Form, Boyce–Codd Normal Form (BCNF).. | 3 |
| 21 | **Project / CCP Discussion and Group allocation** | **1/2/3** |
| **8** | **Midterm Exam** | | | |
| 9 | 22 | Structured Query Language: History of SQL, SQL Commands, Literals, Data Manipulation Language, | 2 |  |
| 23 | Select, From, Where, Multiple conditions, IN, Distinct, Between, Like, Null, Ordering, | 2 |  |
| 24 | Aggregate function, group by, having, subquery, ANY & ALL | 2 | **A2** |
| 10 | 25 | SQL - Data Manipulation Language Advanced: Joins, Types of Join (Inner, Outer, Left, Right, Natural), | 2 |  |
| 26 | Computing a join, union, intersect and difference, | 2 |  |
| 27 | Insert, bulk insert, update, delete | 2 |  |
| 11 | 28 | SQL - Data Definition Language: MySQL data types, Create Table, Alter Table, Add and modify Constraints, Create View, View Resolution, View Materialization, updating Views | 2 |  |
| 29 | SQL – Data Control Language, Transaction Control Language: Create User, | 2 |  |
| 30 | Grant, Revoke, BEGIN, END Transaction, Roll back, Commit. | 2 | **Q3** |
| 12 | 31 | Transaction Management: ACID, Concurrency control, problems caused by concurrency, | 2 |  |
| 32 | Serializability, concurrency control techniques, Locking, Time stamping | 2 |  |
| 33 | Deadlock & its prevention, Recovery, Buffer management, Log file, Checkpoints | 2 |  |
| 13 | 34 | Indexes: Indexing, Heap and Table Scan, | 3 |  |
| 35 | Type of Indexes, Clustered & Non-Clustered, | 3 |  |
| 36 | Data Structure, B Tree, | 1 | **A3** |
| 14 | 37 | B+ Tree and Hash Table, Data Entry | 1 |  |
| 38 | Indexing in SQL, | 1 |  |
| 49 | Pros & Cons of Indexing, Choosing Column for Index | 3 |  |
| 15 | 40 | NoSQL: Document Oriented DB, Intro to MongoDB, | 1 |  |
| 41 | BSON, Schema design, Replication, Sharding, | 1 |  |
| 42 | Installation, CRUD, Create, Read, Update and Delete using NoSQL | **3** |  |
| 16 | 43 | **Project / CCP presentations and submissions.** | **1/2/ 3** |  |
| 44 |  |
| 45 |  |
| **17** | **Final Exam** | | | |

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| 1. **IU Assessment / grading Policy** | **Instructor grading for course \*** |
| Quizzes 10-15%  Assignments 10-15%  Projects/Presentation/CCP 0-10%  Mid Semester Examination/ 20-30%  End Semester Examination 40-50% | 10%  15%  10%  25%  40% |

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| **IQRA University (IU)** | | |
| **Faculty of Engineering Sciences and Technology (FEST)** | | |
| **Computer Science Department (CS)** | | |
| **Course Code** | **Course Name** | **Credit Hr** |
| **CMC331-L** | Database Systems Lab | **3+1** |

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| 1. **Basic Information** | | | |
| **Instructor** |  | **Designation** |  |
| **Prerequisite(s)** | CMC241-L | **Semester** |  |
| **Email** |  | **Phone** |  |
| **Consulting Hours** |  | **Office Location** |  |

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| 1. **Course Objective(s)** |
| 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 |

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| 1. **Course Contents** |
| 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. |

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| 1. **Course Learning Outcomes** | | | | | | |
| **CLOs** | **CLO Statement** | **BT Level** | **Mapping** | | | **% Weight** |
| **GAs** | **ACM KA** | **SGDs** |
| CLO1 | **Performs** queries as demonstrated. Follows instructions to build a model. | P3 | GA2 | #8  IM | 4 | 25% |
| CLO2 | **Analyze** conceptual, logical and physical database schemas using ERD and Identify functional dependencies to resolve database anomalies for normalized database tables. | C4 | GA3 | 25% |
| CLO3 | ***Participate*** in lab activities such as projects as an individual and as an effective team member utilizing the concepts of data structures to solve real-life problems. | A3 | GA6 | 50% |
| ***Note: On successful completion of course GA1 (Academic Education) will automatically attain.*** | | | | | | |

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| 1. **Course Textbook / Reference Books and Supplementary Reading Material** | | | |
| **S No** | **Book Title** | **Author(s)** | **Edition/ publication year/publisher** |
| 1. 1 | Fundamentals of Database Management Systems | Mark L. Gillenson | 2nd Edition, 2023, John Wiley & Sons Inc |
| 1. 2 | Modern Database Management | Jeff Hoffer, Ramesh Venkataraman, and Heikki Topi | 13th edition , 2021 |

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| 1. **CLO Outcome Based Assessment (OBA) Tentative** | | | | | | |
| **Assessment Tool** | | **CLO Mapped** | **CLO Marks** | **% Weight** | **Total Marks** | **Assessment Date** |
| **Quizzes**  **0** |  |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
| **Total Quizzes %** | | | **0** | 0 |  |
|  | | | | | | |
| **Lab Manual Task**  **15** | Lab task | **CLO 1/2/3** | 15 | **100%** | 15 | TBD |
| **Total Assignments %** | | | **100%** | **15** |  |
|  | | | | | | |
| **Midterm**  **25** | Midterm Q#1 | CLO 1 | 10 | 40% | 10 | TBD |
| Midterm Q#2 | CLO 1 | 10 | 40% | 10 | TBD |
| Midterm Q#3 | CLO 2 | 5 | 20% | 5 | TBD |
|  | **Total Midterm %** | | | **100%** | **25** |  |
|  | | | | | | |
| **Project/OEL**  **20** | Project/OEL | CLO 3 | 20 | 100% | 20 | TBD |
|  | **Total Project /CCP %** | | | **100%** | **20** |  |
|  | | | | | | |
| **Final Exam**  **40** | Final Exam Q#1 | CLO2 | 10 | 25% | 10 | TBD |
| Final Exam Q#2 | CLO2 | 10 | 25% | 10 | TBD |
| Final Exam Q#3 | CLO3 | 20 | 50% | 20 | TBD |
|  | **Total Final Exam %** | | | **100%** | **40** |  |
| **100** | **Total Marks** | | | | **100** |  |
| **Note: Please make sure every CLO must be assessed at least 3 time.** | | | | | | |

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| 1. **Weekly Plan** | | | | | | |
| **Week**  **No** | | **Lab No** | | **Lab Description** | **Contact**  **Hr** | **CLO** |
| 1 | | 1 | | Introduction to SQL Server and Database Creation | 3 | 1/2/3 |
| 2 | | 2 | | Entity-Relationship Diagram (ERD) Basics | 3 | 1/2/3 |
| 3 | | 3 | | Advanced ERD Design | 3 | 1/2/3 |
| 4 | | 4 | | Creating Tables and Constraints | 3 | 1/2/3 |
| 5 | | 5 | | Normalization (1NF and 2NF) | 3 | 1/2/3 |
| 6 | | 6 | | Normalization (3NF and BCNF) | 3 | 1/2/3 |
| 7 | |  | | **Open Ended Lab/ Project / PBL assignment** | 3 | 1/2/3 |
| 8 | | **Midterm Exam** | | | | |
| 9 | | 7 | | Basic CRUD Operations | | 3 | 1/2/3 |
| 10 | | 8 | | Aggregate Functions and Grouping | | 3 | 1/2/3 |
| 11 | | 9 | | Joins | | 3 | 1/2/3 |
| 12 | | 10 | | Subqueries and Nested Queries | | 3 | 1/2/3 |
| 13 | | 11 | | Stored Procedures and Triggers | | 3 | 1/2/3 |
| 14 | | 12 | | Indexing | | 3 | 1/2/3 |
| 15 | | 13 | | Transactions and Rollbacks | | 3 | 1/2/3 |
| 16 | | 14 | | **Open Ended Lab/Project / PBL Assessment** | 3 | 1/2/3 |
| 17 | | **Final Exam** | | | | |

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| 1. **IU Assessment / grading Policy** | **Instructor grading for course \*** |
| Quizzes 0-10%  Labs Task Assessment 10-20%  Projects/OEL/PBL 5-20%  Mid Semester Examination/ 20-30%  End Semester Examination 40-50% | 0  15%  20%  25%  40% |

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| **IQRA University (IU)** | | |
| **Faculty of Engineering Sciences and Technology (FEST)** | | |
| **Computer Science Department (CS)** | | |
| **Course Code** | **Course Name** | **Credit Hr** |
| **CSC 354** | Compiler Construction | **2+1** |

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| 1. **Basic Information** | | | |
| **Instructor** |  | **Designation** |  |
| **Prerequisite(s)** | CSC 252 | **Semester** | Fall 2024 |
| **Email** |  | **Phone** |  |
| **Office Hours** |  | **Office Location** |  |

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| 1. **Course Objective(s)** |
| This course provides a comprehensive understanding of the internal structure of compilers and interpreters, equipping students with the ability to implement a compiler or interpreter for a simple programming language. Participants will gain knowledge of frameworks, patterns, and data structures commonly used in the compilation process and develop the skills necessary to specify and design the components of a compiler or interpreter. Additionally, the course emphasizes collaborative programming, offering valuable experience in working effectively within a team environment. |

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| 1. **Course Contents** |
| The lectures give an overview of the structure and the functionality of a compiler for a programming language. The focus is on the analysis of languages including lexical analysis, parsing, and type checking using attributed grammars. Intermediate code generation, the runtime environment and code generation. The practical part of compiler construction comprises two units. In the first unit exercises based on the content of the lecture are given and have to be solved and presented by the students. In the second unit the students have to implement a compiler for a defined small programming language. The language used for implementation will be C, C++, Java or Visual Basic. |

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| 1. **Course Learning Outcomes** | | | | | | |
| **CLOs** | **CLO Statement** | **BT Level** | **Mapping** | | | **% Weight** |
| **GAs** | **ACM KA** | **SGDs** |
| CLO1 | **Explain** the basic techniques used in compiler construction such as lexical analysis. | C2 | GA2 | #14  PL | 4,9 | 33.3% |
| CLO2 | **Analyze** the basic data structures used in compiler construction such as abstract syntax trees, symbol  Tables, three-address code, and stack machines. | C4 | GA3 | 33.3% |
| CLO3 | **Design** and implement lexical and syntax analyzers by using various algorithms. | C5 | GA4 | 33.3% |
| ***Note: On successful completion of course GA1 (Academic Education) will automatically attain.*** | | | | | | |

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| 1. **Course Textbook / Reference Books and Supplementary Reading Material** | | | |
| **S No** | **Book Title** | **Author(s)** | **Edition/ publication year/publisher** |
|  | Compilers Principles, Techniques, and Tools | Alfred V. Aho, Ravi Sethi, Jeffrey D. Ullman | 2nd Edition, 2014, Pearson |
|  | Introduction to Compilers and Language Design, | Douglas Thain | 2nd Edition, 2020, Lulu Press, Inc |

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| 1. **CLO Outcome Based Assessment (OBA)** | | | | | | |
| **Assessment Tool** | | **CLO Mapped** | **CLO Marks** | **% Weight** | **Total Marks** | **Assessment Date** |
| **Quizzes**  **10** | Quiz #1 | *CLO1* | 2.5 | 25% | 2.5 | TBD |
| Quiz #2 | *CLO2* | 2.5 | 25% | 2.5 |  |
| Quiz #3 | *CLO3* | 5 | 50% | 5 |  |
| **Total Quizzes %** | | | **100%** | 10 |  |
|  | | | | | | |
| **Assignments**  **10** | Assignment #1 | *CLO1* | 5 | 33.33% | 5 |  |
| Assignment #2 | *CLO2* | 5 | 33.33% | 5 |  |
| Assignment #3 | *CLO3* | 5 | 33.33% | 5 |  |
|  |  | | | **100%** | 15 |  |
|  | | | | | | |
| **Midterm**  **25** | Midterm Q# | *CLO1* | 12 |  |  |  |
| Midterm Q# | *CLO2* | 13 |  |  |  |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
|  | **Total Midterm %** | | | **100%** | **25** |  |
|  | | | | | | |
| **Project/CCP**  **10** | Project/CCP | *CLO2/3* | 10 | **100%** | **10** |  |
|  | **Total Project /CCP %** | | | **100%** | **10** |  |
|  | | | | | | |
| **Final Exam**  **40** | Final Exam Q# | *CLO1/2/3* |  |  |  |  |
| Final Exam Q# | *CLO1/2/3* |  |  |  |  |
| …. | *CLO1/2/3* |  |  |  |  |
|  | Final Exam Qn | *CLO1/2/3* |  |  |  |  |
|  | **Total Final Exam %** | | | **100%** | **40** |  |
| **100** | **Total Marls** | | | | **100** |  |
| ***Note: Please make sure every CLO must be assessed at least 3 time.*** | | | | | | |

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| 1. **Weekly Plan** | | | | |
| **Week** | **Lecture No** | **Topic Covered** | **CLO** | **Assessment Tool** |
| 1 | 1 | Introduction to Compilers, Interpreters and Modern Compilers. | **1** |  |
| 2 | Analysis of Source Program and Phases of Compilers | **1** |  |
| 2 | 3 | Types of Compilers, Cross Compiler, Compiler-construction tools and Grouping the Compiler Phases. | **1** |  |
| 4 | Syntax Definition, Syntax-Directed Translation and Introduction of Parsing. | **1** |  |
| 3 | 5 | Symbol Table and Techniques. | **1** |  |
| 6 | Translator for Simple expressions. Lexical analysis | **1** | **Quiz 1** |
| 4 | 7 | Role of Lexical Analyzer, Input Buffering, Specifications of Tokens, and Recognition of Tokens. | **1** |  |
| 8 | Languages for Lexical Analyzer, Implementing of Regular Expressions. | **2** | **Assignment 1** |
| 5 | 9 | Finite Automata, Design of a Lexical Analyzer Generator. | **2** |  |
| 10 | Optimization of DFA-based Pattern Matchers. | **2** |  |
| 6 | 11 | Role of Parser, Context Free Grammars and Writing a Grammar, Ambiguity. | **1** |  |
| 12 | Recursive Descent Parser, Recursion. Bottom up Parsing. | **2** | **Quiz 2** |
| **7** | 13 | Shift Reduce Parsing, LR Parsers and Parser Generators. | **2** |  |
|  | 14 | **CCP Announcement and Discussion** | **2/3** |  |
| **8** | **Midterm Exam** | | | |
| 9 | 15 | Canonical Collection of Items, Operator Precedence Parsing. | **2** |  |
| 16 | LL(1), LR (0), CLR, SLR (1) parsers | **2** |  |
| 10 | 17 | Syntax-Directed Translators, Construction of Syntax Trees and Bottom-Up Evaluation of S-attributed Definitions. | **2** |  |
| 18 | L-attributed Definitions, Syntax Tree, Top-down Translation. | **2** | **Assignment 2** |
| 11 | 19 | Bottom-Up Evaluation, and Recursive Evaluators, Attriibute Grammars, Implementation of Small Lexical Analyzer. | **2** |  |
| 20 | Analysis of Space and Syntax-Directed Trees, Type Systems. | **2** |  |
| 12 | 21 | Data Structures Quadruple, Triples, Indirect Triples. Types of Declaration. | **3** |  |
| 22 | Specification of Simple Type Checkers, and Type Conversions. Storage Organization. | **3** | **Quiz 3** |
| 13 | 23 | Intermediate Code Generation, Intermediate Languages. | **3** |  |
| 24 | A simple Code Generator, Register Allocations. | **3** |  |
| 14 | 25 | Generating of Codes and Dynamic Programming for Code-Generation Algorithm. | **3** |  |
| 26 | Code-Generator Generators, Principle of Source Optimization. | **3** | **Assignment 3** |
| 15 | 27 | Optimization of Basic Blocks | **3** |  |
| 28 | Global Data Flow Analysis and Data Flow Equations. | **3** |  |
| 16 | 29 | **CCP Assessment and Submission** | **2/3** |  |
| 30 |  |  |
| **17** | **Final Exam** | | | |

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| 1. **IU Assessment / grading Policy** | **Instructor grading for course \*** |
| Quizzes 10-15%  Assignments 10-15%  Projects/Presentation/CCP 0-10%  Mid Semester Examination/ 20-30%  End Semester Examination 40-50% | 10%  15%  10%  25%  40% |

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| IQRA University (IU) | | |
| Faculty of Engineering Sciences and Technology (FEST) | | |
| Computer Science Department (CS) | | |
| Course Code | Course Name | Credit Hr |
| CSC354-L | Compiler Construction Lab | 2+1 |

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| 1. Basic Information | | | |
| Instructor |  | Designation |  |
| Prerequisite(s) | CSC 252-L | Semester | FALL-2024 |
| Email |  | Phone |  |
| Office Hours |  | Office Location |  |

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| 1. **Course Objective(s)** |
| This course provides a comprehensive understanding of the internal structure of compilers and interpreters, equipping students with the ability to implement a compiler or interpreter for a simple programming language. Participants will gain knowledge of frameworks, patterns, and data structures commonly used in the compilation process and develop the skills necessary to specify and design the components of a compiler or interpreter. Additionally, the course emphasizes collaborative programming, offering valuable experience in working effectively within a team environment. |

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| 1. **Course Contents** |
| The lectures give an overview of the structure and the functionality of a compiler for a programming language. The focus is on the analysis of languages including lexical analysis, parsing, and type checking using attributed grammars. Intermediate code generation, the runtime environment and code generation. The practical part of compiler construction comprises two units. In the first unit exercises based on the content of the lecture are given and have to be solved and presented by the students. In the second unit the students have to implement a compiler for a defined small programming language. The language used for implementation will be C, C++, Java or Visual Basic. |

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| 1. **Course Learning Outcomes** | | | | | | |
| **CLOs** | **CLO Statement** | **BT Level** | **Mapping** | | | **% Weight** |
| **GAs** | **ACM KA** | **SGDs** |
| CLO1 | Demonstrate the ability to construct and implement deterministic and non-deterministic finite automata, recursive descent parsing, and predictive parsing techniques using C/C++ and LEX. | P3 | GA2 | #14  OS | 4,9 | 75% |
| CLO2 | Analyze and implement advanced compiler design concepts, including SLR, LR parser table generation, code generation, and optimization using programming techniques. | A3 | GA6 | 25% |
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| ***Note: On successful completion of course GA1 (Academic Education) will automatically attain.*** | | | | | | |

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| 1. **Course Textbook / Reference Books and Supplementary Reading Material** | | | |
| **S No** | **Book Title** | **Author(s)** | **Edition/ publication year/publisher** |
|  | Compilers Principles, Techniques, and Tools | Alfred V. Aho, Ravi Sethi, Jeffrey D. Ullman | 2nd Edition, 2014, Pearson |
|  | Introduction to Compilers and Language Design, | Douglas Thain | 2nd Edition, 2020, Lulu Press, Inc |

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| 1. **CLO Outcome Based Assessment (OBA)** | | | | | | |
| **Assessment Tool** | | **CLO Mapped** | **CLO Marks** | **% Weight** | **Total Marks** | **Assessment Date** |
| **Quizzes**  **0** | Quiz #1 | *CLO1* | 0 | 0% | 0 |  |
| Quiz #2 | *CLO2* | 0 | 0% | 0 |  |
| Quiz #3 | *CLO3* | 0 | 0% | 0 |  |
| **Total Quizzes %** | | | **100%** |  |  |
|  | | | | | | |
| **Lab Manual**  **20** | Lab Task #1 | *CLO1* | 10 | 50% | 10 |  |
| Lab Task #2 | *CLO2* | 10 | 50% | 10 |  |
|  |  |  |  | 0 |  |
|  |  | | | **100%** | 20 |  |
|  | | | | | | |
| **Midterm**  **25** | Midterm Q#1 | *CLO1* | 20 | 40% | 10 |  |
| Midterm Q#2 | *CLO2* | 5 | 60% | 15 |  |
|  | **Total Midterm %** | | | **100%** | **25** |  |
|  | | | | | | |
| **Project/OEL**  **15** | Project/OEL | *CLO1/2* | 15 | 100% | 15 |  |
|  | **Total Project /CCP %** | | | **100%** | **15** |  |
|  | | | | | | |
| **Final Exam**  **40** | Final Exam Q#1 | *CLO1* |  |  |  |  |
| Final Exam Q#2 | *CLO2* |  |  |  |  |
|  |  |  |  |  |  |
|  | **Total Final Exam %** | | | **100%** | **40** |  |
| **100** | **Total Marls** | | | | **100** |  |
| ***Note: Please make sure every CLO must be assessed at least 3 time.*** | | | | | | |

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| 1. **Weekly Plan** | | | | |
| **Week** | **Lecture No** | **Topic Covered** | **Cr. Hrs** | **CLO** |
| 1 | 1 | Write a C/C++ program to construct DFA from NFA | 3 | 1-2 |
| 2 | 2 | Write a LEX program to implement standalone | 3 | 1-2 |
| 3 | 3 | Write a C/C++ program for construction of predictive parsing table | 3 | 1-2 |
| 4 | 4 | Write a C / C++ program for SLR parser table generation | 3 | 1-2 |
| 5 | 5 | Write a C/C++ program for implementing unification algorithm | 3 | 1-2 |
| 6 | 6 | Write a C/C++ program for LR Parser table generation | 3 | 1-2 |
| **7** | **7** | **Open Ended Lab** | 3 | 1-2 |
| **8** | Midterm Exam | | | |
| 9 | 9 | Write a C/C++ program on code generation | 3 | 1-2 |
| 10 | 10 | Write a C/C++ program on code optimization | 3 | 1-2 |
| 11 | 11 | Basic LEX Programs | 3 | 1-2 |
| 12 | 12 | Write a C/C++ program to implement recursive descent parsing | 3 | 1-2 |
| 13 | 13 | Write a C/C++ program to find FIRST and FOLLOW for the given grammar | 3 | 1-2 |
| 14 | 14 | Write a C/C++ program to find Parsing Table | 3 | 1-2 |
| 15 | 15 | Write a C/C++ program to Parse String using Parsing Table. | 3 | 1-2 |
| 16 | 16 | **Open Ended Lab** | 3 | 1-2 |
| **17** | **Final Exam** | | | |

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| 1. **IU Assessment/grading Policy** | **Instructor grading for the course \*** |
| Lab Manual 10-20%  Projects/OEL/PBL 10-25%  Mid Semester Examination/ 20-30%  End Semester Examination 40-50% | 15  20  25  40 |

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| **IQRA University (IU)** | | |
| **Faculty of Engineering Sciences and Technology (FEST)** | | |
| **Computer Science Department (CS)** | | |
| **Course Code** | **Course Name** | **Credit Hr** |
| **CMC 362** | Information Security | **3+1** |

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| 1. **Basic Information** | | | |
| **Instructor** | Ali Ahmad Siddiqui | **Designation** | Assistant Professor |
| **Prerequisite(s)** | CMC261 | **Semester** | Fall 2024 |
| **Email** | [alisiddiqui@iqra.edu.pk](mailto:alisiddiqui@iqra.edu.pk) | **Phone** | 021-38658861 ext. 9698 |
| **Office Hours** | Thurs (8:30 – 11:30) | **Office Location** | EDC 8th Floor Faculty Area |

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| 1. **Course Objective(s)** |
| 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. |

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| 1. **Course Contents** |
| 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. |

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| 1. **Course Learning Outcomes** | | | | | | |
| **CLOs** | **CLO Statement** | **BT Level** | **Mapping** | | | **% Weight** |
| **GAs** | **ACM KA** | **SGDs** |
| CLO1 | **Explain** the key concepts of Information Security that includes design principles, cryptography, risk management and ethics | C2 | GA2 | #7  IAS | 9 | - |
| CLO2 | **Analyze** appropriate techniques to tackle and solve problems in the discipline of information security | C4 | GA3 | - |
| CLO3 | **Design** security strategies using various tools and devices for achieving information security and privacy such as Network Firewall and VPN’s using IP Sec and SSL protocols | C6 | GA4 | - |
| ***Note: On successful completion of course GA 1 (Academic Education) will automatically attain.*** | | | | | | |

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| 1. **Course Textbook / Reference Books and Supplementary Reading Material** | | | |
| **S No** | **Book Title** | **Author(s)** | **Edition/ publication year/publisher** |
|  | Computer Security: Principles and Practice | William Stallings | 4th edition, 2019, Pearson |
|  | Principles of Information Security | M. Whitman and H. Mattord | 6th edition. 2018, Course Technology |
|  | Computer Security | Dieter Gollmann | 3rd edition, 2011, John Wiley & Sons |

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| 1. **CLO Outcome Based Assessment (OBA)** | | | | | | |
| **Assessment Tool** | | **CLO Mapped** | **CLO Marks** | **% Weight** | **Total Marks** | **Assessment Date** |
| **Quizzes**  **10** | Quiz #1 | *CLO1* | 3 | 30% | 3 | 14-11-2024 |
| Quiz #2 | *CLO2* | 3 | 30% | 3 |  |
| Quiz #3 | *CLO3* | 4 | 40% | 4 |  |
| **Total Quizzes %** | | | **100%** | 10 |  |
|  | | | | | | |
| **Assignments**  **15** | Assignment #1 | *CLO1* | 5 | 33.3% | 5 | 30-10-2024 |
| Assignment #2 | *CLO2* | 5 | 33.3% | 5 | 20-11-2024 |
| Assignment #3 | *CLO3* | 5 | 33.3% | 5 |  |
|  |  | | | **100%** | 15 |  |
|  | | | | | | |
| **Midterm**  **25** | Midterm Q#1 | *CLO1* | 6 | 24% | **6** | 27-11-2024 |
| Midterm Q#2 | *CLO2* | 7 | 28% | **7** |  |
|  | Midterm Q#3 | *CLO2* | 6 | 24% | **6** |  |
|  | Midterm Q#4 | *CLO3* | 6 | 24% | **6** |  |
|  | **Total Midterm %** | | | **100%** | **25** |  |
|  | | | | | | |
| **Project/CCP**  **10** | Project/CCP | *CLO3* | 10 |  |  |  |
|  | **Total Project /CCP %** | | | **100%** | **10** |  |
|  | | | | | | |
| **Final Exam**  **40** | Final Exam Q# | *CLO1/2/3* | 10 |  |  |  |
| Final Exam Q# | *CLO1/2/3* | 10 |  |  |  |
| …. | *CLO1/2/3* |  |  |  |  |
|  | Final Exam Qn | *CLO1/2/3* |  |  |  |  |
|  | **Total Final Exam %** | | | **100%** |  |  |
| **100** | **Total Marls** | | | | **100** |  |
| ***Note: Please make sure every CLO must be assessed at least 3 time.*** | | | | | | |

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| 1. **Weekly Plan** | | | | |
| **Week** | **Lecture No** | **Topic Covered** | **CLO** | **Assessment Tool** |
| 1 | 1 | Introduction to Information Security, Key Factors | **CLO/1/2/3** | **Quiz#, Mid, Final** |
| 2 | Types and Classes of attacks, Interruption, Interception, Modification, Fabrication | 1 |  |
| 3 | Active vs Passive Attacks, Brute force Attack, Numerical | 1 |  |
| 2 | 4 | Encryption, Types of Operation, Substitution/ Transposition cipher, Block vs Stream ciphers | 1 |  |
| 5 | Ceasor Cipher, Mono Alphabetic Cipher, Playfair Cipher | 1 |  |
| 6 | Rail Fence Cipher, Data Encryption Standard (DES) | 1 |  |
| 3 | 7 | Data Encryption Standard (DES) | 1 |  |
| 8 | Advanced Encryption Standard (AES) | 1 |  |
| 9 | Symmetric Key Algorithm and its Drawbacks | 2 |  |
| 4 | 10 | Public Key Cryptography, Asymmetric Key Algorithm | 2 |  |
| 11 | Applications of Public Key Algorithms | 2 |  |
| 12 | Mathematics in Cryptography, Trapdoor Function | 2 |  |
| 5 | 13 | RSA Algorithm, Numerical | 2 |  |
| 14 | Diffie Hellman Key Exchange | 2 |  |
| 15 | Data Integrity, MD5 and SHA Hash Algorithm | 2 |  |
| 6 | 16 | Application of Hash Algorithm (Password Storage) | 2 |  |
| 17 | Digital Signature, Email Security Pretty Good Privacy (PGP) | 2 |  |
| 18 | Web Security, Secure Socket Layer (SSL) | 2 |  |
| 7 | 19 | How SSL/TLS works, Certificate Signing Request (CSR), Self-Signed Certificate | 3 |  |
|  | 20 | Project/CCP | 3 |  |
|  | 21 | Project/CCP | 3 |  |
| **8** | **Midterm Exam** | | | |
| 9 | 22 | Private/Public IP address, NAT/PAT | 3 |  |
| 23 | Firewall Basics, Security zones | 3 |  |
| 24 | Stateless vs Stateful Firewall, Basic rules of the Firewall | 3 |  |
| 10 | 25 | Cisco ASA Firewall configuration, Configuring NAT/PAT | 3 |  |
| 26 | Access Control Lists (ACL) | 3 |  |
| 27 | DDoS/SYN Attack and Prevention | 3 |  |
| 11 | 28 | Application Layer Inspection | 3 |  |
| 29 | IP Security | 3 |  |
| 30 | Virtual Private Networks – VPN , Encapsulation | 3 |  |
| 12 | 31 | Types and Application of VPN | 2 |  |
| 32 | Authentication methods, AAA Authentication | 2 |  |
| 33 | RADIUS Server | 2 |  |
| 13 | 34 | Intrusion Prevention and Detection System IPS/IDS, Classes of Intruders | 3 |  |
| 35 | Network vs Host based IPDS, Detection methods | 3 |  |
| 36 | Signature vs Anomaly based IPDS and their drawbacks | 3 |  |
| 14 | 37 | Availability of Data (Fault Tolerance by implementing RAID) | 2 |  |
| 38 | Disaster Recovery and Backup Strategies | 2 |  |
| 39 | Malicious Software, Spam, Virus | 2 |  |
| 15 | 40 | Backdoor, Hoaxes, Password Crack, Trojan, Zombie | 2 |  |
| 41 | Threat, Attack, Vulnerability, Risk, Spoofing, Man in the Middle | 2 |  |
| 42 | Risk Assessment, Cyber crime | 2 |  |
| 16 | 43 | Law and Ethics in Information Security | 2 |  |
| 44 | Project/CCP Assessment | 3 |  |
| 45 | Project/CCP Assessment | 3 |  |
| **17** | **Final Exam** | | | |

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| 1. **IU Assessment / grading Policy** | **Instructor grading for course \*** |
| Quizzes 10-15%  Assignments 10-15%  Projects/Presentation/CCP 0-10%  Mid Semester Examination/ 20-30%  End Semester Examination 40-50% | 10%  15%  10%  25%  40% |

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| **IQRA University (IU)** | | |
| **Faculty of Engineering Sciences and Technology (FEST)** | | |
| **Computer Science Department (CS)** | | |
| **Course Code** | **Course Name** | **Credit Hr** |
| **CMC 362-L** | Information Security Lab | **3+1** |

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| 1. **Basic Information** | | | |
| **Instructor** | Ali Ahmad Siddiqui | **Designation** | Assistant Professor |
| **Prerequisite(s)** | CMC261-L | **Semester** | Fall 2024 |
| **Email** | [alisiddiqui@iqra.edu.pk](mailto:alisiddiqui@iqra.edu.pk) | **Phone** | 021-38658861 ext. 9698 |
| **Consulting Hours** | Mon (8:30 – 10:30) | **Office Location** | EDC 8th Floor Faculty Area |

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| 1. **Course Objective(s)** |
| The course aims to equip students with the practical skills needed to perform security measures against the threats and vulnerabilities. Students will also study and learn to install and configure different security devices in this course |

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| 1. **Course Contents** |
| Implementation of Encryption algorithms, DES, RSA. Data Integrity, Hash function, Web security, Email Security, Sniffers, Port monitoring, Firewall, ACL, IPS/IDS, Honey Pot. |

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| 1. **Course Learning Outcomes** | | | | | | |
| **CLOs** | **CLO Statement** | **BT Level** | **Mapping** | | | **% Weight** |
| **GAs** | **ACM KA** | **SGDs** |
| CLO1 | **Apply** the concepts of security measures taken against threats and vulnerabilities in a network | P1 | GA2 | #7  IAS | 9 | NA |
| CLO2 | **Practice** problem-solving and network monitoring skills by configuring and testing security devices | A2 | GA6 | NA |
| CLO3 | **Analyze** and optimize the performance of network by implementing security solutions both hardware and software | C4 | GA4 | NA |
| ***Note: On successful completion of course GA 1 (Academic Education) will automatically attain.*** | | | | | | |

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| 1. **Course Textbook / Reference Books and Supplementary Reading Material** | | | |
| **S No** | **Book Title** | **Author(s)** | **Edition/ publication year/publisher** |
|  | Computer Security: Principles and Practice | William Stallings | 4th edition, 2019, Pearson |
|  | Principles of Information Security | M. Whitman and H. Mattord | 6th edition. 2018, Course Technology |
|  | Computer Security | Dieter Gollmann | 3rd edition, 2011, John Wiley & Sons |

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| 1. **CLO Outcome Based Assessment (OBA) - Tentative** | | | | | | |
| **Assessment Tool** | | **CLO Mapped** | **CLO Marks** | **% Weight** | **Total Marks** | **Assessment Date** |
| **Quizzes** | Quiz #1 |  |  |  |  | TBD |
| Quiz #2 |  |  |  |  |  |
|  |  |  |  |  |  |
| **Total Quizzes %** | | | **0%** |  |  |
|  | | | | | | |
| **Lab Manual**  **Tasks**  **20** | Lab Tasks | *CLO1/2/3* | 20 | **100** |  |  |
|  |
|  |
|  |  | | | **100%** | 20 |  |
|  | | | | | | |
| **Midterm**  **25** | Midterm Q# | *CLO1/2/3* | 20 |  |  |  |
| Midterm Q# | *CLO1/2/3* | 5 |  |  |  |
|  | …. | *CLO1/2/3* |  |  |  |  |
|  | Midterm Qn | *CLO1/2/3* |  |  |  |  |
|  | **Total Midterm %** | | | **100%** | **25** |  |
|  | | | | | | |
| **Project/OEL**  **15** | Project/CCP | *CLO1/2/3* | 15 |  |  |  |
|  | **Total Project /CCP %** | | | **100%** |  |  |
|  | | | | | | |
| **Final Exam**  **40** | Final Exam Q# | *CLO1/2/3* | 10 |  |  |  |
| Final Exam Q# | *CLO1/2/3* | 10 |  |  |  |
| …. | *CLO1/2/3* |  |  |  |  |
|  | Final Exam Qn | *CLO1/2/3* |  |  |  |  |
|  | **Total Final Exam %** | | | **100%** |  |  |
| **100** | **Total Marls** | | | | **100** |  |
| ***Note: Please make sure every CLO must be assessed at least 3 time.*** | | | | | | |

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| 1. **Weekly Plan** | | | | |
| **Week**  **No** | **Lab No** | **Lab Description** | **Contact**  **Hr** | **CLO** |
| 1 | 1 | Implementation of Ceasor cipher in C/C++ Language | 3 | 1,2,3 |
| 2 | 2 | Implementation of Playfair Substitution technique in C/C++ | 3 | 1,2,3 |
| 3 | 3 | Implementation of RSA Algorithm in C/C++ | 3 | 1,2,3 |
| 4 | 4 | Implementation of DES Algorithm using a third party Software | 3 | 1,2,3 |
| 5 | 5 | Finding Hash and Verify Data Integrity of a file using SHA256 | 3 | 1,2,3 |
| 6 | 6 | Steps to ensure security of a web browser | 3 | 1,2,3 |
| 7 |  | **Open Ended Lab/Project Assigned** | 3 | 1,2,3 |
| 8 | **Midterm Exam** | | | |
| 9 | 7 | Configuring S/MIME for email communication | 3 | 1,2,3 |
| 10 | 8 | Working with Sniffers Wireshark and Snort for monitoring network communication | 3 | 1,2,3 |
| 11 | 9 | Implementing and configuring NMAP for port monitoring | 3 | 1,2,3 |
| 12 | 10 | Firewall Basic, configuring firewall for Internet Access | 3 | 1,2,3 |
| 13 | 11 | Configuring security policies/ACLs on the firewall | 3 | 1,2,3 |
| 14 | 12 | Study Intrusion Detection Systems and Honey Pots | 3 | 1,2,3 |
| 15 | 13 | Analysis of Security Vulnerabilities of E-commerce services | 3 | 1,2,3 |
| 16 |  | **Open Ended Lab/Project Assessment** | 3 | 1,2,3 |
| 17 | **Final Exam** | | | |

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| 1. **IU Assessment / grading Policy** | **Instructor grading for course \*** |
| Quizzes 0-10%  Labs Task Assessment 10-20%  Projects/OEL/PBL 5-20%  Mid Semester Examination/ 20-30%  End Semester Examination 40-50% | 0  20  15  25  40 |

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| **IQRA University (IU)** | | |
| **Faculty of Engineering Sciences and Technology (FEST)** | | |
| **Computer Science Department (CS)** | | |
| **Course Code** | **Course Name** | **Credit Hr** |
| **CMC371** | Software Engineering | **3+0** |

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| 1. **Basic Information** | | | |
| **Instructor** | Saira Khurram Arbab | **Designation** | Senior Lecturer |
| **Prerequisite(s)** | CMC252 | **Semester** | Fall 2024 |
| **Email** | [sairarbab@iqra.edu.pk](mailto:sairarbab@iqra.edu.pk) | **Phone** | 111-264-264 |
| **Office Hours** | 8:30 to 4:30 (Mon to Fri) | **Office Location** | Faculty Room, 5th Floor |

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| 1. **Course Objective(s)** |
| The course in Software Engineering aims to provide students with a solid foundation in fundamental concepts and practices essential for software development. Students will learn various software development methodologies, including agile approaches, and gain proficiency in requirements engineering, software design, testing techniques, and project management. Emphasis will be placed on cultivating skills for eliciting, analyzing, and managing software requirements, designing modular and maintainable software systems, and implementing effective testing strategies to ensure quality and reliability. Additionally, the course will promote collaboration and teamwork through group projects, encourage awareness of emerging technologies and trends, and instill ethical and professional values in software engineering practices. By the end of the course, students will be equipped with the knowledge and skills necessary to develop high-quality software solutions while adhering to ethical standards and professional best practices. |

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| 1. **Course Contents** |
| 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, UML Diagrams, Design Patterns, Software Testing and Quality Assurance, Software Evolution, Project Management and Project Planning, Software Process Improvement |

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| 1. **Course Learning Outcomes** | | | | | | |
| **CLOs** | **CLO Statement** | **BT Level** | **Mapping** | | | **% Weight** |
| **GAs** | **ACM KA** | **SGDs** |
| CLO1 | ***Discuss*** various software engineering processes, key principles, and common methods for software project management, such as scheduling, size estimation, cost estimation, and risk analysis and the significance of professional and ethical practices in software development. | C2 | GA2 | #16  SE | 4 | 63% |
| CLO2 | ***Apply*** the system modeling techniques to model a medium size software system | C3 | GA2 | 23% |
| CLO3 | ***Analyze*** software quality assurance and testing principles for a medium size software system. | C4 | GA3 | 14% |
| *Note: On successful completion of course GA 1 (Academic Education) will automatically attain.* | | | | | | |

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| 1. **Course Textbook / Reference Books and Supplementary Reading Material** | | | |
| **S No** | **Book Title** | **Author(s)** | **Edition/ publication year/publisher** |
|  | Software Engineering | Ian Sommerville | 10th Edition, Pearson Inc.(2021) |
|  | Software Engineering, A Practitioner’s Approach | Roger S. Pressman and Bruce R. Maxim. | 9th Edition, McGraw-Hill  (2020) |

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| 1. **CLO Outcome Based Assessment (OBA)** | | | | | | |
| **Assessment Tool** | | **CLO Mapped** | **CLO Marks** | **% Weight** | **Total Marks** | **Assessment Date** |
| **Quizzes**  **15** | Quiz #1 | *CLO1* | 10 | 30% | 5 | TBD |
| Quiz #2 | *CLO2* | 10 | 30% | 5 |  |
| Quiz #3 | *CLO3* | 10 | 40% | 5 |  |
| **Total Quizzes %** | | | **100%** | 15 |  |
|  | | | | | | |
| **Assignments**  **10** | Assignment #1 | *CLO1* | 10 | 30% | 3 |  |
| Assignment #2 | *CLO2* | 10 | 30% | 3 |  |
| Assignment #3 | *CLO3* | 10 | 40% | 4 |  |
|  | **Total Assignment %** | | | **100%** | 10 |  |
|  | | | | | | |
| **Midterm**  **25** | Midterm Q#1, 2, 3 , 4 | *CLO1* | 20 |  |  |  |
| Midterm Q#5 | *CLO2* | 5 |  |  |  |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
|  | **Total Midterm %** | | | **100%** | **25** |  |
|  | | | | | | |
| **Project**  **10** | Project/CCP | *CLO1* | 5 |  |  |  |
|  | Project/CCP | *CLO2* | 5 |  |  |  |
|  | **Total Project** | | | **100%** |  |  |
|  | | | | | | |
| **Final Exam**  **40** | Final Exam Q# 1 , 2 | *CLO1* |  |  | **30** |  |
| Final Exam Q# 3 | *CLO2* |  |  | **5** |  |
| Final Exam Q# 3 | *CLO3* |  |  | **5** |  |
|  |  |  |  |  |  |  |
|  | **Total Final Exam %** | | | **100%** |  |  |
| **100** | **Total Marls** | | | | **100** |  |
| ***Note: Please make sure every CLO must be assessed at least 3 time.*** | | | | | | |

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| 1. **Weekly Plan** | | | | |
| **Week** | **Lecture No** | **Topic Covered** | **CLO** | **Assessment Tool** |
| 1 | 1 | Software, Software Engineering, Professional software development, Software engineering ethics. | CLO1 | Quiz1, Mid, Final |
| 2 | A brief introduction to ethical issues that affect software engineering. | CLO1 | Mid, Final |
| 3 | Case studies | CLO1 | - |
| 2 | 4 | What is a Feasibility Study? Why Feasibility Study? | CLO1 | Assignment1, Mid, Final |
| 5 | Decision before feasibility and Confusion over scope, Feasibility Study Techniques | CLO1 | Mid, Final |
| 6 | Examples, Software Constraints | CLO1 | Mid, Final |
| 3 | 7 | Software process models, Process activities, Software development life cycle, Coping with change | CLO1 | Mid, Final |
| 8 | Sequence of processes, Examples of Software development | CLO1 | Mid, Final |
| 9 | Process improvement, Practice Examples | CLO1 | Mid, Final |
| 4 | 10 | Agile software Development, Agile process models | CLO1 | Mid, Final |
| 11 | Agile development techniques, Agile Principles and Core Values | CLO1 | Mid |
| 12 | Scrum & Extreme Programming (XP) | CLO1 | Mid, Final |
| 5 | 13 | What is requirements engineering, Requirement Engineering Steps, Requirement Gathering, Requirements Analysis and its steps | CLO1 | Mid, Final |
| 14 | Functional and Non-Functional Requirements | CLO1 | Mid, Final |
| 15 | Requirements Specification – SRS Document -Examples | CLO1 | Mid, Final |
| 6 | 16 | What is a Scenario? How is it described and developed? | CLO2 | Assignment2, Mid |
| 17 | Scenario Modelling (Use case diagram) | CLO2 | Assignment, Mid |
| 18 | Project management concept, the management spectrum, 4 P’s of process management, Managing people, Teamwork, Examples, The W5HH, 4 P’s of process management, Managing people, | CLO2 | **-** |
| 7 | 19 | Project/CCP Discussion |  |  |
|  | 20 |  |  |
|  | 21 |  |  |
| **8** | **Midterm Exam** | | | |
| 9 | 22 | Overview of risk management principles, processes, and methodologies, Methods for analyzing and assessing identified risks, including qualitative and quantitative risk analysis techniques. | CLO1 | Final |
| 23 | Strategies for prioritizing risks based on their potential impact and likelihood of occurrence | CLO1 | Final |
| 24 | Class Activity | CLO1 | **-** |
| 10 | 25 | Introduction to context diagrams, Importance and benefits of context diagrams in system modeling | CLO2 | Quiz2, Final |
| 26 | Elements of a context diagram, Guidelines for creating clear and effective context diagrams | CLO2 | Final |
| 27 | Practice with context diagram – Class Activity | CLO2 | **-** |
| 11 | 28 | Usability & user interface, what is meant by User Interface (UI) and User Experience (UX)? | CLO1 | Final |
| 29 | Mental Model Vs Computer Model, User Interface Principles, Model View Controller Model View Controller | CLO1 | Final |
| 30 | Websites Analysis – Class Activity | CLO1 | Final |
| 12 | 31 | UI for mobile and web, Computer System & Networks, | CLO1 | Final |
| 32 | User Interface Designs | CLO1 | Final |
| 33 | Class Activity | CLO1 | **-** |
| 13 | 34 | System Architecture, System Design, Design patterns, | CLO1 | Final |
| 35 | Design Implementation and issues, Examples | CLO1 | Final |
| 36 | Case Study | CLO1 | **-** |
| 14 | 37 | Fundamentals of software testing, testing levels (unit testing, integration testing, system testing), | CLO3 | Assignment 3, Final |
| 38 | Testing techniques and strategies | CLO3 | Final |
| 49 | Scenario Practice Examples | CLO3 | **-** |
| 15 | 40 | Principles of software quality assurance, Quality attributes and metrics, Quality assurance techniques and tools, | CLO3 | Final |
| 41 | Continuous integration and deployment | CLO3 | Quiz 3, Final |
| 42 | Case Study | CLO3 | - |
| 16 | 43 | Project Submission | CLO1 &2 | **-** |
| 44 | Project Submission | CLO1 &2 | **-** |
| 45 | Revision | CLO1,2 & 3 | **-** |
| **17** | **Final Exam** | | | |

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| 1. **IU Assessment / grading Policy** | **Instructor grading for course \*** |
| Quizzes 10-15%  Assignments 10-15%  Projects/Presentation/CCP 0-10%  Mid Semester Examination/ 20-30%  End Semester Examination 40-50% | Quizzes 15%  Assignments 10%  Projects 10%  Mid Semester Examination/ 25%  End Semester Examination 40% |

## SEMESTER 6

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| **S.No** | **Course Code** | **Title** | **Cr.Hrs** |
| 1 | CSC332 | Advance Database Management Systems | 2 + 0 |
| 2 | CSC332-L | Advance Database Management Systems (Lab) | 0 + 1 |
| 3 | CMC381 | Artificial Intelligence | 3 + 0 |
| 4 | CMC381-L | Artificial Intelligence (Lab) | 0 + 1 |
| 5 | CSC382 | HCI & Computer Graphics | 2 + 0 |
| 6 | CSC382-L | HCI & Computer Graphics (Lab) | 0 + 1 |
| 7 | CSEXXX | Domain Elective 2 | 2 + 1 |
| 8 | ESCXXX | Social Science II | 3 + 0 |
|  |  |  | **12+4 (16)** |

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| **IQRA University (IU)** | | |
| **Faculty of Engineering Sciences and Technology (FEST)** | | |
| **Computer Science Department (CS)** | | |
| **Course Code** | **Course Name** | **Credit Hr** |
| **CSC332** | Advance Database Management Systems | **2+1** |

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| 1. **Basic Information** | | | |
| **Instructor** |  | **Designation** |  |
| **Prerequisite(s)** | CMC331 | **Semester** |  |
| **Email** |  | **Phone** |  |
| **Consulting Hours** |  | **Office Location** |  |

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| 1. **Course Objective(s)** |
| 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. |

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| 1. **Course Contents** |
| 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) |

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| 1. **Course Learning Outcomes** | | | | | | |
| **CLOs** | **CLO Statement** | **BT Level** | **Mapping** | | | **% Weight** |
| **GAs** | **ACM KA** | **SGDs** |
| CLO1 | **Understanding** advance data models, technologies and approaches for building distributed database systems. | C2 | GA2 | #8  IM | 4 | 31% |
| CLO2 | **Applying** the models and approaches in order to become enabled to select and apply appropriate methods for a particular case | C3 | GA3 | 34% |
| CLO3 | **Investigate** a database solution for a given scenario/ challenging problem in the domain of database systems. | C4 | GA5 | 35% |
| ***Note: On successful completion of course GA1 (Academic Education) will automatically attain.*** | | | | | | |

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| 1. **Course Textbook / Reference Books and Supplementary Reading Material** | | | |
| **#** | **Book Title** | **Author(s)** | **Edition/ publication year/publisher** |
| 1. 1 | Fundamentals of Database Systems | Ramez Elmasri and Shamkant B. Navathe | 7th Edition, 2015 , Pearson |
| 1. 2 | Distributed Systems: Principles and Paradigms | Andrew S. Tanenbaum and Maarten Van Steen | 2nd Edition 2016 |

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| 1. **CLO Outcome Based Assessment (OBA) Tentative** | | | | | | |
| **Assessment Tool** | | **CLO Mapped** | **CLO Marks** | **% Weight** | **Total Marks** | **Assessment Date** |
| **Quizzes**  **10** | Quiz #1 | CLO 1 | 3 | 30% | 3 | TBD |
| Quiz #2 | CLO 2 | 3 | 30% | 3 | TBD |
| Quiz #3 | CLO 3 | 4 | 40% | 4 | TBD |
| **Total Quizzes %** | | | **100%** | 10 |  |
|  | | | | | | |
| **Assignments**  **15** | Assignment #1 | CLO 1 | 5 | 33% | 5 | TBD |
| Assignment #2 | CLO 2 | 5 | 33% | 5 | TBD |
| Assignment #3 | CLO 3 | 5 | 33% | 5 | TBD |
|  | **Total Assignments %** | | | **100%** | 15 |  |
|  | | | | | | |
| **Midterm**  **25** | Midterm Q#1 | CLO 1 | 5 | 20% | **5** | TBD |
| Midterm Q#2 | CLO 1 | 5 | 20% | **5** | TBD |
| Midterm Q#3 | CLO 1 | 5 | 20% | **5** | TBD |
| Midterm Q#4 | CLO 2 | 5 | 20% | **5** | TBD |
| Midterm Q#5 | CLO 2 | 5 | 20% | **5** | TBD |
|  | **Total Midterm %** | | | **100%** | **25** |  |
|  | | | | | | |
| **Project/CCP**  **10** | Project/CCP | CLO3 | 10 | **100%** | **10** | **TBD** |
|  | **Total Project /CCP %** | | | **100%** |  |  |
|  | | | | | | |
| **Final Exam**  **40** | Final Q #1 | CLO1 | 8 | 20% | 8 | TBD |
| Final Q#2 | CLO2 | 8 | 20% | 8 | TBD |
| Final Q #3 | CLO2 | 8 | 20% | 8 | TBD |
| Final Q#4 | CLO3 | 8 | 20% | 8 | TBD |
| Final Q#5 | CLO3 | 8 | 20% | 8 | TBD |
|  | **Total Final Exam %** | | | **100%** |  |  |
| **100** | **Total Marks** | | | | **100** |  |
| ***Note: Please make sure every CLO must be assessed at least 3 time.*** | | | | | | |

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| 1. **Weekly Plan** | | | | |
| **Week** | **Lecture No** | **Topic Covered** | **CLO** | **Assessment Tool** |
| 1 | 1 | **Week 1: Introduction to Advanced Data Models**  Overview of database systems, advanced data models | 1 |  |
| 2 | Object-relational databases (features, advantages, use cases) | 1 |  |
| 3 | Object-oriented databases (concepts, design, and examples) | 1 |  |
| 2 | 4 | **Week 2: File Organization Concepts**  Fundamentals of file organization (heap, sorted files) | 1 |  |
| 5 | Hashing and clustering methods | 1 |  |
| 6 | Indexing: Primary, secondary, and multi-level indexes | 1 |  |
| 3 | 7 | **Week 3: Transaction Processing and Concurrency Control**  ACID properties and transaction lifecycle | 3 |  |
| 8 | Concurrency control techniques: Locking and timestamping | 3 |  |
| 9 | Multiversion concurrency control and practical applications | 3 | **Q1** |
| 4 | 10 | **Week 4: Recovery Techniques**  Recovery concepts and log-based recovery | 1 |  |
| 11 | Shadow paging and checkpointing | 2 |  |
| 12 | Practical implementation of recovery mechanisms | 2 | **A1** |
| 5 | 13 | **Week 5: Query Processing and Optimization**  Query execution process | 3 |  |
| 14 | Heuristic and cost-based optimization techniques | 3 |  |
| 15 | Execution plans and practical examples | 3 |  |
| 6 | 16 | **Week 6: Database Programming with PL/SQL and T-SQL**  Introduction to procedural SQL: Syntax and structures | 3 |  |
| 17 | Writing and using cursors, triggers, and stored procedures | 3 |  |
| 18 | Error handling and debugging in PL/SQL or T-SQL | 3 | **Q2** |
| **7** | 19 | Review of Weeks 1–6 concepts and hands-on activities | **1/2/3** |  |
| 20 | Review of Weeks 1–6 concepts and hands-on activities | **1/2/3** |
| 21 | **Project / CCP Discussion and Group allocation** | **1/2/3** |
| **8** | **Midterm Exam** | | | |
| 9 | 22 | **Week 9: Integrity and Security in Databases**  Integrity constraints: Keys, checks, and domain constraints | 2 |  |
| 23 | Security mechanisms: Authentication, authorization, and encryption | 2 |  |
| 24 | Configuring security policies in a DBMS | 2 | **A2** |
| 10 | 25 | **Week 10: Database Administration**  Role management and access control | 2 |  |
| 26 | Managing views and stored procedures for user-specific access | 2 |  |
| 27 | Backup and restore operations: Strategies and tools | 2 |  |
| 11 | 28 | **Week 11: Physical Database Design and Tuning**  Principles of physical database design (partitioning, sharding) | 2 |  |
| 29 | Database performance tuning techniques | 2 |  |
| 30 | Practical session on query tuning and database configuration | 2 | **Q3** |
| 12 | 31 | **Week 12: Distributed Database Systems**  Distributed database architectures and principles | 2 |  |
| 32 | Data fragmentation and allocation: Horizontal, vertical, and hybrid fragmentation | 2 |  |
| 33 | Data replication: Techniques, advantages, and challenges | 2 |  |
| 13 | 34 | **Week 13: Distributed Database Systems (Continue)**  Query processing in distributed databases | 3 |  |
| 35 | Concurrency control in distributed databases | 3 |  |
| 36 | Distributed database recovery techniques | 1 | **A3** |
| 14 | 37 | **Week 14: Emerging Research Trends in Database Systems**  Graph databases: Concepts and applications (Neo4j overview) | 1 |  |
| 38 | Cloud databases and Database-as-a-Service (DBaaS) | 1 |  |
| 49 | Blockchain and its implications in databases | 3 |  |
| 15 | 40 | **Week 15: NoSQL Databases and MongoDB**  Introduction to NoSQL: Types and applications | 1 |  |
| 41 | MongoDB: Schema design and CRUD operations | 1 |  |
| 42 | Indexing and querying in MongoDB | **3** |  |
| 16 | 43 | **Project / CCP presentations and submissions.** | **1/2/ 3** |  |
| 44 |  |
| 45 |  |
| **17** | **Final Exam** | | | |

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| 1. **IU Assessment / grading Policy** | **Instructor grading for course \*** |
| Quizzes 10-15%  Assignments 10-15%  Projects/Presentation/CCP 0-10%  Mid Semester Examination/ 20-30%  End Semester Examination 40-50% | 10%  15%  10%  25%  40% |

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| **IQRA University (IU)** | | |
| **Faculty of Engineering Sciences and Technology (FEST)** | | |
| **Computer Science Department (CS)** | | |
| **Course Code** | **Course Name** | **Credit Hr** |
| **CSC332-L** | Advance Database Management Systems Lab | **2+1** |

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| 1. **Basic Information** | | | |
| **Instructor** |  | **Designation** |  |
| **Prerequisite(s)** | CMC331-L | **Semester** |  |
| **Email** |  | **Phone** |  |
| **Consulting Hours** |  | **Office Location** |  |

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| 1. **Course Objective(s)** |
| 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. |

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| 1. **Course Contents** |
| 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) |

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| 1. **Course Learning Outcomes** | | | | | | |
| **CLOs** | **CLO Statement** | **BT Level** | **Mapping** | | | **% Weight** |
| **GAs** | **ACM KA** | **SGDs** |
| CLO1 | **Performs** queries as demonstrated. Follows instructions to build a model. | P3 | GA2 | #8  IM | 4 | 25% |
| CLO2 | **Applying** the models and approaches in order to become enabled to select and apply appropriate methods for a particular case | C4 | GA3 | 25% |
| CLO3 | ***Participate*** in lab activities such as projects as an individual and as an effective team member utilizing the concepts of data structures to solve real-life problems. | A3 | GA6 | 50% |
| ***Note: On successful completion of course GA1 (Academic Education) will automatically attain.*** | | | | | | |

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| 1. **Course Textbook / Reference Books and Supplementary Reading Material** | | | |
| **S No** | **Book Title** | **Author(s)** | **Edition/ publication year/publisher** |
| 1. 1 | Fundamentals of Database Systems | Ramez Elmasri and Shamkant B. Navathe | 7th Edition, 2015 , Pearson |
| 1. 2 | Distributed Systems: Principles and Paradigms | Andrew S. Tanenbaum and Maarten Van Steen | 2nd Edition 2016 |

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| 1. **CLO Outcome Based Assessment (OBA) Tentative** | | | | | | |
| **Assessment Tool** | | **CLO Mapped** | **CLO Marks** | **% Weight** | **Total Marks** | **Assessment Date** |
| **Quizzes**  **0** |  |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
| **Total Quizzes %** | | | **0** | 0 |  |
|  | | | | | | |
| **Lab Manual Task**  **15** | Lab task | **CLO 1/2/3** | 15 | **100%** | 15 | TBD |
| **Total Assignments %** | | | **100%** | **15** |  |
|  | | | | | | |
| **Midterm**  **25** | Midterm Q#1 | CLO 1 | 10 | 40% | 10 | TBD |
| Midterm Q#2 | CLO 1 | 10 | 40% | 10 | TBD |
| Midterm Q#3 | CLO 2 | 5 | 20% | 5 | TBD |
|  | **Total Midterm %** | | | **100%** | **25** |  |
|  | | | | | | |
| **Project/OEL**  **20** | Project/OEL | CLO 3 | 20 | 100% | 20 | TBD |
|  | **Total Project /CCP %** | | | **100%** | **20** |  |
|  | | | | | | |
| **Final Exam**  **40** | Final Exam Q#1 | CLO2 | 10 | 25% | 10 | TBD |
| Final Exam Q#2 | CLO2 | 10 | 25% | 10 | TBD |
| Final Exam Q#3 | CLO3 | 20 | 50% | 20 | TBD |
|  | **Total Final Exam %** | | | **100%** | **40** |  |
| **100** | **Total Marks** | | | | **100** |  |
| **Note: Please make sure every CLO must be assessed at least 3 time.** | | | | | | |

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| 1. **Weekly Plan** | | | | | | |
| **Week**  **No** | | **Lab No** | | **Lab Description** | **Contact**  **Hr** | **CLO** |
| 1 | | 1 | | Week 1: Introduction to Advanced Data Models  Task 1: Create an object-relational table using PostgreSQL or Oracle.  Task 2: Define object types and use them in a table.  Task 3: Explore inheritance and polymorphism in object-oriented databases. | 3 | 1/2/3 |
| 2 | | 2 | | Week 2: File Organization Concepts  Task 1: Implement a heap file and perform basic CRUD operations.  Task 2: Create and query indexed tables (B-tree, hash index).  Task 3: Compare query performance with and without indexing. | 3 | 1/2/3 |
| 3 | | 3 | | Week 3: Transaction Processing and Concurrency Control  Task 1: Simulate a basic transaction in SQL and explore ACID properties.  Task 2: Implement locking (shared, exclusive) using a DBMS.  Task 3: Explore multiversion concurrency control (MVCC) in PostgreSQL. | 3 | 1/2/3 |
| 4 | | 4 | | Week 4: Recovery Techniques  Task 1: Enable logging in a DBMS and inspect log files.  Task 2: Perform a crash recovery simulation using log-based recovery.  Task 3: Configure and test checkpointing. | 3 | 1/2/3 |
| 5 | | 5 | | Week 5: Query Processing and Optimization  Task 1: Use EXPLAIN PLAN or equivalent to analyze query execution.  Task 2: Optimize poorly performing queries using indexing or rewriting.  Task 3: Experiment with cost-based optimization by tweaking statistics. | 3 | 1/2/3 |
| 6 | | 6 | | Week 6: Database Programming with PL/SQL and T-SQL  Task 1: Write stored procedures for basic operations.  Task 2: Create and use triggers for audit logging.  Task 3: Develop a cursor to iterate through a result set and process rows. | 3 | 1/2/3 |
| 7 | |  | | **Open Ended Lab/ Project / PBL assignment** | 3 | 1/2/3 |
| 8 | | **Midterm Exam** | | | | |
| 9 | | 7 | | Week 7: Integrity and Security in Databases  Task 1: Implement primary keys, foreign keys, and check constraints.  Task 2: Configure user authentication and roles in the DBMS.  Task 3: Encrypt sensitive data using built-in functions. | | 3 | 1/2/3 |
| 10 | | 8 | | Week 8: Database Administration  Task 1: Create and manage roles and permissions for different users.  Task 2: Configure views for specific user access.  Task 3: Perform database backup and restore using a DBMS tool. | | 3 | 1/2/3 |
| 11 | | 9 | | Week 9: Physical Database Design and Tuning  Task 1: Partition a large table and perform queries to observe performance.  Task 2: Shard data across multiple nodes and test queries.  Task 3: Apply database tuning techniques (e.g., cache size adjustment). | | 3 | 1/2/3 |
| 12 | | 10 | | Week 10: Distributed Database Systems  Task 1: Set up a simple distributed database environment.  Task 2: Implement horizontal and vertical data fragmentation.  Task 3: Perform replication and test fault tolerance. | | 3 | 1/2/3 |
| 13 | | 11 | | Week 11: Distributed Database Systems (Part 2)  Task 1: Query a distributed database with replicated data.  Task 2: Implement distributed concurrency control using a DBMS.  Task 3: Configure and test distributed recovery. | | 3 | 1/2/3 |
| 14 | | 12 | | Week 12: NoSQL Databases and MongoDB  Task 1: Install and set up MongoDB.  Task 2: Design a schema and perform CRUD operations.  Task 3: Create and query indexed data in MongoDB. | | 3 | 1/2/3 |
| 15 | | 13 | | Review and Disscussion | | 3 | 1/2/3 |
| 16 | | 14 | | **Open Ended Lab/Project / PBL Assessment** | 3 | 1/2/3 |
| 17 | | **Final Exam** | | | | |

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| 1. **IU Assessment / grading Policy** | **Instructor grading for course \*** |
| Quizzes 0-10%  Labs Task Assessment 10-20%  Projects/OEL/PBL 5-20%  Mid Semester Examination/ 20-30%  End Semester Examination 40-50% | 0  15%  20%  25%  40% |

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| **IQRA University (IU)** | | |
| **Faculty of Engineering Sciences and Technology (FEST)** | | |
| **Computer Science Department (CS)** | | |
| **Course Code** | **Course Name** | **Credit Hr** |
| **AIC211** | Artificial Intelligence | **3+1** |

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| 1. **Basic Information** | | | |
| **Instructor** | Dr Razia Maroof | **Designation** | Assistant Professor |
| **Prerequisite(s)** | CMC112 | **Semester** | Fall 2024 |
| **Email** | [razia.maroof@iqra.edu.pk](mailto:razia.maroof@iqra.edu.pk) | **Phone** |  |
| **Consulting Hours** | 9:00 till 5:00 | **Office Location** | First Floor Faculty offices |

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| 1. **Course Objective(s)** |
| 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. Python has been proposed for the practical work of this course. |

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| 1. **Course Contents** |
| Introduction to AI, Intelligence and Artificial Intelligence, branches and applications. Agent based Systems: Introduction, applications, rationality, environment types, and agent types. Problem Solving, formulating problems. Uninformed search strategies, Breadth-first search, uniform search, depth first search, iterative depending search. Performance parameters. Informed (Heuristic) Search Strategies, Heuristic functions, greedy search, A\* Search, Genetic algorithm. Game Playing, minmax algorithm, Alpha Beta Pruning. Knowledge and reasoning, Introduction to Fuzzy Logic, operator, inference procedure. Advanced Topics, Machine Learning, Types of machine learning, artificial neural network, Naïve Bayes etc. Natural Language Processing; Recent trends in AI and applications of AI algorithms. Any programming language will be used to explore and illustrate various issues and techniques in Artificial Intelligence. |

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| 1. **Course Learning Outcomes** | | | | | | |
| **CLOs** | **CLO Statement** | **BT Level** | **Mapping** | | | **% Weight** |
| **GAs** | **ACM KA** | **SGDs** |
| CLO1 | **Explain** key concepts in the field of artificial intelligence | C2 | GA2 | #9  IS | 9 | N.A |
| CLO2 | **Apply** appropriate algorithms and AI techniques to solve complex problems | C3 | GA5 | N.A |
| CLO3 | **Design** and implement basic AI algorithms, and test their effectiveness on real-world problems. | C4 | GA4 | N.A |
| ***Note: On successful completion of course GA 1 (Academic Education) will automatically attain.*** | | | | | | |

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| 1. **Course Textbook / Reference Books and Supplementary Reading Material** | | | |
| **S No** | **Book Title** | **Author(s)** | **Edition/ publication year/publisher** |
|  | Artificial Intelligence: A Modern Approach | Stuart Russell and Peter Norvig | 4th Edition |
|  | Artificial Intelligence: Foundations of Computational Agents | David L. Poole and Alan K. Mackworth | 3rd Edition |
|  | Fuzzy Logic with Engineering Applications | Timothy J. Ross, | 4th Edition, John Wiley & Sons, Ltd, 2016 |

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| 1. **CLO Outcome Based Assessment (OBA) Tentative** | | | | | | |
| **Assessment Tool** | | **CLO Mapped** | **CLO Marks** | **% Weight** | **Total Marks** | **Assessment Date** |
| **Quizzes**  **10** | Quiz #1 | *CLO1* | 10 | 30% | 3 | TBD |
| Quiz #2 | *CLO2* | 10 | 30% | 3 |  |
| Quiz #3 | *CLO3* | 10 | 40% | 4 |  |
| **Total Quizzes %** | | | **100%** | 10 |  |
|  | | | | | | |
| **Assignments**  **15** | Assignment #1 | *CLO1* | 3 | 33.3% | 5 |  |
| Assignment #2 | *CLO2* | 3 | 33.3% | 5 |  |
| Assignment #3 | **CLO3** | 4 | 33.3% | 5 |  |
|  |  | | | **100%** | 15 |  |
|  | | | | | | |
| **Midterm**  **25** | Midterm Q1 | *CLO1* | 10 | 40% | 10 |  |
| Midterm Q2 | *CLO1* | 5 | 20% | 5 |  |
|  | Midterm Q3 | *CLO2* | 5 | 20% | 5 |  |
|  | Midterm Q4 | *CLO2* | 5 | 20% | 5 |  |
|  | **Total Midterm %** | | | **100%** | **25** |  |
|  | | | | | | |
| **Project/CCP**  **10** | Project/CCP | *CLO1/2/3* | 10 |  |  |  |
|  | **Total Project /CCP %** | | | **100%** | **10** |  |
|  | | | | | | |
| **Final Exam**  **40** | Final Exam Q1 | *CLO1* | 10 | 25% | 10 |  |
| Final Exam Q2 | *CLO2* | 10 | 25% | 10 |  |
| Final Exam Q3 | *CLO3* | 10 | 25% | 10 |  |
|  | Final Exam Q4 | *CLO3* | 10 | 25% | 10 |  |
|  | **Total Final Exam %** | | | **100%** | **40** |  |
| **100** | **Total Marls** | | | | **100** |  |
| ***Note: Please make sure every CLO must be assessed at least 3 time.*** | | | | | | |

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| 1. **Weekly Plan** | | | | |
| **Week** | **Lecture No** | **Topic Covered** | **CLO/1/2/3** | **Assessment Tool (Quiz#, Mid, Final)** |
| 1 | 1 | Definition and scope of AI | **CLO1** |  |
| 2 | Historical development | **CLO1** |  |
| 3 | Current state of AI and its applications | **CLO1** |  |
| 2 | 4 | Types of AI Agent and Environments | **CLO1** |  |
| 5 | Introduction to Rational Agent | **CLO1** |  |
| 6 | Structure of Rational Agent | **CLO1** |  |
| 3 | 7 | Simple Reflex Agents | **CLO2** |  |
| 7 | Goal based agents | **CLO2** | **QUIZ#1** |
| 9 | Learning agents | **CLO2** | **ASSIGN1** |
| 4 | 10 | Solving Problems by Searching: Problem formulation, 8 puzzle, 8 queens, | **CLO2** |  |
| 11 | Measuring Problem Solving performance | **CLO1** |  |
| 12 | Uninformed Search Strategies: BFS Uniform cost, Depth First. Queue approach to BFS and DFS | **CLO1** |  |
| 5 | 13 | Depth limited, Iterative deepening cost | **CLO1** |  |
| 14 | Informed Search Methods | **CLO2** |  |
| 15 | Heuristic Search | **CLO2** |  |
| 6 | 16 | Greedy Search, A\* Search (Conti….) | **CLO2** | **Assignment 2** |
| 17 | Greedy Search, A\* Search (Conti….) |  |  |
| 18 | Greedy Search, A\* Search | **CLO2** |  |
| **7** | 19 | Local Search: Hill Climbing, (Conti..) |  |  |
|  | 20 | Local Search: Hill Climbing, Genetic Algorithm |  |  |
|  | 21 | **CCP / Project Assignment** |  |  |
| **8** | **Midterm Exam** | | | |
| 9 | 22 | Game Theory: Min max algorithm, | **CLO3** |  |
| 23 | Game Theory: Min max algorithm, Alpha beta pruning algorithm | **CLO1** |  |
| 24 | Game Theory: Alpha beta pruning algorithm, Revision | **CLO1** |  |
| 10 | 25 | Introduction to Fuzzy Logic- CRISP Set to FUZZY Sets: | **CLO1** |  |
| 26 | Crispy Set, Sets (Basic & Concepts), Fuzzy Sets Vs Crisp Sets – | **CLO2** | **Assignment 3** |
| 27 | Additional Properties, Representation of Fuzzy Sets | **CLO2** |  |
| 11 | 28 | Operation on Fuzzy Sets – Types of Operations, | **CLO2** |  |
| 29 | Fuzzy Complements, Fuzzy intersection, union, combination, aggregation operations (Conti..) | **CLO3** |  |
| 30 | Fuzzy Complements, Fuzzy intersection, union, combination, aggregation operations | **CLO3** |  |
| 12 | 31 | Fuzzy Relations, Fuzzy Inference, | **CLO3** |  |
| 32 | Fuzzification of the input variables, Rule evaluation, | **CLO3** | **Quiz 2** |
| 33 | Aggregation of the rule outputs, Defuzzification, | **CLO1** |  |
| 13 | 34 | Process of developing a fuzzy expert system, | **CLO1** |  |
| 35 | Operation of a fuzzy expert system | **CLO1** |  |
| 36 | Examples: Air Conditioner | **CLO1** |  |
| 14 | 37 | Advanced Topics: Introduction to Machine Learning, | **CLO1** |  |
| 38 | Types of Learning (selected topics) |  |  |
| 49 | Types of Learning (selected topics) | **CLO2** |  |
| 15 | 40 | Advanced Topics: Naïve Bayes (Conti…) |  |  |
| 41 | Advanced Topics: Naïve Bayes | **CLO2** | **Quiz3** |
| 42 | Advanced Topics: K-mean (Conti..) | **CLO2** |  |
| 16 | 43 | Advanced Topics: ANN | **CLO2** |  |
| **44** | **CCP/ Project Assessment** | **CLO1** |  |
| **45** | **Revision** |  |  |
| **17** | **Final Exam** | | | |

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| 1. **IU Assessment / grading Policy** | **Instructor grading for course \*** |
| Quizzes 10-15%  Assignments 10-15%  Projects/Presentation/CCP 0-10%  Mid Semester Examination/ 20-30%  End Semester Examination 40-50% | 10  15  10  25  40 |

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| **IQRA University (IU)** | | |
| **Faculty of Engineering Sciences and Technology (FEST)** | | |
| **Computer Science Department (CS)** | | |
| **Course Code** | **Course Name** | **Credit Hr** |
| **AIC211- L** | Artificial Intelligence Lab | **3+1** |

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| 1. **Basic Information** | | | |
| **Instructor** | Hafiza Maliha | **Designation** | Lab Instructor |
| **Prerequisite(s)** | CMC112 | **Semester** | Fall 2024 |
| **Email** | Hafiza.m@iqra.edu.pk | **Phone** | NA |
| **Consulting Hours** | Friday(12:00 – 14:00) | **Office Location** | -- |

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| 1. **Course Objective(s)** |
| 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. Python has been proposed for the practical work of this course. |

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| 1. **Course Contents** |
| Introduction to AI, Intelligence and Artificial Intelligence, branches and applications. Agent based Systems: Introduction, applications, rationality, environment types, and agent types. Problem Solving, formulating problems. Uninformed search strategies, Breadth-first search, uniform search, depth first search, iterative depending search. Performance parameters. Informed (Heuristic) Search Strategies, Heuristic functions, greedy search, A\* Search, Genetic algorithm. Game Playing, minmax algorithm, Alpha Beta Pruning. Knowledge and reasoning, Introduction to Fuzzy Logic, operator, inference procedure. Advanced Topics, Machine Learning, Types of machine learning, artificial neural network, Naïve Bayes etc. Natural Language Processing; Recent trends in AI and applications of AI algorithms. Any programming language will be used to explore and illustrate various issues and techniques in Artificial Intelligence. |

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| 1. **Course Learning Outcomes** | | | | | | |
| **CLOs** | **CLO Statement** | **BT Level** | **Mapping** | | | **% Weight** |
| **GAs** | **ACM KA** | **SGDs** |
| CLO1 | **Apply** fundamental concepts of Artificial Intelligence, including rational agents, search algorithms, and fuzzy logic, to solve real-world problems. | C3 | GA2 | #9  IS | 9 | 60% |
| CLO2 | Leverage modern AI tools and frameworks to **design** and implement basic algorithms, including search strategies and machine learning models. | P2 | GA5 | 40% |
| ***Note: On successful completion of course GA 1 (Academic Education) will automatically attain.*** | | | | | | |

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| 1. **Course Textbook / Reference Books and Supplementary Reading Material** | | | |
| **S No** | **Book Title** | **Author(s)** | **Edition/ publication year/publisher** |
|  | Artificial Intelligence: A Modern Approach | Stuart Russell and Peter Norvig | 4th Edition (latest edition- 2022) |
|  | Artificial Intelligence: Foundations of Computational Agents | David L. Poole and Alan K. Mackworth | 3rd Edition (2023) |
|  | Fuzzy Logic with Engineering Applications | Timothy J. Ross, | 4th Edition, John Wiley & Sons, Ltd, 2016 |

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| 1. **CLO Outcome Based Assessment (OBA) (Tentative)** | | | | | | |
| **Assessment Tool** | | **CLO Mapped** | **CLO Marks** | **% Weight** | **Total Marks** | **Assessment Date** |
| **Lab Manual**  **10** |  | ***CLO 1, 2*** | 10 | 100% | 10 | TBD |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
| **Total Quizzes %** | | | **100%** | 10 |  |
|  | | | | | | |
| **Assignments/ Lab Task**  **15** | Assignment #1 | *CLO1* | 10 | 25% | 5 |  |
| Assignment #2 | *CLO2* | 10 | 25% | 5 |  |
| Assignment #3 | *CLO1* | 10 | 50% | 10 |  |
|  |  | | | **100%** | 20 |  |
|  | | | | | | |
| **Midterm**  **25** | Midterm Q1 | *CLO1* | 15 | **60%** | **15** |  |
| Midterm Q2 | *CLO2* | **10** | **40%** | **10** |  |
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|  | **Total Midterm %** | | | **100%** | **25** |  |
|  | | | | | | |
| **Project/OEL**  **10** | OEL | *CLO2* | 10 |  |  |  |
|  | **Total Project /CCP %** | | | **100%** | **10** |  |
|  | | | | | | |
| **Final Exam**  **40** | Final Exam Q1 | *CLO1* | 20 | **50%** |  |  |
| Final Exam Q2 | *CLO2* | 20 | **50%** |  |  |
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|  | **Total Final Exam %** | | | **100%** | **40** |  |
| **100** | **Total Marls** | | | | **100** |  |
| ***Note: Please make sure every CLO must be assessed at least 3 time.*** | | | | | | |

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| 1. **Weekly Plan** | | | | |
| **Week**  **No** | **Lab No** | **Lab Description** | **Contact**  **Hr** | **CLO** |
| 1 | 1 | Understand the scope of AI, types of agents, and environments.  Activities: Explore real-world AI applications (image recognition, chatbots, etc.). Implement a basic reflex agent in Python for a simple environment (e.g., vacuum cleaner problem). | 3 |  |
| 2 | 2 | Learn problem formulation and solve puzzles using search strategies.  Activities: Implement the 8-puzzle problem.  Measure problem-solving performance by tracking node expansion. | 3 |  |
| 3 | 3 | Explore BFS, DFS, and Uniform Cost Search.  Activities: Write Python implementations for BFS and DFS.  Compare their performance on a graph-based maze. | 3 |  |
| 4 | 4 | Dive deeper into search optimizations.  Activities: Implement depth-limited search and iterative deepening algorithms.  Visualize their search patterns using graphical tools. | 3 |  |
| 5 | 5 | Introduce heuristic-based search techniques like Greedy and A\* Search.  Activities: Implement the A\* algorithm for the 8-puzzle problem using Manhattan distance.  Compare Greedy Search and A\* on the same problem. | 3 |  |
| 6 | 6 | Explore optimization techniques like Hill Climbing and Genetic Algorithms.  Activities: Implement Hill Climbing for the 8-queens problem.  Simulate a Genetic Algorithm to optimize a fitness function. | 3 |  |
| 7 |  | **Open Ended Lab/Project Assigned** |  |  |
| 8 | **Midterm Exam** | | | |
| 9 | 7 | Understand game-playing agents with Minimax and Alpha-Beta pruning.  Activities: Implement Minimax for a simple game like Tic-Tac-Toe.  Enhance performance with Alpha-Beta pruning. | 3 |  |
| 10 | 8 | Explore Fuzzy Sets and Operations.  Activities: Write Python code to represent crisp and fuzzy sets.  Perform union, intersection, and complement operations on fuzzy sets. | 3 |  |
| 11 | 9 | Design a fuzzy logic-based expert system.  Activities: Develop a fuzzy system for temperature control (e.g., an air conditioner).  Implement fuzzification, rule evaluation, and defuzzification. | 3 |  |
| 12 | 10 | Explore supervised and unsupervised learning.  Activities: Implement Naïve Bayes for text classification.  Apply K-Means clustering on a dataset (e.g., Iris dataset). | 3 |  |
| 13 | 11 | Build a foundational understanding of ANN.  Activities: Create a simple perceptron for binary classification.  Train the perceptron on a linearly separable dataset. | 3 |  |
| 14 | 12 | Deep dive into multi-layer perceptrons and backpropagation.  Activities: Implement a multi-layer perceptron using libraries like TensorFlow or PyTorch.  Train it on a dataset (e.g., MNIST for digit classification). | 3 |  |
| 15 |  | **Revision / Open Ended Lab/Project Assessment** |  |  |
| 16 |  | **Open Ended Lab/Project Assessment** |  |  |
| 17 | **Final Exam** | | | |

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| 1. **IU Assessment / grading Policy** | **Instructor grading for course \*** |
| Lab Manual 0-10%  Labs Task Assessment 10-20%  Projects/OEL/PBL 5-20%  Mid Semester Examination/ 20-30%  End Semester Examination 40-50% | 10  15  10  25  40 |

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| **IQRA University (IU)** | | |
| **Faculty of Engineering Sciences and Technology (FEST)** | | |
| **Computer Science Department (CS)** | | |
| **Course Code** | **Course Name** | **Credit Hr** |
| **CSC382** | HCI & Computer Graphics | **2+1** |

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| 1. **Basic Information** | | | |
| **Instructor** |  | **Designation** |  |
| **Prerequisite(s)** | CMC371 | **Semester** | Fall 2024 |
| **Email** |  | **Phone** |  |
| **Office Hours** |  | **Office Location** |  |

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| 1. **Course Objective(s)** |
| The objective of the Human-Computer Interaction (HCI) course is to familiarize students with theoretical foundations and practical techniques in designing intuitive and user-friendly interfaces. Through this course, students will develop an understanding of user behaviors, interface design principles, and usability evaluation methods, enabling them to create effective computing solutions that prioritize user needs and experiences. |

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| 1. **Course Contents** |
| Contexts for HCI, Psychology of usable things, Processes for User-Centered Design, Metrics and Measures for Evaluation, Usability heuristics and principles of Usability testing, Physical capabilities, Cognitive and social models for interaction design, Principles of good interaction design, Accessibility, Principles of GUI, Visual design elements, Data gathering, Task analysis, Prototyping, Help and user documentation, Internationalization, Usability inspection methods, Usability testing methods, New Interaction Technologies, Usability in practice, Visual Design and Typography, Icon Design, Ubiquitous, Augmented and Virtual Reality. |

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| 1. **Course Learning Outcomes** | | | | | | |
| **CLOs** | **CLO Statement** | **BT Level** | **Mapping** | | | **% Weight** |
| **GAs** | **ACM KA** | **SGDs** |
| **CLO 1** | **Apply**the principles of universal design to analyze and create inclusive solutions for people of all ages and abilities, addressing accessibility and usability challenges***.*** | C3 | GA3 | 6  HCI | 9 | 35.71% |
| **CLO 2** | **Analyze** techniques for user centered design for a medium sized software | C4 | GA4 | 32.14% |
| **CLO 3** | **Design**and critically evaluate the usability of a medium-sized software user interface, considering diverse user needs and global accessibility standards. | C6 | GA5 | 32.14% |
| ***Note: On successful completion of course GA1 (Academic Education) will automatically attain.*** | | | | | | |

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| 1. **Course Textbook / Reference Books and Supplementary Reading Material** | | | |
| **S No** | **Book Title** | **Author(s)** | **Edition/ publication year/publisher** |
|  | Human Computer Interaction | Alan Dix | 4th edition. 2017, Pearson Education. |
|  | Designing Interactive Systems: A Comprehensive Guide to HCI, UX and Interaction Design | Benyon, D. | 3rd edition, 2013, Publisher, Pearson,  2013 |

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| 1. **CLO Outcome Based Assessment (OBA)** | | | | | | |
| **Assessment Tool** | | **CLO Mapped** | **CLO Marks** | **% Weight** | **Total Marks** | **Assessment Date** |
| **Quizzes**  **10** | Quiz #1 | *CLO1* | 2.5 | 25% | 2.5 |  |
| Quiz #2 | *CLO2* | 2.5 | 25% | 2.5 |  |
| Quiz #3 | *CLO3* | 5 | 50% | 5 |  |
| **Total Quizzes %** | | | **100%** | 10 |  |
|  | | | | | | |
| **Assignments**  **10** | Assignment #1 | *CLO1* | 2.5 | 25% | 2.5 |  |
| Assignment #2 | *CLO2* | 2.5 | 25% | 2.5 |  |
|  | Assignment #3 | *CLO3* | 5 | 50% | 5 |  |
|  |  | | | **100%** | 10 |  |
|  | | | | | | |
| **Midterm**  **25** | Midterm Q#1,2 | *CLO1* | 16 | 64% | **16** |  |
| Midterm Q#3 | *CLO2* | 9 | 36% | **9** |  |
|  | Midterm Q# | *CLO3* |  |  |  |  |
|  | Midterm Q# | *CLO4* |  |  |  |  |
|  | **Total Midterm %** | | | **100%** | **25** |  |
|  | | | | | | |
| **Project/CCP**  **15** | Project/CCP | *CLO 2/3* | 15 | 7+8 |  |  |
|  | **Total Project /CCP %** | | | **100%** | **15** |  |
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| **Final Exam**  **40** | Final Exam Q# | *CLO 2* |  |  |  |  |
| Final Exam Q# | *CLO 3* |  |  |  |  |
| …. | *CLO 2* |  |  |  |  |
|  | Final Exam Qn | *CLO 3* |  |  |  |  |
|  | **Total Final Exam %** | | | **100%** |  |  |
| **100** | **Total Marls** | | | | **100** |  |
| ***Note: Please make sure every CLO must be assessed at least 3 time.*** | | | | | | |

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| 1. **Weekly Plan** | | | | |
| **Week** | **Lecture No** | **Topic Covered** | **CLO** | **Assessment Tool** |
| 1 | 1 | Introduction to Human-Computer Interaction (HCI), its importance, and basic concepts. | **1** |  |
| 2 | Design focus, human error and false memories, reasoning and problem solving. Psychology and the design of interactive systems | **1** |  |
| 2 | 3 | Physical controls, sensors and special devices. | **1** |  |
| 4 | Processing and networks, Case study. | **1** |  |
| 3 | 5 | Models of interaction. The ergonomics rules and designs | **1** |  |
| 6 | The context of the interaction, design focus and industrial interface | **1** | **Quiz 1** |
| 4 | 7 | Paradigms for interaction. The process of design, user focus and design focus. | **1** |  |
| 8 | Design iteration and prototyping. | **1** | **Assignment 1** |
| 5 | 9 | HCI in the software process and the software life cycle. | **1** |  |
| 10 | Usability engineering and design rationale, Case study. | **1** |  |
| 6 | 11 | Design rules, principles, standards to support usability | **2** |  |
| 12 | Golden rules of designing and heuristics, Case study. | **2** | **Quiz 2** |
| **7** | 13 | **CCP Announcement and Discussion** | **2/3** |  |
| 14 |  |
| **8** | **Midterm Exam** | | | |
| 9 | 15 | Evaluation techniques and goals | **2** |  |
| 16 | Evaluation through expert analyst and through user participation, Case study. | **2** |  |
| 10 | 17 | Universal design principles | **2** | **Assignment 2** |
| 18 | Designing for diversity | **2** |  |
| 11 | 19 | Requirements and approaches to user support | **2** |  |
| 20 | Adaptive help systems for designing user support, Case study | **2** |  |
| 12 | 21 | How to design cognitive models to analyze task hierarchies and goals for enhancing user experience. Explore how to apply these designs considering diverse cognitive abilities and cultural contexts. | **3** |  |
| 22 | How to create linguistic models to improve communication in display-based systems. How to address global linguistic diversity and accessibility challenges in user interactions. | **3** |  |
| 13 | 23 | Cognitive architectures and integrate physical/device models to optimize user interactions and focus on designing for global usability and adapting to various physical environments. | **3** | **Assignment 3** |
| 24 | Evaluate task analysis methods in comparison to other techniques. Apply task decomposition and knowledge-based techniques to design user-centric solutions for global applications. | **3** |  |
| 14 | 25 | Model of the system and standard formalisms | **3** |  |
| 26 | Interaction models and continuous behavior, Case study. | **3** |  |
| 15 | 27 | Ubiquitous computing applications and research | **3** | **Quiz 3** |
| 28 | Virtual and augmented reality. Design focus of augmented reality | **3** |  |
| 16 | 29 | **Assessment and CCP Submission** | **2/3** |  |
| 30 |  |
| **17** | **Final Exam** | | | |

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| 1. **IU Assessment / grading Policy** | **Instructor grading for course \*** |
| Quizzes 10-15%  Assignments 10-15%  Projects/Presentation/CCP 0-10%  Mid Semester Examination/ 20-30%  End Semester Examination 40-50% | 10  10  15  25  40 |

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| **IQRA University (IU)** | | |
| **Faculty of Engineering Sciences and Technology (FEST)** | | |
| **Computer Science Department (CS)** | | |
| **Course Code** | **Course Name** | **Credit Hr** |
| **CSC382-L** | HCI & Computer Graphics Lab | **2+1** |

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| 1. **Basic Information** | | | |
| **Instructor** | Zuha Soomro | **Designation** | Lecturer |
| **Prerequisite(s)** | CMC371 | **Semester** | Fall 2024 |
| **Email** | [Zuha.soomro@iqra.edu.pk](mailto:Zuha.soomro@iqra.edu.pk) | **Phone** | +92 331 2696860 |
| **Office Hours** | Monday 10:00-1:00 & Thursday 9:30-11:30 for students’ consultation | **Office Location** | EDE faculty room, cubicle # 10 |

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| 1. **Course Objective(s)** |
| The objective of the Human-Computer Interaction (HCI) Lab course is to familiarize students with hands on experience for practical techniques in designing intuitive and user-friendly interfaces. Through this course, students will develop an understanding of user behaviors, interface design principles, and usability evaluation methods, enabling them to create effective computing solutions that prioritize user needs and experiences. |

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| 1. **Course Contents** |
| The Human-Computer Interaction (HCI) Lab course provides a hands-on exploration of designing intuitive, user-friendly interfaces with a strong emphasis on usability and user experience. It introduces students to the principles of HCI and the role human psychology plays in creating effective interfaces. A core component of the course is the application of user-centered design, contrasting it with system-centered approaches to highlight the importance of understanding diverse user needs, such as children, teenagers, the elderly, and rural populations. |

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| 1. **Course Learning Outcomes** | | | | | | |
| **CLOs** | **CLO Statement** | **BT Level** | **Mapping** | | | **% Weight** |
| **GA** | **ACM KA** | **SGDs** |
| **CLO 1** | *To* ***apply*** *HCI in their day-to-day activities.* | C3 | GA2 | #6  HCI | 9 | % |
| **CLO 2** | *To add* ***value*** *to user models and develop user centric interfaces* | A3 | GA9 | % |
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| 1. **Course Textbook / Reference Books and Supplementary Reading Material** | | | |
| **S No** | **Book Title** | **Author(s)** | **Edition/ publication year/publisher** |
|  | Human Computer Interaction | Alan Dix | 3rd edition. 2004, Pearson Education  Limited 2004. |
|  | Designing Interactive Systems: A Comprehensive Guide to HCI, UX and Interaction Design | Benyon, D. | 3rd edition, 2013, Publisher, Pearson,  2013 |

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| 1. **CLO Outcome Based Assessment (OBA)** | | | | | | |
| **Assessment Tool** | | **CLO Mapped** | **CLO Marks** | **% Weight** | **Total Marks** | **Assessment Date** |
| **Lab Manual**  **10** |  | *CLO1* | 07 | 70% | 7 |  |
|  | *CLO2* | 03 | 30% | 3 |  |
|  |  |  |  |  |  |
| **Total Quizzes %** | | | **100%** | 10 |  |
|  | | | | | | |
| **Viva**  **10** | Oral Viva | *CLO 2* | 10 | 100% | 10 |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  | | | **100%** | 10 |  |
|  | | | | | | |
| **Midterm**  **25** | Midterm Q#1 | *CLO1* | 15 | 60% | 15 |  |
| Midterm Q#2 | *CLO2* | 10 | 40% | 10 |  |
|  | …. |  |  |  |  |  |
|  |  |  |  |  |  |  |
|  | **Total Midterm %** | | | **100%** | 25 |  |
|  | | | | | | |
| **OEL**  **05** | Project/CCP | *CLO2* | 5 | 100% | 5 |  |
|  | **Total Project /CCP %** | | | **100%** | 5 |  |
|  | | | | | | |
| **Final Exam**  **50** | Final Exam Q# | *CLO1/2/3* |  |  |  |  |
| Final Exam Q# | *CLO1/2/3* |  |  |  |  |
| …. | *CLO1/2/3* |  |  |  |  |
|  | Final Exam Qn | *CLO1/2/3* |  |  |  |  |
|  | **Total Final Exam %** | | | **100%** |  |  |
| **100** | **Total Marls** | | | | **100** |  |
| ***Note: Please make sure every CLO must be assessed at least 3 time.*** | | | | | | |

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| 1. **Weekly Plan** | | | | |
| **Week**  **No.** | **Lab No.** | **Lab Description** | **Contact**  **Hr.** | **CLO** |
| 1 | 1 | Introduction to the basics of software interface designing. | 3 | 1-2 |
| 2 | 2 | structuring the interface layout. | 3 | 1-2 |
| 3 | 3 | To learn the technique of evaluating interactive system design through expert analysis where experts give their feedback directly, based on their expertise or a set of design heuristics. | 3 | 1-2 |
| 4 | 4 | To learn how to validate the web accessibility of websites using the freely available online tools. | 3 | 1-2 |
| 5 | 5 | Learn the technique of evaluating interactive system’s design through user participation where the actual users are asked to interact with the system. | 3 | 1-2 |
| 6 | 6 | Creating Personas for available Project. | 3 | 1-2 |
| 7 |  | **Open Ended Lab/Project Assigned** | 3 | 1-2 |
| 8 | **Midterm Exam** | | | |
| 9 | 7 | Writing Scenarios for available Project. | 3 | 1-2 |
| 10 | 8 | Learn the prototyping as a method to involve the users in testing design ideas and get their feedback in the early stage of development. | 3 | 1-2 |
| 11 | 9 | Basic features of the Pencil prototyping tool, allowing students to learn the essentials of wire framing and UI component creation. | 3 | 1-2 |
| 12 | 10 | Advanced features such as adding interactivity, animations, and exporting prototypes, which are essential for real-world prototyping and user testing. | 3 | 1-2 |
| 13 | 11 | Learn the vocabulary of graphical interaction, basic interaction tasks, pros and cons of various graphical control elements. | 3 | 1-2 |
| 14 | 12 | Learn the use of colors which is very important for graphical interaction design | 3 | 1-2 |
| 15 | 13 | The practical application of colors in terms of accessibility, contrast, and how they affect the usability and visual appeal of interfaces. | 3 | 1-2 |
| 16 |  | **Open Ended Lab/Project Assessment** |  | 1-2 |
| 17 | **Final Exam** | | | |

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| 1. **IU Assessment / grading Policy** | **Instructor grading for course \*** |
| Lab Manual 0-10%  Labs Task Assessment 10-20%  Projects/OEL/PBL 5-20%  Mid Semester Examination/ 20-30%  End Semester Examination 40-50% | 10  10 (Viva)  05  25  50 |

## SEMESTER 7

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| **S.No** | **Course Code** | **Title** | **Cr.Hrs** |
| 1 | CSC442 | Parallel & Distributed Computing | 3 + 0 |
| 2 | CSC442-L | Parallel & Distributed Computing (Lab) | 0 + 1 |
| 3 | GER462 | Technopreneurship | 2 + 0 |
| 4 | CMC491 | Final Year Project - I | 0 + 3 |
| 5 | CSEXXX | Domain Elective 3 | 2 + 1 |
| 6 | CSEXXX | Domain Elective 4 | 2 + 1 |
| 7 | CSEXXX | Domain Elective 5 | 2 + 1 |
|  |  |  | **11+7 (18)** |

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| **IQRA University (IU)** | | |
| **Faculty of Engineering Sciences and Technology (FEST)** | | |
| **Computer Science Department (CS)** | | |
| **Course Code** | **Course Name** | **Credit Hr** |
| **CSC 442** | Parallel and Distributed Computing | **3+1** |

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| 1. **Basic Information** | | | |
| **Instructor** |  | **Designation** |  |
| **Prerequisite(s)** | CMC241 | **Semester** | Fall 2024 |
| **Email** |  | **Phone** |  |
| **Office Hours** |  | **Office Location** |  |

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| 1. **Course Objective(s)** |
| This Parallel and Distributed Computing course aims to equip students with a solid theoretical understanding of parallel and distributed computing principles. This includes exploring various architectures, programming paradigms, algorithms, and their analysis, along with addressing key challenges like concurrency control and performance optimization. |

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| 1. **Course Contents** |
| 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). |

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| 1. **Course Learning Outcomes** | | | | | | |
| **CLOs** | **CLO Statement** | **BT Level** | **Mapping** | | | **% Weight** |
| **GAs** | **ACM KA** | **SGDs** |
| CLO1 | **Understand** the principles and challenges of parallel and distributed systems in real-world scenarios. | C2 | GA2 | #13  PD | 4 | 30% |
| CLO2 | **Analyze** the efficiency, performance, and scalability of parallel and distributed systems using performance metrics. | C4 | GA4 | 40% |
| CLO3 | **Design** high-performance distributed systems and parallel applications, optimizing for scalability and performance. | C6 | GA5 | 30% |
| ***Note: On successful completion of course GA1 (Academic Education) will automatically attain.*** | | | | | | |

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| 1. **Course Textbook / Reference Books and Supplementary Reading Material** | | | |
| **S No** | **Book Title** | **Author(s)** | **Edition/ publication year/publisher** |
|  | Distributed and Parallel Computing | Hesham ElRewini, | 2nd Edition, Manning |
|  | Introduction to Parallel Computing in C | W.P. Peterson, P.Abenz | 1st Edition, Oxford |
|  | Parallel Scientific Computing in C++ and MPI | G.E. Karniadakis | 2003, Cambridge |

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| 1. **CLO Outcome Based Assessment (OBA)** | | | | | | |
| **Assessment Tool** | | **CLO Mapped** | **CLO Marks** | **% Weight** | **Total Marks** | **Assessment Date** |
| **Quizzes**  **10** | Quiz #1 | *CLO1* | 10 | 30% | 3 | TBD |
| Quiz #2 | *CLO2* | 10 | 40% | 4 |  |
| Quiz #3 | *CLO3* | 10 | 30% | 3 |  |
| **Total Quizzes %** | | | **100%** | 10 |  |
|  | | | | | | |
| **Assignments**  **10** | Assignment #1 | *CLO1* | 10 | 30% | 4 |  |
| Assignment #2 | *CLO2* | 10 | 40% | 7 |  |
| Assignment #3 | *CLO3* | 10 | 30% | 4 |  |
|  |  | | | **100%** | 15 |  |
|  | | | | | | |
| **Midterm**  **25** | Midterm Q# | *CLO1* | **10** |  |  |  |
| Midterm Q# | *CLO2* | 15 |  |  |  |
|  | …. | *CLO1/2/3* |  |  |  |  |
|  | Midterm Qn | *CLO1/2/3* |  |  |  |  |
|  | **Total Midterm %** | | | **100%** | **25** |  |
|  | | | | | | |
| **Project/CCP**  **10** | Project/CCP | *CLO2/3* | **10** | **100%** | **10** |  |
|  | **Total Project /CCP %** | | | **100%** |  |  |
|  | | | | | | |
| **Final Exam**  **40** | Final Exam Q# | *CLO1/2/3* | 10 |  |  |  |
| Final Exam Q# | *CLO1/2/3* | 10 |  |  |  |
| …. | *CLO1/2/3* |  |  |  |  |
|  | Final Exam Qn | *CLO1/2/3* |  |  |  |  |
|  | **Total Final Exam %** | | | **100%** | **40** |  |
| **100** | **Total Marls** | | | | **100** |  |
| ***Note: Please make sure every CLO must be assessed at least 3 time.*** | | | | | | |

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| 1. **Weekly Plan** | | | | |
| **Week** | **Lecture No** | **Topic Covered** | **CLO** | **Assessment Tool** |
| 1 | 1 | History of computers, operating systems and sequential algorithms. Review: Types of processors (RISC & CISC) | 1 |  |
| 2 | Flynn’s taxonomy SISD, SIMD (vector and array processors), MIMD (shared and distributed memory), GPU | 1 |  |
| 3 | Design Goal of Distributed System, and Application (high performance computing, information integration system and pervasive system) | 1 |  |
| 2 | 4 | Multitasking Systems, system API for multiprogramming | 1 |  |
| 5 | Multithreading Systems, system APIs for thread management | 1 |  |
| 6 | Multiprocessing Systems, shared memory architecture | 1 |  |
| 3 | 7 | Mutual exclusion in concurrency control | 1 | Quiz 1 |
| 7 | Synchronization in concurrency control | 1 |  |
| 9 | System APIs for concurrency control | 1 |  |
| 4 | 10 | Inter process communications using PIPS/FIF | 2 |  |
| 11 | Shared memory in Inter process communications | 2 |  |
| 12 | Network Sockets in Data distribution Technique. | 2 | Assignment 1 |
| 5 | 13 | Overview of Parallel Random Access Machine, | 2 |  |
| 14 | PRAM Models, EREW PRAM Algorithms | 2 | Quiz 2 |
| 15 | Analysis of ERCW-PRAM, Algorithms | 1 |  |
| 6 | 16 | Analysis of CRCW-PRAM Algorithms | 3 |  |
| 17 | Analysis of CREW-PRAM Algorithms | 1 |  |
| 18 | Communication in Distribution system | 1 |  |
| **7** | 19 | **CCP Announcement and Discussion** | 1 |  |
| 20 | 2 |  |
| 21 | 3 |  |
| **8** | Midterm Exam | | | |
| 9 | 22 | Cluster Computing, GRID Computing, | 3 |  |
| 23 | Overview of Message Passing Systems | 3 |  |
| 24 | MPI/MPICH & Applications | 3 |  |
| 10 | 25 | Six Basic APIs to implement distributed memory applications | 2 | Assignment 2 |
| 26 | APIs for group management and communications | 2 |  |
| 27 | APIs for data distribution and collections | 2 |  |
| 11 | 28 | Converting PRAM models into MPI Programs. | 2 |  |
| 29 | Architectures, Architectural styles, Layered architectures, Service-oriented architectures, Publish-subscribe architectures | 2 |  |
| 30 | Middleware and distributed systems, Middleware organization. | 2 |  |
| 12 | 31 | Modifiable middleware, Layered-system architectures. | 2 |  |
| 32 | Simple client-server architecture, Multi-tiered Architectures | 2 |  |
| 33 | Cloud Computing Architecture | 2 |  |
| 13 | 34 | Coordination and Synchronization | 2 |  |
| 35 | Cloud Computing Services | 2 |  |
| 36 | High-Performance Computing, | 2 |  |
| 14 | 37 | GPU Architecture | 3 |  |
| 38 | GPU programming review and applications | 3 | Quiz 3 |
| 49 | Algorithmic design for GPU Programming | 3 |  |
| 15 | 40 | High-Performance Clusters, Super Computers. | 3 |  |
| 41 | Bully and Ring algorithm | 3 | Assignment 3 |
| 42 | Gossip-based coordination: aggregation | 3 |  |
| 16 | 43 | **CCP Assessment and Submission** | 3 |  |
| 44 | 3 |  |
| 45 | 3 |  |
| **17** | **Final Exam** | | | |

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| 1. **IU Assessment / grading Policy** | **Instructor grading for course \*** |
| Quizzes 10-15%  Assignments 10-15%  Projects/Presentation/CCP 0-10%  Mid Semester Examination/ 20-30%  End Semester Examination 40-50% | 10%  15%  10%  25%  40% |

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| IQRA University | | |
| Faculty of Engineering Sciences and Technology (FEST) | | |
| Computer Science Department (CS) | | |
| Course Code | Course Name | Credit Hr. |
| CSC 442-L | Parallel and Distributed Computing Lab | 3+1 |

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| 1. Basic Information | | | |
| Instructor |  | Designation |  |
| Prerequisite(s) | CMC241-L | Semester | Fall 2024 |
| Email |  | Phone |  |
| Office Hours |  | Office Location |  |

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| 1. **Course Objective(s)** |
| This Parallel and Distributed Computing course aims to equip students with a solid theoretical understanding of parallel and distributed computing principles. This includes exploring various architectures, programming paradigms, algorithms, and their analysis, along with addressing key challenges like concurrency control and performance optimization. |

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| 1. **Course Contents** |
| 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). |

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| 1. **Course Learning Outcomes** | | | | | | |
| **CLOs** | **CLO Statement** | **BT Level** | **Mapping** | | | **% Weight** |
| **GAs** | **ACM KA** | **SDGs** |
| CLO1 | **Demonstrate** the ability to apply basic OpenMP and MPI principles, and explore communication techniques in parallel programming. | P4 | GA5 | #13  PD | 4 | 65% |
| CLO2 | **Analyze** and implement OpenMP, MPI, SIMD vectorization, and socket programming techniques to solve complex computational problems. | A4 | GA6 | 35% |
| **Note: On successful completion of course GA 1 (Academic Education) will automatically attain.** | | | | | | |

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| 1. **Course Textbook / Reference Books and Supplementary Reading Material** | | | |
| **S No** | **Book Title** | **Author(s)** | **Edition/ publication year/publisher** |
|  | Distributed and Parallel Computing | Hesham ElRewini, | 2nd Edition, Manning |
|  | Introduction to Parallel Computing in C | W.P. Peterson, P.Abenz | 1st Edition, Oxford |
|  | Parallel Scientific Computing in C++ and MPI | G.E. Karniadakis | 2003, Cambridge |

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| 1. **CLO Outcome-Based Assessment (OBA)** | | | | | | |
| **Assessment Tool** | | **CLO Mapped** | **CLO Marks** | **% Weight** | **Total Marks** | **Assessment Date** |
| **Quizzes**  **0** | Quiz #1 | *CLO1/2* | 0 | 0% | 0 |  |
| Quiz #2 | *CLO1/2* | 0 | 0% | 0 |  |
| Quiz #3 | *CLO1/2* | 0 | 0% | 0 |  |
| **Total Quizzes %** | | | **0%** | 0 |  |
|  | | | | | | |
| **Lab Manual**  **20** | Lab Task #1 | *CLO1/2* | 10 | 10% | 0 |  |
| Lab Task #2 | *CLO1/2* | 10 | 10% | 0 |  |
| Lab Task #n | *CLO1/2* | 0 |  | 0 |  |
|  | **Total Lab Manual %** | | | **20%** | 20 |  |
|  | | | | | | |
| **Midterm**  **25** | Midterm Q#1, 2 | *CLO1* | 20 |  |  |  |
| Midterm Q#3 | *CLO1* | 5 |  |  |  |
|  |  |  |  |  |  |  |
|  | **Total Midterm %** | | | **25%** | **25** |  |
|  | | | | | | |
| **Project/OEL**  **15** | Project/CCP | *CLO1/2* | 15 |  |  |  |
|  | **Total Project /CCP %** | | | **15%** | **15** |  |
|  | | | | | | |
| **Final Exam**  **40** | Final Exam Q# | *CLO1/2* | 10 |  |  |  |
| Final Exam Q# | *CLO1/2* | 10 |  |  |  |
|  | Final Exam Qn | *CLO1/2* |  |  |  |  |
|  | **Total Final Exam %** | | | **40%** | **40** |  |
| **100** | **Total Marls** | | | | **100** |  |
| ***Note: Please make sure every CLO must be assessed at least 3 times.*** | | | | | | |

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| 1. **Weekly Plan** | | | | |
| **Week**  **No.** | **Lab No.** | **Lab Description** | **Contact**  **Hr.** | **CLO** |
| 1 | 1 | Acquire basic OpenMP (Open Multi-Processor) Principles | 3 | 1-2 |
| 2 | 2 | Explore the OpenMP Loop Construct. | 3 | 1-2 |
| 3 | 3 | Explore the OpenMP Sections and Single Construct. | 3 | 1-2 |
| 4 | 4 | Analyze the performance of OpenMP real Applications | 3 | 1-2 |
| 5 | 5 | Explore the SIMD Vectorization. | 3 | 1-2 |
| 6 | 6 | Explore the advanced features of SIMD Vectorization. | 3 | 1-2 |
| 7 |  | **Open Ended Lab/Project Assigned** |  | 1-2 |
| 8 | **Midterm Exam** | | | |
| 9 | 7 | Acquire basic MPI (Message Passing Interface) Principles | 3 | 1-2 |
| 10 | 8 | Explore the communication between MPI processes | 3 | 1-2 |
| 11 | 9 | Explore the MPI collective operations. | 3 | 1-2 |
| 12 | 10 | Analyze the performance of MPI real Applications. | 3 | 1-2 |
| 13 | 11 | Explore Socket Programming in Linux Environment. | 3 | 1-2 |
| 14 | 12 | Explore the Socket Programming in Linux over the Network. | 3 | 1-2 |
| 15 | 13 | Explore the Java Remote Method Invocation (RMI). | 3 | 1-2 |
| 16 |  | **Open Ended Lab/Project Assessment** |  | 1-2 |
| 17 | **Final Exam** | | | |

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| 1. **IU Assessment/grading Policy** | **Instructor grading for the course \*** |
| Lab Manual 10-20%  Projects/OEL/PBL 10-25%  Mid Semester Examination/ 20-30%  End Semester Examination 40-50% | 15  20  25  40 |

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| **IQRA University (IU)** | | |
| **Faculty of Engineering Sciences and Technology (FEST)** | | |
| **Computer Science Department (CS)** | | |
| **Course Code** | **Course Name** | **Credit Hr** |
| **GER462** | Technopreneurship | **2+ 0** |

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| 1. **Basic Information** | | | |
| **Instructor** |  | **Designation** |  |
| **Prerequisite(s)** | -- | **Semester** |  |
| **Email** | @iqra.edu.pk | **Phone** | 0300-xxxxxxx |
| **Consulting Hours** | Fri 09:30 PM to 10:30 PM | **Office Location** | X Floor Faculty Room (X Cubicle) |

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| 1. **Course Objective(s)** |
| This course explores the intersection of technology and entrepreneurship, focusing on developing entrepreneurial skills, understanding technology trends, and applying innovative strategies to launch and manage tech-based ventures. The goal of this course is to equip students with a comprehensive understanding of technopreneurship, emphasizing the merging of technology and entrepreneurship. Students will explore innovation, technology commercialization, venture creation, and management principles specific to tech startups. |

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| 1. **Course Contents** |
| This course explores the intersection of technology and entrepreneurship, focusing on equipping students with the skills to identify and evaluate technological opportunities, innovate solutions, and launch successful tech ventures. It examines trends in emerging technologies, innovation strategies, and the startup ecosystem, including incubators, funding, and commercialization. Students will develop business plans, enhance leadership skills, and address ethical and societal impacts of technology. By the end, participants will have hands-on experience in creating and pitching a tech-based venture, fostering critical skills for thriving in the dynamic field of technopreneurship. |

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| 1. **Course Learning Outcomes** | | | | | | |
| **CLOs** | **CLO Statement** | **BT Level** | **Mapping** | | | **% Weight** |
| **GAs** | **ACM KA** | **SGDs** |
| CLO1 | Develop an **understanding** of the fundamental principles of Technopreneurship. | C3 | GA7 | #18  SP | 9,5,10,1 | 30% |
| CLO2 | **Structure** the pitch logically, aligning values with the presentation, prioritizing key messages, and ensuring adherence to ethical standards. | A4 | GA9 | 30% |
| CLO3 | ***Create*** a business plan for a technology-based venture and pitch it effectively. | C6 | GA10 | 40% |
| *Note: On successful completion of course GA 1 (Academic Education) will automatically attain.* | | | | | | |

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| 1. **Course Textbook / Reference Books and Supplementary Reading Material** | | | |
| **S No** | **Book Title** | **Author(s)** | **Edition/ publication year/publisher** |
|  | The Startup Owner's Manual: The Step-by-Step Guide for Building a Great Company | Steve Blank and Bob Dorf | 2020 / Wiley & Sons, Inc. |
|  | The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses. | Eric Ries | 2011 / Crown Business |
|  | Strategic Management of Technological Innovation. | Melissa Schilling | 7th Edition / 2022 / McGraw-Hill |

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| 1. **CLO Outcome Based Assessment (OBA) Tentative** | | | | | | |
| **Assessment Tool** | | **CLO Mapped** | **CLO Marks** | **% Weight** | **Total Marks** | **Assessment Date** |
| **Quizzes**  **15** | Quiz #1 | CLO 1 | 5 | 33.3 | 5 | TBD |
| Quiz #2 | CLO 2 | 5 | 33.3 | 5 | TBD |
| Quiz #3 | CLO 3 | 5 | 33.3 | 5 | TBD |
| **Total Quizzes %** | | | **100%** | **15** |  |
|  | | | | | | |
| **Assignments**  **10** | Assignment #1 | CLO 1 | 5 | 50 | 5 | TBD |
| Assignment #2 | CLO 2 | 3 | 30 | 3 | TBD |
|  | Assignment #3 | CLO 2 | 2 | 20 | 2 |  |
|  | **Total Assignments%** | | | **100%** | **10** |  |
|  | | | | | | |
| **Midterm**  **25** | Midterm Q#1,2,3 | CLO 1 | 15 |  | 15 | TBD |
| Midterm Q# 4,5 | CLO 2 | 10 | 52 | 10 | TBD |
|  | **Total Midterm %** | | | **100%** | **25** |  |
|  | | | | | | |
| **Project/CCP**  **10** | Project/CCP | CLO 3 | 10 | **100** | 10 | TBD |
|  | **Total Project /CCP %** | | | **100%** | **10** |  |
|  | | | | | | |
| **Final Exam**  **40** | Final Exam Q#1 | CLO 1 | 5 | 25 | 5 | TBD |
| Final Exam Q#2,3 | CLO 2 | 12 | 25 | 12 | TBD |
|  | Final Exam Q# 4,5 | CLO 3 | 23 | 50 | 23 | TBD |
|  | **Total Final Exam %** | | | **100%** | **40** |  |
| **100** | **Total Marls** | | | | **100** |  |
| ***Note: Please make sure every CLO must be assessed at least 3 time.*** | | | | | | |

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| 1. **Weekly Plan** | | | | |
| **Week** | **Lecture No** | **Topic Covered** | **CLO** | **Assessment Tool** |
| 1 | 1 | Definition of technology, Definition of Entrepreneur , Definition and importance of Technopreneurship. | CLO1 |  |
| 2 | Evolution of technology and entrepreneurship | CLO1 |  |
| 3 | Overview of the technological landscape | CLO1 |  |
| 2 | 4 | Characteristics of successful Technopreneurship | CLO1 |  |
| 5 | Innovation and creativity in technopreneurship | CLO1 |  |
| 3 | Case studies of successful technopreneurs | CLO1 |  |
| 3 | 6 | Difference between Entrepreneurship and technopreneurship, Real-world examples of Technopreneurship | CLO1 | Quiz 1 |
| 7 | Trends in technology and market opportunities , Emerging Technologies (AI, IoT, Blockchain) , Identify opportunities in Tech market | CLO1 |  |
| 8 | Class Activity: Brainstorming session on potential tech business ideas. | CLO1 |  |
| 4 | 9 | Market research methods  plan for a selected idea. | CLO1 |  |
| 10 | Conducting market research, Validating business ideas | CLO1 |  |
| 11 | Class Activity: Develop a basic market research | CLO1 |  |
| 5 | 12 | Types of business models (B2B, B2C, etc.), Revenue generation strategies | CLO2 | Assignment 1 |
| 13 | Evaluate various business models suitable for tech businesses. | CLO2 |  |
| 14 | Lean startup methodology | CLO2 | Quiz 2 |
| 6 | 15 | Managing innovation in a tech startup, | CLO2 |  |
| 16 | The role of technology in business strategies | CLO2 |  |
| 17 | Class Activity: Case study analysis of a tech company’s innovation strategy. | CLO2 |  |
| **7** | 18 | Components of a comprehensive business plan, Executive summary, Market Analysis, Financial projections , Market analysis and competitive landscape, Structure and formatting of a business plan | CLO2 |  |
|  | 19 | Financial projections and funding strategies, Crafting an executive summary and elevator pitch, Peer review of business plan drafts | CLO2 |  |
|  | 20 | Pitch Presentations Discussion | CLO3 |  |
| **8** | **Midterm Exam** | | | |
| 9 | 21 | Types of funding (angel investors, venture capital, crowdfunding), Preparing Pitch for funds | CLO3 |  |
| 22 | Financial projections and budgeting, Financial Management for startups | CLO3 |  |
| 23 | Class Activity: Create a funding proposal for your tech business | CLO3 |  |
| 10 | 24 | Intellectual property rights, Business regulations and compliance | CLO3 |  |
| 25 | Business registration and structure | CLO3 |  |
| 26 | Contracts and agreements (non-disclosure, partnership), Compliance and regulatory issues | CLO2 |  |
| 11 | 27 | Branding and Marketing Strategies | CLO2 |  |
| 28 | Building a brand in the tech industry | CLO2 | Assignment 2 |
| 29 | Digital marketing strategies | CLO2 |  |
| 12 | 30 | Leadership and team dynamics, Role of leadership in a tech startup | CLO2 |  |
| 31 | Building a diverse and skilled team | CLO2 |  |
| 32 | Conflict resolution and team dynamics | CLO2 | Quiz 3 |
| 13 | 33 | Developing a sales strategy | CLO2 |  |
| 34 | Customer acquisition strategies | CLO2 |  |
| 35 | Customer retention strategies | CLO2 |  |
| 14 | 36 | Challenges in Technopreneurship | CLO2 |  |
| 37 | Common challenges faced by technopreneurs | CLO2 |  |
| 38 | Risk management strategies | CLO2 |  |
| 15 | 39 | Pitching Technological Venture | CLO3 | Assignment 2 |
| 40 | Crafting a compelling pitch | CLO3 | Quiz 3 |
| 41 | Presentation skills for entrepreneurs , Prepare for a business pitch to potential investors | CLO3 |  |
| 16 | 42 | Pitch presentations followed by Q&A | CLO3 |  |
| 43 | Pitch presentations followed by Q&A | CLO3 |  |
| 44 | Pitch presentations followed by Q&A | CLO3 |  |
| **17** | **Final Exam** | | | |

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| 1. **IU Assessment / grading Policy** | **Instructor grading for course \*** |
| Quizzes 10-15%  Assignments 10-15%  Projects/Presentation/CCP 0-10%  Mid Semester Examination/ 20-30%  End Semester Examination 40-50% | 15 Marks  10 Marks  10 Marks  25 Marks  40 Marks |

## SEMESTER 8

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| **S.No** | **Course Code** | **Title** | **Cr.Hrs** |
| 1 | GER443 | Civics and Community Engagement | 2 + 0 |
| 2 | GER463 | Professional Practices | 2 + 0 |
| 3 | CMC492 | Final Year Project - II | 0 + 3 |
| 4 | CSEXXX | Domain Elective 6 | 2 + 1 |
| 5 | CSEXXX | Domain Elective 7 | 2 + 1 |
|  |  |  | **8+5 (13)** |

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| IQRA University (IU) | | |
| Faculty of Engineering Sciences and Technology (FEST) | | |
| Computer Science Department (CS) | | |
| Course Code | Course Name | Credit Hr |
| GER443 | Civics and Community Engagement | 2+0 |

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| 1. Basic Information | | | |
| Instructor |  | Designation | Senior Lecturer |
| Prerequisite(s) | - | Semester | Fall 2024 |
| Email | @iqra.edu.pk | Phone | 0300-xxxxxxx |
| Consulting Hours | Fri 09:30 PM to 10:30 PM | Office Location | X Floor Faculty Room (X Cubicle) |

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| 1. **Course Objective(s)** |
| This course explores civic responsibility, active citizenship, and the principles of community engagement. It emphasizes understanding democratic processes, community challenges, and the development of strategies for meaningful participation. The course integrates theoretical foundations with practical activities to promote civic engagement. |

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| 1. **Course Contents** |
| This course introduces the foundational concepts of civics, citizenship, and democratic governance, emphasizing rights, responsibilities, and civic identity. Students will analyze community challenges such as inequality, environmental issues, and social justice while learning strategies for effective community engagement and ethical decision-making. The course highlights civic leadership and advocacy, focusing on practical tools for mobilizing social change. Through a hands-on community engagement project, students design and implement initiatives to address real-world issues. By the end, students will develop critical skills and values for active citizenship and meaningful community participation. |

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| 1. **Course Learning Outcomes** | | | | | | |
| **CLOs** | **CLO Statement** | **BT Level** | **Mapping** | | | **% Weight** |
| **GAs** | **ACM KA** | **SGDs** |  |
| CLO1 | ***Explain*** foundational concepts of civics, citizenship, and community engagement. | C2 | GA8 | #18  SEP | 16 and 17 | 33% |
| CLO2 | ***Analyze*** civic challenges and evaluate the effectiveness of community engagement strategies. | C4 | GA9 | 32% |
| CLO3 | Actively ***participate*** in designing and implementing initiatives to address civic and community issues. | A4 | GA10 | 35% |
| ***Note: On successful completion of course GA1 (Academic Education) will automatically attain.*** | | | | | | |

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| 1. **Course Textbook / Reference Books and Supplementary Reading Material** | | | |
| **S No** | **Book Title** | **Author(s)** | **Edition/ publication year/publisher** |
|  | Civics Today: Citizenship, Economics, & You” | Remy, Patrick J. | 6th Edition / 2009 / McGraw-Hill Education. |
|  | Citizenship in Diverse Societies | Will Kymlicka and Wayne Norman | 1st Edition / 2000 / Oxford |
|  | Digital Citizenship in Action: Empowering Students to Engage in Online Communities: | Kristen Mattson | 2nd Edition / 2024 / Pearson |
|  | Engaging Young People in Civic Life | James Youniss, Peter Levine | 1st Edition / 2009 / Vanderbilt University Press |
|  | Community Engagement for Sustainable Practices in Higher Education | Prabhat Mittal, Rachna Bansal | 1st Edition / 2024 / Springer Nature Switzerland |

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| 1. **CLO Outcome Based Assessment (OBA) Tentative** | | | | | | |
| **Assessment Tool** | | **CLO Mapped** | **CLO Marks** | **% Weight** | **Total Marks** | **Assessment Date** |
| **Quizzes**  **15** | Quiz #1 | *CLO1* | 05 | 33.3 | 5 | TBD |
| Quiz #2 | *CLO2* | 05 | 33.3 | 5 | TBD |
| Quiz #3 | *CLO3* | 05 | 33.3 | 5 | TBD |
| **Total Quizzes %** | | | **100%** | **15** |  |
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| **Assignments**  **15** | Assignment #1 | *CLO1* | 05 | 33.3 | 5 | TBD |
| Assignment #2 | *CLO2* | 05 | 33.3 | 5 | TBD |
| Assignment #3 | *CLO3* | 05 | 33.3 | 5 | TBD |
|  |  | | | **100%** | **15** |  |
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| **Midterm**  **25** | Midterm Q#1 | *CLO1* | 13 | 52 | 13 | TBD |
| Midterm Q#2 | *CLO2* | 12 | 48 | 12 | TBD |
|  | **Total Midterm %** | | | **100%** | **25** |  |
|  | | | | | | |
| **Project/CCP**  **05** | Project/CCP | *CLO3* | 5 | 100 | **5** | TBD |
|  | **Total Project /CCP %** | | | **100%** | **5** |  |
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| **Final Exam**  **40** | Final Exam Q#1 | *CLO1* | 10 | 10 | 10 | TBD |
| Final Exam Q#2 | *CLO2* | 10 | 10 | 10 | TBD |
| Final Exam Q#3 | *CLO3* | 20 | 20 | 20 | TBD |
|  | **Total Final Exam %** | | | **100%** | **40** |  |
| **100** | **Total Marks** | | | | **100** |  |
| ***Note: Please make sure every CLO must be assessed at least 3 time.*** | | | | | | |

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| 1. **Weekly Plan** | | | | |
| **Week** | **Lecture No** | **Topic Covered** | **CLO** | **Assessment Tool** |
| 1 | 1 | Introduction to Civics and Citizenship: Definitions and Importance | CLO1 |  |
| 2 | Types of Citizenship: Active, Participatory, Digital | CLO1 |  |
| 2 | 3 | Relationship Between Democracy and Citizenship | CLO1 |  |
| 4 | Concepts of Civics, Citizenship, and Civic Engagement, Foundations of Modern Society and Citizenship | CLO2 |  |
| 3 | 5 | Structure of Government in Pakistan | CLO1 | Quiz 1 |
| 6 | Functions of Government in Pakistan, Relationship Between Democracy and Civil Society | CLO1 |  |
| 4 | 7 | Right to Vote: Importance and History | CLO1 | Assignment 1 |
| 8 | Political Participation and Representation, Fundamental Rights Under the Constitution of Pakistan 1973 | CLO1 |  |
| 5 | 9 | Civic Responsibilities and Duties | CLO2 |  |
| 10 | Ethical Considerations in Civic Engagement: Accountability and Non-Violence, Ethical Considerations: Peaceful Dialogue and Civility | CLO2 |  |
| 6 | 11 | Community Engagement: Concepts and Characteristics | CLO2 | Quiz 2 |
| 12 | Community Development and Social Cohesion, Approaches to Effective Community Engagement | CLO1 |  |
| 7 | 13 | Case Studies of Successful Community-Driven Initiatives, Public Discourse and Public Opinion | CLO2 |  |
|  | 14 | Project Discussion | CLO2 | Project Announced |
| **8** | **Midterm Exam** | | | |
| 9 | 15 | Role of Advocacy in Addressing Social Issues | CLO1 |  |
| 16 | Introduction to Social Action Movements, Examples of Historical and Contemporary Movements | CLO1 |  |
| 10 | 17 | Digital Citizenship: Definitions and Scope | CLO2 | Assignment 2 |
| 18 | Civic Engagement Through Digital Platforms, Cyber Ethics and Responsible Use of Social Media | CLO2 |  |
| 11 | 19 | Digital Divides: Access and Usage Issues | CLO2 |  |
| 20 | Socioeconomic and Geographic Impacts on Citizenship, Addressing the Digital Divide: Policies and Solutions | CLO2 |  |
| 12 | 21 | Advocacy and Activism in a Digital Age | CLO2 |  |
| 22 | Role of Technology in Social Movements, Case Studies: Digital Advocacy Campaigns | CLO2 |  |
| 13 | 23 | Rights and Liberties in Comparative Contexts | CLO1 |  |
| 24 | Challenges in Ensuring Fundamental Rights, International Perspectives on Citizenship | CLO1 |  |
| 14 | 25 | Balancing Rights and Responsibilities | CLO1 |  |
| 26 | Fostering Civic Engagement Through Education, Community Engagement: Best Practices | CLO3 | Assignment 3 |
| 15 | 27 | Introduction to SDGs: Relevance to Civics and Citizenship  Practical Applications: Community Projects Addressing SDGs | CLO3 | Quiz 3 |
| 28 | Inspiring real-world change through community involvement | CLO3 |  |
| 16 | 29 | Project Submission | CLO3 |  |
| 30 | Project Submission | CLO3 |  |
| **17** | **Final Exam** | | | |

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| 1. **IU Assessment / grading Policy** | **Instructor grading for course \*** |
| Quizzes 10-15%  Assignments 10-15%  Projects/Presentation/CCP 0-10%  Mid Semester Examination/ 20-30%  End Semester Examination 40-50% | 15%  15%  05%  25%  40% |

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| **IQRA University (IU)** | | |
| **Faculty of Engineering Sciences and Technology (FEST)** | | |
| **Computer Science Department (CS)** | | |
| **Course Code** | **Course Name** | **Credit Hr** |
| **GER463** | Professional Practices | **2+0** |

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| 1. **Basic Information** | | | |
| Instructor |  | Designation | Senior Lecturer |
| Prerequisite(s) | None | Semester | Fall 2024 |
| Email | @iqra.edu.pk | Phone | 0300-xxxxxxx |
| Consulting Hours | Fri 09:30 PM to 10:30 PM | Office Location | X Floor Faculty Room (X Cubicle) |

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| 1. **Course Objective(s)** |
| * Develop self-awareness and self-discipline sufficient to enable students to apply their knowledge, values, and skills when working with client system. * Develop critical thinking skills and an inquiring interest in professional issues and knowledge along with a commitment to the ethical principles of Social Work and the development of a professional identity. * There are seven educational objectives addressed within four areas: the organizational context of practice, the community context of practice, the social work skills context of practice and the professional context of practice. * Foster professional development wherein personal and professional skills are promoted in the interest of competent professional practice. * Develop practice competence as an entry level professional in generalist social work practice within the organization, the community, social work skills of assessment, planning and evaluation, and the profession. |

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| 1. **Course Contents** |
| This course provides a foundational understanding of law and ethics, focusing on the essential attributes, origin, and importance of law in ensuring justice. It explores the intersection of law and ethics, particularly emphasizing religion and ethics, with a focus on Islamic ethics and the Code of Ethics by the Pakistan Engineering Council (PEC). Students will examine professionalism, ethical challenges, and common misconduct in organizations, along with unethical behaviors. Key topics include the PEC Code of Conduct (SRO 1463 (1) / 78), the ACM Code of Ethics, and the IEEE Code of Ethics. The course also covers essential elements of legal contracts such as offer, acceptance, and the mirror image rule. Students will study harassment, including its causes, definition, punishment, and reporting procedures, as well as anger management strategies. Additionally, the course addresses time management, including its benefits, symptoms of poor management, barriers, and strategies for overcoming distractions to improve productivity. |

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| 1. **Course Learning Outcomes** | | | | | | |
| CLOs | CLO Statement | BT Level | Mapping | | | % Weight |
| GAs | ACM KA | SGDs |
| CLO1 | *Understand* computing ethical issues and their impact on individuals, professionals, and society by applying ethical and moral frameworks. Illustrate how human values and ethical principles can be used to identify, assess, and resolve ethical dilemmas in professional contexts, including a thorough examination of their root causes. | C2 | GA-10 | #18  SEP | 8 | 50% |
| CLO2 | *Apply* financial principles to professional practice by calculating compound interest, analyzing annuity structures, and evaluating costing strategies to make informed decisions and develop cost-effective solutions in professional contexts. | C3 | GA-8 | 30% |
| CLO3 | *Present* well-organized and ethical thoughts orally to an audience in a formal environment as a professional. | A2 | GA-9 | 20% |
| *Note: On successful completion of course GA 1 (Academic Education) will automatically attain.* | | | | | | |

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| 1. **Course Textbook / Reference Books and Supplementary Reading Material** | | | |
| **S No** | **Book Title** | **Author(s)** | **Edition/ publication year/publisher** |
|  | Engineering Ethics | Charles E. Harris Jr., Michael S. Pritchard, Ray W. James, Elaine E. Englehardt, and Michael J. Rabins | 6th Edition / 2015 / Cengage Learning |
|  | PEC Code of Conduct (SRO 1463 (1) / 78 | Pakistan Engineering Council (PEC) | Pakistan Engineering Council Website |
|  | Professional Engineering Practice: Ethical and Legal Aspects | Charles B. Fleddermann | 4th Edition / 2012 / Pearson |
| 4. | Ethics in Information Technology | George Reynolds | 6th Edition / 2018 / Cengage Learning |

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| 1. **CLO Outcome Based Assessment (OBA) Tentative** | | | | | | |
| Assessment Tool | | CLO Mapped | CLO Marks | % Weight | Total Marks | Assessment Date |
| Quizzes  10 | Quiz #1 | CLO 1 | 2 | 20 | 2 | TBD |
| Quiz #2 | CLO 2 | 3 | 30 | 3 | TBD |
| Quiz #3 | CLO 3 | 5 | 50 | 5 | TBD |
| Total Quizzes % | | | 100% | 10 |  |
|  | | | | | | |
| Assignments  15 | Assignment #1 | CLO 1 | 5 | 33.3 | 5 | TBD |
| Assignment #2 | CLO 2 | 5 | 33.3 | 5 | TBD |
| Assignment #3 | CLO 3 | 5 | 33.3 | 5 | TBD |
| Total Assignments % | | | 100% | 15 |  |
|  | | | | | | |
| Midterm  25 | Midterm Q#1 | CLO 1 | 4 | 16 | 4 | TBD |
| Midterm Q#2 | CLO 1 | 6 | 24 | 6 | TBD |
| Midterm Q#3 | CLO 1 | 4 | 16 | 4 | TBD |
| Midterm Q#4 | CLO 1 | 6 | 25 | 6 | TBD |
| Midterm Q#5 | CLO 1 | 5 | 20 | 5 | TBD |
|  | Total Midterm % | | | 100% | 25 |  |
|  | | | | | | |
| Presentations/Project/CCP  10 | Project/CCP | CLO3 | 10 | 100% | 10 | TBD |
|  | Total Project /CCP % | | | 100% | 10 |  |
|  | | | | | | |
| Final Exam  40 | Final Exam Q#1 | CLO1 | 10 | 25 | 10 | TBD |
| Final Exam Q#2 | CLO1 | 8 | 20 | 8 | TBD |
| Final Exam Q#3 | CLO2 | 8 | 20 | 8 | TBD |
| Final Exam Q#4 | CLO2 | 8 | 20 | 8 | TBD |
| Final Exam Qn5 | CLO2 | 6 | 15 | 6 | TBD |
|  | Total Final Exam % | | | 100% | 40 |  |
| 100 | Total Marks | | | | 100 |  |
| *Note: Please make sure every CLO must be assessed at least* 3 time. | | | | | | |

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| 1. **Weekly Plan** | | | | |
| Week | Lecture No | Topic Covered | CLO | Assessment Tool |
| 1 | 1 | Fundamentals of Laws & Ethics: Understanding Law | CLO1 |  |
| 2 | Attributes of Law, Origin of Law, Importance of Law, the essences of law to ensure justice. | CLO1 |  |
| 2 | 3 | Personal Vision Statement | CLO1 |  |
| 4 | Understanding Ethics (Morality), Corporate Scenarios regarding ethics. | CLO1 | A1 |
| 3 | 5 | Software Uses, Misuses, and the Criminal Law, Regulation and Control of Personal Information | CLO1 |  |
| 6 | British Computer Society (BCS) Code of Conduct, Intellectual Property and Software Law (Cyber Law) | CLO1 | Q1 |
| 4 | 7 | Religion & Ethics (Verses of Holy Quran recommended by PEC) | CLO1 |  |
| 8 | Profession and Professionalism | CLO1 |  |
| 5 | 9 | Common Misconduct in Organizations & Common Causes of Unethical Behavior | CLO1 | Q2 |
| 10 | PEC Code of Conduct (SRO 1463 (1) / 78), ACM Code of Ethics and Professional Conduct & IEEE Code of Ethics | CLO1 |  |
| 6 | 11 | Introduction to Human Resource Management | CLO1 |  |
| 12 | Human Resource Management Process | CLO1 |  |
| 7 | 13 | Promises, Agreements & Contracts: Essential Elements of a Legal Contract , Consideration, Validity of Contract (Bi-directional Consideration) | CLO1 |  |
| 14 | Project Discussion | CLO1 | Project |
| 8 | **Midterm Exam** | | | |
| 9 | 15 | Affection based Contracts, Essential Elements of Consideration, Capacity and its elements | CLO1 |  |
| 16 | Meaning of Consent and Free Consent, Lawful Object | CLO1 |  |
| 10 | 17 | Harassment: Causes of Harassment | CLO1 | A2 |
| 18 | Definition of harassment. Punishment of harassment, standing committee, procedure to report harassment | CLO1 |  |
| 11 | 19 | Financial Mathematics | CLO2 |  |
| 20 | Annuities | CLO2 | Q3 |
| 12 | 21 | Cost mathematics | CLO2 |  |
| 22 | Time management: Benefits of Time Management, Symptoms of Poor Time Management | CLO1 |  |
| 13 | 23 | Barriers to Effective Time Management, Distractions, Disorganization, Procrastination, Rigidity, IMPORTANT, URGENT, Stephen Covey Matrix, the ‘STOP’ Strategy | CLO1 |  |
| 24 | Anger Management, Causes and reasons of anger & Anxiety | CLO1 |  |
| 14 | 25 | Tips and strategies for anger management | CLO1 |  |
| 26 | Conflict Management | CLO1 | A3 |
| 15 | 27 | Conflict Management different styles | CLO1 |  |
| 28 | Corporate Scenarios regarding Conflict Management | CLO1 |  |
| 16 | 29 | Presentation | CLO3 |  |
| 30 | Presentation | CLO3 |  |
| 17 | **Final Exam** | | | |

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| 1. **IU Assessment / grading Policy** | **Instructor grading for course \*** |
| Quizzes 10-15%  Assignments 10-15%  Projects/Presentation/CCP 0-10%  Mid Semester Examination/ 20-30%  End Semester Examination 40-50% | 10%  15%  10%  25%  40% |

## ELECTIVES

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| **S.No** | **Course Code** | **Title** | **Cr.Hrs** |
| 1 | GER261 | Introduction to Management | 2+0 |
| 2 | ESC311 | Introduction To Marketing | 3+0 |
| 3 | CSEXXX | Artificial Neural Networks | 3+0 |
| 4 | CSEXXX | Internet of Things (IoT) | 3+0 |

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| IQRA University (IU) | | |
| Faculty of Engineering Sciences and Technology (FEST) | | |
| Computer Science Department (CS) | | |
| Course Code | Course Name | Credit Hr |
| GER261 | Introduction to Management | 2+0 |

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| 1. Basic Information | | | |
| Instructor |  | Designation | Senior Lecturer |
| Prerequisite(s) | - | Semester | Fall 2024 |
| Email | @iqra.edu.pk | Phone | 0300-xxxxxxx |
| Consulting Hours | Fri 09:30 PM to 10:30 PM | Office Location | X Floor Faculty Room (X Cubicle) |

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| 1. **Course Objective(s)** |
| This course introduces the basic topics of management, provides the students with an understanding of what the job of a manager involves. In addition to covering the basic theoretical concepts, the course also allows the students to have some hands-on practice as an effective manager. |

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| 1. **Course Contents** |
| The "Introduction to Management" course explores foundational management principles and practices. It begins by defining management, examining managers' roles, and understanding organizational responsibilities. Students study the evolution of management through classical, behavioral, quantitative, and contemporary approaches. Topics include organizational culture, external environments, decision-making, strategic planning, and managing change. Advanced modules cover organizational structure, team dynamics, motivation theories, leadership models, and performance control. Through case studies and discussions, students analyze strategies, decision-making processes, and methods to foster innovation and creativity. The course emphasizes applying theoretical knowledge to real-world scenarios, preparing students for leadership and effective management in dynamic environments. |

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| 1. **Course Learning Outcomes** | | | | | | |
| **CLOs** | **CLO Statement** | **BT Level** | **Mapping** | | | **% Weight** |
| **GAs** | **ACM KA** | **SGDs** |  |
| CLO1 | **Demonstrate** an understanding of the fundamental concepts and functions of management. | C2 | GA3 | #18  SP | 18 and  17 | 33.3% |
| CLO2 | **Employ** management techniques to solve simple organizational problems and showcase decision-making. | C3 | GA3 | 33.3% |
| CLO3 | **Analyze** management practices and case studies to identify opportunities and challenges in organizations. | A3 | GA6 | 33.3% |
| ***Note: On successful completion of course GA1 (Academic Education) will automatically attain.*** | | | | | | |

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| 1. **Course Textbook / Reference Books and Supplementary Reading Material** | | | |
| **S No** | **Book Title** | **Author(s)** | **Edition/ publication year/publisher** |
|  | Management | Stephen P. Robbins & Mary Coulter | 14th Edition / 2017 / Pearson Education |
|  | Management Leading and Collaborating in a competitive world. | Bateman,T.S& Snell | 13th Edition /2018/ McGraw-Hill |
|  | Management: A Pacific Rim focus | Bartol, K, Tein, M, Matthews, G, Sharma, B & Scott-Laden B | 6th Edition / 2011 / McGraw-Hill |
|  | Organisational behaviour on the Pacific Rim | McShane, S, Travaglione, T & Olekalns M | 3rd Edition / 2009 / McGraw-Hill |
|  | Contemporary issues in management and organisational behaviour | Murray, P, Poole, D & Jones, G | 1st Edition / 2006 Thomson Learning |

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| 1. **CLO Outcome Based Assessment (OBA) Tentative** | | | | | | |
| **Assessment Tool** | | **CLO Mapped** | **CLO Marks** | **% Weight** | **Total Marks** | **Assessment Date** |
| **Quizzes**  **15** | Quiz #1 | *CLO1* | 05 | 33.33% | 5 | TBD |
| Quiz #2 | *CLO2* | 05 | 33.33% | 5 | TBD |
| Quiz #3 | *CLO3* | 05 | 33.34% | 5 | TBD |
| **Total Quizzes %** | | | **100%** | **15** |  |
|  | | | | | | |
| **Assignments**  **15** | Assignment #1 | *CLO1* | 05 | 33.33% | 5 | TBD |
| Assignment #2 | *CLO2* | 05 | 33.33% | 5 | TBD |
| Assignment #3 | *CLO3* | 05 | 33.34% | 5 | TBD |
|  |  | | | **100%** | **15** |  |
|  | | | | | | |
| **Midterm**  **25** | Midterm Q#1 | *CLO1* | 13 | 52% | **13** | TBD |
| Midterm Q#2 | *CLO2* | 12 | 48% | **12** | TBD |
|  | **Total Midterm %** | | | **100%** | **25** |  |
|  | | | | | | |
| **Project/CCP**  **05** | Project/CCP | *CLO3* | 5 | 100% | **5** | TBD |
|  | **Total Project /CCP %** | | | **100%** | **5** |  |
|  | | | | | | |
| **Final Exam**  **40** | Final Exam Q#1 | *CLO1* | 10 | 25% | **10** | TBD |
| Final Exam Q#2 | *CLO2* | 10 | 25% | **10** | TBD |
| Final Exam Q#3 | *CLO3* | 20 | 50% | **20** | TBD |
|  | **Total Final Exam %** | | | **100%** | **40** |  |
| **100** | **Total Marks** | | | | **100** |  |
| ***Note: Please make sure every CLO must be assessed at least 3 time.*** | | | | | | |

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| 1. **Weekly Plan** | | | | |
| **Week** | **Lecture No** | **Topic Covered** | **CLO** | **Assessment Tool** |
| 1 | 1 | **Introduction to Management** Introduction to the course and faculty, understanding managers' roles. | CLO1 |  |
| 2 | Defining management and organizational responsibilities | CLO1 |  |
| 3 | Exploring the importance of studying management. | CLO1 |  |
| 2 | 4 | **Management History:** Evolution of management from early methods to modern approaches. | CLO1 |  |
| 5 | Examining the Classical Approach and Behavioral Approach | CLO2 |  |
| 6 | Analyzing the Quantitative and Contemporary Approaches | CLO2 |  |
| 3 | 7 | **Organizational Culture:** Constraints and Challenges Exploring managers' roles as omnipotent or symbolic figures. | CLO1 |  |
| 8 | Analyzing external environments and managerial discretion. | CLO2 |  |
| 9 | Dimensions of organizational culture & differences between strong vs. weak cultures. | CLO2 |  |
| 4 | 10 | **The Environment: Constraints and Challenges:** Learning organizational culture and external environment components. | CLO1 |  |
| 11 | Exploring environmental uncertainty and its effects. | CLO2 | Quiz 1,  Assignment 1 |
| 12 | Understanding the Environmental Uncertainty Matrix. | CLO3 |  |
| 5 | 13 | **Making Decisions:** Decision-making process and key decision-making approaches. | CLO1 |  |
| 14 | Types of decisions and problem-solving strategies | CLO2 |  |
| 15 | Conditions under which managers make decisions. | CLO2 |  |
| 6 | 16 | **Foundations of Planning:** Understanding planning and its role in organizational success. | CLO2 |  |
| 17 | Setting goals and developing strategic plans. | CLO1 |  |
| 18 | Relationship between planning and organizational performance | CLO3 |  |
| 7 | 19 | **Managing Change and Innovation:** Exploring the organizational change process and key change areas. | CLO2 | Quiz 2,  Assignment 2 |
| 20 | Implementing strategies for managing organizational change. | CLO2 |  |
| 21 | Strategies for stimulating innovation and creativity | CLO2 | CCP Announced |
| **8** | Midterm Exam | | | |
| 9 | 22 | **Managing Strategy:** Analyzing strategic management processes and strategic goals | CLO1 |  |
| 23 | Exploring types of organizational strategies | CLO1 |  |
| 24 | Understanding competitive strategies and market competition | CLO1 |  |
| 10 | 25 | **Organizational Structure and Designing:** Understanding organizational structure and performance impact. | CLO3 |  |
| 26 | Exploring the six elements of organizational design. | CLO3 |  |
| 27 | Comparing mechanistic vs. organic structures and analyzing contingency factors. | CLO3 |  |
| 11 | 28 | **Creating and Managing Teams** Group development stages and team performance | CLO1 |  |
| 29 | Identifying strategies to improve team satisfaction | CLO2 |  |
| 30 | Transforming groups into goal-oriented, effective teams | CLO3 |  |
| 12 | 31 | **Motivating Employees:** Exploring motivation theories and concepts | CLO1 |  |
| 32 | Analyzing theories like Maslow’s, Herzberg’s, and McGregor’s theories. | CLO2 |  |
| 33 | Exploring reinforcement, equity, and goal-setting theories. | CLO3 | Quiz 3,  Assignment 3 |
| 13 | 34 | **Controlling:** Understanding the control process and its importance. | CLO1 |  |
| 35 | Analyzing organizational performance monitoring | CLO1 |  |
| 36 | Identifying tools to enhance organizational efficiency. | CLO3 |  |
| 14 | 37 | **Managers as Leaders:** Exploring leadership roles and early leadership theories | CLO1 |  |
| 38 | Analyzing trait theories | CLO3 |  |
| 49 | behavioral theories. | CLO3 |  |
| 15 | 40 | Examining contingency theories like Fiedler's model | CLO1 |  |
| 41 | Hersey and Blanchard’s SLT | CLO3 |  |
| 42 | Path Goal Model | CLO3 |  |
| 16 | 43 | Project / CCP Discussion and Group Submission | 1/2/3 | CCP Submission |
| 44 |
| 45 |
| **17** | **Final Exam** | | | |

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| 1. **IU Assessment / grading Policy** | **Instructor grading for course \*** |
| Quizzes 10-15%  Assignments 10-15%  Projects/Presentation/CCP 0-10%  Mid Semester Examination/ 20-30%  End Semester Examination 40-50% | 15%  15%  05%  25%  40% |

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| **IQRA University (IU)** | | |
| **Faculty of Engineering Sciences and Technology (FEST)** | | |
| **Computer Science Department (CS)** | | |
| **Course Code** | **Course Name** | **Credit Hr** |
| **ESC311** | Introduction To Marketing | **3+0** |

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| 1. **Basic Information** | | | |
| Instructor | Beenish Ahmed | Designation | Senior Lecturer |
| Prerequisite(s) | None | Semester | Fall 2024 |
| Email | beenish@iqra.edu.pk | Phone | 03452363360 |
| Office Hours | 3 + 0 | Office Location | Faculty Cubicle, 5th Floor |

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| 1. **Course Objective(s)** |
| The course aims to enable students to understand how well-thought-out and carefully implemented marketing strategies can contribute to the success of businesses in a competitive environment. It seeks to provide an understanding of the marketing process from both the consumer's and the firm's perspectives. Students will gain a basic but comprehensive understanding of the real world of marketing, allowing them to assess marketing strategies for products or services from both organizational and societal viewpoints. The course also lays the foundation for more advanced studies and provides work experience guidelines. It establishes connections between academic research and business development, especially for students majoring in marketing. For those majoring in other disciplines, the course helps students understand how marketing impacts their functional areas and aims to make them more responsible and informed consumers. Ultimately, the course aims to equip students with a solid grasp of basic marketing theories and practices, enabling them to make more informed purchasing decisions. |
| 1. **Course Contents** |
| This course helps you to develop a real and practical understanding of the basics of marketing, both as a management tool and as a force in our society. Through an exploration of basic concepts, principles and activities in modern marketing, you will learn to develop and bring to the market products (goods or services) that create value for customers. |

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| 1. **Course Learning Outcomes** | | | | | | |
| **CLOs** | **CLO Statement** | **BT Level** | **Mapping** | | | **% Weight** |
| **GAs** | **ACM KA** | **SGDs** |
| CLO1 | **Understanding** of marketing principles, including customer value creation, consumer behavior analysis, and the design of customer-driven marketing strategies to meet evolving marketplace needs. | C2 | GA-8 | #18  SP | 17 | 31% |
| CLO2 | **Analyze** marketing research, segmentation, targeting, and positioning to design strategies that align with organizational goals and customer expectations to build sustainable customer relationships and drive business growth. . | C4 | GA-7 | 34% |
| CLO 3 | **Demonstrate** effective presentation skills by delivering clear and persuasive marketing content using appropriate tools and techniques. Analyze and communicate marketing strategies to diverse audiences. | A2 | GA-9 |  |  | 35% |
| ***Note: On successful completion of course GA 1 (Academic Education) will automatically attain.*** | | | | | | |

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| 1. **Course Textbook / Reference Books and Supplementary Reading Material** | | | |
| **S No** | **Book Title** | **Author(s)** | **Edition/ publication year/publisher** |
|  | Principles of Marketing | Philip Kotler and Gary Armstrong | 17th Edition |

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| 1. **CLO Outcome Based Assessment (OBA)** | | | | | | |
| **Assessment Tool** | | **CLO Mapped** | **CLO Marks** | **% Weight** | **Total Marks** | **Assessment Date** |
| **Quizzes**  **10** | Quiz #1 | CLO 1 | 3 | 30% | 3 | TBD |
| Quiz #2 | CLO 2 | 3 | 30% | 3 | TBD |
| Quiz #3 | CLO 3 | 4 | 40% | 4 | TBD |
| **Total Quizzes %** | | | **100%** | 10 |  |
|  | | | | | | |
| **Assignments**  **15** | Assignment #1 | CLO 1 | 5 | 33% | 5 | TBD |
| Assignment #2 | CLO 2 | 5 | 33% | 5 | TBD |
| Assignment #3 | CLO 3 | 5 | 33% | 5 | TBD |
| **Total Assignments %** | | | **100%** | 15 |  |
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| **Midterm**  **25** | Midterm Q#1 | CLO 1 | 5 | 20% | **5** | TBD |
| Midterm Q#2 | CLO 1 | 5 | 20% | **5** | TBD |
| Midterm Q#3 | CLO 1 | 5 | 20% | **5** | TBD |
| Midterm Q#4 | CLO 2 | 5 | 20% | **5** | TBD |
| Midterm Q#5 | CLO 2 | 5 | 20% | **5** | TBD |
|  | **Total Midterm %** | | | **100%** | **25** |  |
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| **Project/CCP**  **10** | Project/CCP | CLO3 | 10 | **100%** | **10** | **TBD** |
|  | **Total Project /CCP %** | | | **100%** | **10** |  |
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| **Final Exam**  **40** | Final Exam Q#1 | CLO1 | 8 | 20% | 8 | TBD |
| Final Exam Q#2 | CLO2 | 8 | 20% | 8 | TBD |
| Final Exam Q#3 | CLO2 | 8 | 20% | 8 | TBD |
| Final Exam Q#4 | CLO3 | 8 | 20% | 8 | TBD |
| Final Exam Qn5 | CLO3 | 8 | 20% | 8 | TBD |
|  | **Total Final Exam %** | | | **100%** | **40** |  |
| **100** | **Total Marks** | | | | **100** |  |
| **Note: Please make sure every CLO must be assessed at least 3 time.** | | | | | | |

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| **7. Weekly Plan** | | | | |
| **Week** | **Lecture**  **No** | **Topic Covered** | **CLO** | **Assessment Tool** |
| 1 | 1 | Marketing: Creating and capturing Customer Value | 1 |  |
| 2 | Understanding the marketplace and customer need  Designing a customer-driven marketing strategy | 1 |  |
| 3 | Building customer relationship  Creating and capturing customer value | 1 |  |
| 2 | 1 | Analyzing the marketing environment | 2 |  |
| 2 | The Microenvironment and Macro-environment | 2 |  |
| 3 | Responding to the Marketing environment | 2 |  |
| 3 | 1 | Managing Marketing Information to gain Customer insights | 1 | Q1 |
| 2 | Marketing Information systems | 1 | A1 |
| 3 | Marketing research  Customer relationship management | 2 |  |
| 4 | 1 | Consumer Markets and Consumer Buyer Behavior | 1 |  |
| 2 | Model of Consumer Behavior | 2 | A2 |
| 3 | Characteristics Affecting Consumer Behavior  The Buyer Decision Process | 2 |  |
| 5 | 1 | Business Markets and Business Buyer Behavior | 1 |  |
| 2 | Business Markets  Business Buyer Behavior | 2 |  |
| 3 | E- Procurement  Institutional and Government Markets | 2 |  |
| 6 | 1 | Customer-Driven Marketing Strategy: Creating Value for Target Customers | 2 |  |
| 2 | Market Segmentation, Segmenting Consumer Markets and Business markets | 2 | Q2 |
| 3 | Market Targeting  Differentiation and Positioning | 2 |  |
| 7 | 1 | Products, Services, and Brands: Building Customer Value | 1 |  |
| 2 | Products, Services, and Experiences | 1 |  |
| 3 | Product and Service Decisions | 2 |  |
| 8 | **MIDTERM** | |  |  |
| 9 | 1 | New Product Development and Product Life-Cycle Strategies | 1 |  |
| 2 | The New-Product Development management tools | 2 |  |
| 3 | Managing New- Product Development and Positioning | 2 |  |
| 10 | 1 | Pricing: Understanding and Capturing Customer Value | 2 |  |
| 2 | Defining Price &Major Pricing Strategies | 1 |  |
| 3 | Internal and External Considerations Affecting Price Decisions | 1 |  |
| 11 | 1 | Pricing Strategies | 1 |  |
| 2 | New-Product Pricing Strategies, Product Mix Pricing Strategies | 2 |  |
| 3 | Price Adjustment Strategies and Price Changes | 1 |  |
| 12 | 1 | Marketing Channels: Delivering Customer Value | 2 |  |
| 2 | Supply Chains and the Value Delivery Network | 1 |  |
| 3 | Channel Behavior and Organization  Channel Design and management Decisions | 2 |  |
| 13 | 1 | Advertising and Public Relations, Personal Selling and Sales Promotion | 2 |  |
| 2 | Advertising, Personal Selling | 2 |  |
| 3 | Sales Promotion | 2 |  |
| 14 | 1 | Direct Marketing. Building Direct customer relationships. | 1 |  |
| 2 | The New Direct Marketing Model, Direct Marketing and Forms of Direct Marketing | 2 |  |
| 3 | Public Policy and ethical Issues in Direct Marketing and Importance of data in marketing decision-making | 2 |  |
| 15 | 1 | Digital Marketing and E-commerce | 1 |  |
| 2 | Online marketing strategies | 2 |  |

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| 1. **IU Assessment / grading Policy** | **Instructor grading for course \*** |
| Quizzes                                                    10-15%  Assignments                                            10-15%  Projects/Presentation/CCP                        0-10%  Mid Semester Examination/                     20-30%  End Semester Examination                     40-50% | 10%  15%  10%  25%  40% |

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| **IQRA University (IU)** | | |
| **Faculty of Engineering Sciences and Technology (FEST)** | | |
| **Computer Science Department (CS)** | | |
| **Course Code** | **Course Name** | **Credit Hr** |
| **AIC322** | Artificial Neural Networks | **3+0** |

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| 1. **Basic Information** | | | |
| **Instructor** | DR. DUR E JABEEN | **Designation** | Associate Professor |
| **Prerequisite(s)** | AIC 221 | **Semester** | Fall 2024 |
| **Email** | [Dr.jabeen@iqra.edu.pk](mailto:Dr.jabeen@iqra.edu.pk) | **Phone** | -- |
| **Consulting Hours** | 08:30 to 16:30 | **Office Location** | 1st floor |

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| 1. **Course Objective(s)** |
| This course will introduce Artificial Neural Networks and Deep Learning. ANN’s basic architecture and how they mimic the human brain using simple mathematical models. Many of the important concepts and techniques around brain computing and the major types of ANN will also be introduced. Emphasis is made on the mathematical models, understanding learning laws, selecting activation functions and how to train the networks to solve classification problems. Deep neural networks have achieved state of the art performance on several computer vision and speech recognition benchmarks. This course will further build on the fundamentals of Neural networks and artificial intelligence and will introduce advanced topics in neural networks, convolutional and recurrent network structures, deep unsupervised and reinforcement learning. |

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| 1. **Course Contents** |
| Introduction and history of neural networks, Basic architecture of neural networks, Perceptron and Adaline (Minimum Error Learning) for classification. Basics of deep learning, learning networks, Shallow vs. Deep learning etc.; Machine learning theory – training and test sets, evaluation, etc. Selected topics from: Gradient descent (Delta) rule, Hebbian, Neo-Hebbian and Differential Hebbian Learning, Drive Reinforcement Theory, Kohonen Self Organizing Maps, Associative memory, Bi-directional associative memory (BAM), Energy surfaces, The Boltzmann machines, Backpropagation Networks, Feedforward Networks; Theory of Generalization; Multi-layer perceptrons, error backpropagation; Deep convolutional networks, Computational complexity of feed forward and deep convolutional neural networks; Unsupervised deep learning including auto-encoders; Deep belief networks; Restricted Boltzman Machines; Deep Recurrent Neural Networks (BPTT, LSTM, etc.); GPU programming for deep learning CuDNN; Generative adversarial networks (GANs); Sparse coding and auto-encoders; Data augmentation, elastic distortions, data normalization; Mitigating overfitting with dropout, batch normalization, dropconnect; Novel architectures, ResNet, GoogleNet, etc. |

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| 1. **Course Learning Outcomes** | | | | | | |
| **CLOs** | **CLO Statement** | **BT Level** | **Mapping** | | | **% Weight** |
| **GAs** | **ACM KA** | **SGDs** |
| CLO1 | **Design** neural network architectures and deep learning models to address classification, optimization, and computational challenges effectively. | C6 | GA4 | #9  AR | 4 | 32% |
| CLO2 | **Apply** neural networks and deep learning algorithms to solve classification and complex real-world problems. | C3 | GA5 | 34% |
| CLO3 | **Analyze** results from deep learning to select appropriate solutions. | C4 | GA3 | 34% |
| ***Note: On successful completion of course, GA 1 (Academic Education) will automatically attain.*** | | | | | | |

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| 1. **Course Textbook / Reference Books and Supplementary Reading Material** | | | |
| **S No** | **Book Title** | **Author(s)** | **Edition/ publication year/publisher** |
| 1 | Neural Network Design | Martin T. Hagan, Howard, B. Demuth, Mark Hudson Beale and Orlando De Jesus | 2nd Edition, Publisher: Martin Hagan; (September 1, 2014), ISBN-10: 0971732116 |
| 2 | An Introduction to Neural Networks | James A Anderson | Publisher: A Bradford Book (March 16, 1995), ISBN-10: 0262011441 |
| 3 | Neural Networks and Learning Machines | S. Haykin, | 3rd Ed., Pearson Education, 2009, ISBN139780131293762 ISBN10 0131293761 |

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| 1. **CLO Outcome Based Assessment (OBA)** | | | | | | |
| **Assessment Tool** | | **CLO Mapped** | **CLO Marks** | **% Weight** | **Total Marks** | **Assessment Date** |
| **Quizzes**  **10** | Quiz #1 | CLO1 | 3 | 30% | 3 | 20/11/2024 |
| Quiz #2 | CLO2 | 3 | 30% | 3 | 11/12/2024 |
| Quiz #3 | CLO3 | 4 | 40% | 4 | 08/01/2025 |
| **Total Quizzes %** | | | **100%** | **10** |  |
|  | | | | | | |
| **Assignments**  **15** | Assignment #1 | CLO1 | 7 | 46.67% | 7 | 06/11/2024 |
| Assignment #2 | CLO2 | 8 | 53.33% | 8 | 13/11/2024 |
|  | **Total assignment %** | | | **100%** | **15** |  |
|  | | | | | | |
| **Midterm**  **25** | Midterm Q1 | CLO1 | 12 | 48% | 12 | 27/11/24 |
| Midterm Q2 | CLO2 | 13 | 52% | 13 | 27/11/24 |
|  | **Total Midterm %** | | | 100% | **25** |  |
|  | | | | | | |
| **Project/CCP**  **10** | Project/CCP | CLO3 | **10** | **100%** | **10** | 06/12/2024 |
|  | **Total Project /CCP %** | | | **100%** |  |  |
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| **Final Exam**  **40** | Final Exam Q1 | CLO1 | 10 | 25% | 10 |  |
| Final Exam Q2 | CLO2 | 10 | 25% | 10 |  |
| Final Exam Q3 | CLO3 | 20 | 50% | 20 |  |
|  | **Total Final Exam %** | | | **100%** | **40** |  |
| **100** | **Total Marls** | | | | **100** |  |
| ***Note: Please make sure every CLO must be assessed at least 3 time.*** | | | | | | |

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| 1. **Weekly Plan** | | | | |
| **Week** | **Lecture No** | **Topic Covered** | **CLO** | **Assessment Tool** |
| 1 | 1 | Biological motivation and The Human Brain. | **CLO/1/2/3** | **Quiz1** |
| 2 | Historical remarks on artificial neural networks. |  |  |
| 3 | Applications of artificial neural networks. A taxonomy of artificial neural network models and learning algorithms. |  |  |
| 2 | 4 | General artificial neuron model or Models of a Neuron, |  | **Mid 1** |
| 5 | Discrete valued perceptron model, threshold logic and their limitations. |  |  |
| 6 | Hebb's rule. Connection weight matrix as an outer product of memory patterns. |  |  |
| 3 | 7 | Types of learning: Error-Correction Learning and Memory-Based Learning |  |  |
| 7 | Hebbian Learning, Differential Hebbian Learning |  | **A 1** |
| 9 | Step-by-Step Working of an Artificial Neural Network, Mathematical Models of Hebbian Modifications |  |  |
| 4 | 10 | Hamming, Hopfield networks and learning rules |  |  |
| 11 | Boltzmann Learning and Boltzmann Machine |  |  |
| 12 | Gradient descent: Learning with and without a Teacher |  |  |
| 5 | 13 | Unsupervised Learning, Unsupervised deep learning including auto-encoders |  | **Mid 1** |
| 14 | Typical Problem Areas / Learning Tasks: Pattern Association and Function Approximation |  |  |
| 15 | Reinforcement Learning/Neurodynamic Programming |  |  |
| 6 | 16 | Supervised learning. |  |  |
| 17 | Perceptron learning algorithm. |  |  |
| 18 | Learning Tasks: Memory, and Correlation Matrix Memory and Adaptation |  | **CCP** |
| **7** | 19 | Feedforward Networks, Backpropagation Networks and learning |  |  |
|  | 20 | Recurrent Networks and Training Data or Training Sample, Adaptive linear element. Supervised learning as output error minimization problem. |  |  |
|  | 21 | **Project/ CCP assignment** |  |  |
| **8** | **Midterm Exam** | | | |
| 9 | 22 | Knowledge Representation |  |  |
| 23 | Knowledge Representation types and applications |  | **Quiz2** |
| 24 | Design of a Neural Network for Character Recognition and Rules for Knowledge Representation |  |  |
| 10 | 25 | Gradient descent algorithm for minimization. Least mean square rule. |  |  |
| 26 | Adaptive Filtering Problem, Linear Least-Squares Filter |  |  |
| 27 | Wiener Filter: limiting form of the Linear Least-Squares Filter for an Ergodic Environment |  | **Quiz3** |
| 11 | 28 | Least-Mean-Square Algorithm |  |  |
| 29 | Signal-Flow Graph Representation of the LMS Algorithm |  |  |
| 30 | Learning Curves, Perceptron, Perceptron Convergence Theorem |  |  |
| 12 | 31 | Feature Detection , Relation to Fisher's Linear Discriminant |  |  |
| 32 | Convolutional Networks |  |  |
| 33 | Matrix Multiplication, Structural Constraints |  |  |
| 13 | 34 | Deep Recurrent Neural Networks |  |  |
| 35 | LSTM |  |  |
| 36 | GRU |  |  |
| 14 | 37 | GPU programming for deep learning CuDNN |  |  |
| 38 | Generative adversarial networks (GANs) |  |  |
| 49 | Sparse coding and auto-encoders |  |  |
| 15 | 40 | Data augmentation, elastic distortions, data normalization, Mitigating overfitting with dropout, batch normalization, dropconnect; |  |  |
| 41 | Novel architectures, ResNet, GoogleNet |  |  |
| 42 | **Assessment CCP / Project** |  |  |
| **16** | **Final Exam** | | | |

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| 1. **IU Assessment / grading Policy** | **Instructor grading for course \*** |
| Quizzes 10-15%  Assignments 10-15%  Projects/Presentation/CCP 0-10%  Mid Semester Examination/ 20-30%  End Semester Examination 40-50% | 10  15  10  25  40 |

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| **IQRA University (IU)** | | |
| **Faculty of Engineering Sciences and Technology (FEST)** | | |
| **Computer Science Department (CS)** | | |
| **Course Code** | **Course Name** | **Credit Hr** |
| **CSEXXX** | Internet of Things (IoT) | **3+0** |

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| 1. **Basic Information** | | | |
| **Instructor** |  | **Designation** |  |
| **Prerequisite(s)** |  | **Semester** | Fall 2024 |
| **Email** |  | **Phone** |  |
| **Office Hours** |  | **Office Location** | - |

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| 1. **Course Objective(s)** |
| The objective of this course is to provide students with a comprehensive understanding of the core principles, technologies, and practical applications of the Internet of Things (IoT). Students will learn to design, develop, and implement IoT systems, focusing on device integration, communication protocols (like MQTT), and network security. The course emphasizes hands-on experience with sensors, microcontrollers (e.g., ESP8266), and IoT platforms such as Node-RED, enabling students to develop smart, connected solutions for real-world problems. |

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| 1. **Course Contents** |
| The basics of embedded systems, focusing on the ESP32/8266 platform and its role in IoT applications. The first few weeks cover the setup and usage of the Arduino IDE, basic programming, and working with sensors and actuators. Following this, the course delves into communication protocols like MQTT, HTTP, and CoAP, and progresses to cover the architecture and working of IoT devices, data collection, and cloud integration with platforms like ThingSpeak and Blynk. Students then explore data storage, real-time processing, and automation in IoT systems, learning how to build smart systems with multiple devices. The course also includes security concerns in IoT, with a focus on authentication and data encryption. As the course moves forward, students are introduced to advanced topics such as machine learning at the edge and federated learning, including how these concepts are applied in IoT scenarios. |

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| 1. **Course Learning Outcomes** | | | | | | |
| **CLOs** | **CLO Statement** | **BT Level** | **Mapping** | | | **% Weight** |
| **GAs** | **ACM KA** | **SGDs** |
| CLO1 | By the end of the course, students will be able to **deploy** IoT systems using ESP32/ESP8266, incorporating sensors, actuators, and communication protocols (MQTT, HTTP) to achieve real-time data exchange and control. | C3 | GA2 | #2  AR | 9 & 11 | 30% |
| CLO2 | By the end of the course, students will be able to **integrate** edge AI models on IoT devices using lightweight machine learning techniques, while ensuring data privacy and security through encryption, secure protocols, and basic anomaly detection. | C4 | GA3 | 40% |
| CLO3 | By the end of the course, students will be able to **implement** IoT system in cloud based environments, enabling distributed training of machine learning models on edge devices like ESP32/ESP8266, and demonstrating knowledge of model aggregation, privacy preservation, and system limitations. | C5 | GA4 | 30% |
| ***Note: On successful completion of course GA 1 (Academic Education) will automatically attain.*** | | | | | | |

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| 1. **Course Textbook / Reference Books and Supplementary Reading Material** | | | |
| **S No** | **Book Title** | **Author(s)** | **Edition/ publication year/publisher** |
|  | AI at the Edge: Solving Real-World Problems with Embedded Machine Learning | Daniel Situnayake | O'Reilly Media  *ISBN*: 978-1-098-14404-7 |
|  | Internet of Things with Arduino Cookbook | Marco Schwartz | Packt Publishing  *ISBN*: 978-1-78528-658-2 |

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| 1. **CLO Outcome Based Assessment (OBA)** | | | | | | |
| **Assessment Tool** | | **CLO Mapped** | **CLO Marks** | **% Weight** | **Total Marks** | **Assessment Date** |
| **Quizzes**  **10** | Quiz #1 | *CLO 1* |  | 30% |  |  |
| Quiz #2 | *CLO 2* |  | 40% |  |  |
| Quiz #3 | *CLO 3* |  | 30% |  |  |
| **Total Quizzes %** | | | **100%** |  |  |
|  | | | | | | |
| **Assignments**  **10** | Assignment #1 | *CLO 1* |  | 30% |  |  |
| Assignment #2 | *CLO 2* |  | **40%** |  |  |
| Assignment #3 | *CLO 3* |  | 30% |  |  |
|  |  | | | **100%** |  |  |
|  | | | | | | |
| **Midterm**  **25** | Midterm Q#1 | *CLO 1* |  |  |  |  |
| Midterm Q#2 | *CLO 2* |  |  |  |  |
|  | **Total Midterm %** | | | **100%** | **25** |  |
|  | | | | | | |
| **Project/CCP**  **10** | Project/CCP | *CLO 2* |  |  |  |  |
|  | **Total Project /CCP %** | | | **100%** |  |  |
|  | | | | | | |
| **Final Exam**  **40** | Final Exam Q#1 | *CLO 1* |  |  |  |  |
| Final Exam Q#2 | *CLO 2* |  |  |  |  |
| Final Exam Q#3 | *CLO 2* |  |  |  |  |
|  | **Total Final Exam %** | | | **100%** | **40** |  |
| **100** | **Total Marls** | | | | **100** |  |
| ***Note: Please make sure every CLO must be assessed at least 3 time.*** | | | | | | |

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| **7. WEEKLY PLAN** | | | |
| **Week** | **Topic Covered** | **CLO** | **Assessment Tools** |
| **1** | **Introduction to IoT and ESP32/ESP8266 Platform:**   * What is IoT? (Definition, Importance, Applications) * IoT System Components (Sensors, Actuators, Controllers, Communication, Cloud) * Introduction to **ESP32/ESP8266** (Features, Capabilities, Pin Configuration, Differences)   **Practical Assignment:**   * Install and configure Arduino IDE for ESP32/ESP8266. * Write a simple "Hello World" program to blink an LED on the ESP32/ESP8266. | **1** |  |
| **2** | **Getting Started with ESP32/ESP8266 Programming:**   * Overview of Arduino IDE and libraries for ESP32/ESP8266. * GPIO Pins: Input/Output (Digital and Analog). * Power modes of ESP32 (Active, Sleep, Deep Sleep). * Write and execute basic programs for controlling GPIO pins. * Use input (button) and output (LED) with ESP32. * Understand power-saving modes and when to use them.   **Practical Assignment:**   * Control **LED with a push button** using ESP32. * Write a program to put the ESP32 into **Deep Sleep mode** and wake it up. | **1** | **Mid-Term (Q1)** |
| **3** | **IoT Communication Protocols**   * **Wi-Fi** (Station Mode, AP Mode) with ESP32/ESP8266. * Overview of IoT Protocols: **MQTT, HTTP, CoAP, WebSockets**. * Introduction to cloud platforms (ThingsBoard, Blynk, Adafruit IO). * Connect the ESP32 to a Wi-Fi network. * Understand how IoT devices communicate over Wi-Fi and the internet.   **Practical Assignment:**   * Connect ESP32/ESP8266 to Wi-Fi. * Send a simple **HTTP request to a web server** and receive a response. | **1** | **Assignment # 1**  **Quiz # 1** |
| **4** | **Sensor Integration with ESP32/ESP8266**   * **Sensors**: Temperature, Humidity (DHT11/DHT22), Light, Motion (PIR), Proximity. * Interfacing sensors with ESP32 using GPIO and ADC. * Reading analog and digital sensor data..   **Practical Assignment:**   * Interface **DHT11/DHT22 sensor** with ESP32 and display temperature and humidity on a serial monitor. | **1** | **Mid-Term (Q1)** |
| **5** | **Actuators and Control Systems**   * Introduction to **Actuators** (Relays, Motors, LEDs, Buzzers). * Controlling actuators using GPIO pins on ESP32. * Building simple control systems (e.g., light switches).   **Practical Assignment:**   * Use a relay module to control a 220V appliance (like a lamp) with ESP32. | **2** | **Mid-Term (Q2)** |
| **6** | **Introduction to MQTT Protocol for IoT**   * Introduction to **MQTT** (Message Queuing Telemetry Transport). * MQTT vs. HTTP: Why MQTT is better for IoT. * MQTT Brokers (Mosquitto, HiveMQ, AWS IoT).   **Practical Assignment:**   * Set up an **MQTT broker** (local or cloud) and send temperature data from ESP32 to the broker. | **2** |  |
| **7** | **Cloud Integration for IoT**   * Introduction to IoT Cloud Platforms (Adafruit IO, ThingsBoard, Blynk). * How to send and visualize sensor data in the cloud.   **Practical Assignment:**   * Send **real-time sensor data** (temperature, humidity) from ESP32 to a **ThingsBoard dashboard**. | **2** | **Mid-Term (Q2)** |
| **8** | **IoT Data Visualization**   * Real-time dashboards for IoT data visualization. | **2** |  |
| **9** | **IoT Data Visualization and Dashboard Creation**   * Tools for visualization (Node-RED, ThingsBoard)   **Practical Assignment:**   * Create a Node-RED dashboard to visualize real-time IoT sensor data or do the same using ThingsBoard or Arduino IoT Cloud. | **2** |  |
| **10** | **IoT Security and Privacy**   * Security issues in IoT (Hacking, Data Privacy). * **Encryption methods** (AES, RSA) for IoT communication.   **Practical Assignment:**   * **Encrypt MQTT messages from ESP32 using** AES encryption**.** | **2** |  |
| **11** | **Introduction to Edge Computing in IoT**   * What is Edge Computing? * Edge vs. Cloud Computing. * Role of ESP32 in edge computing.   **Practical Assignment:**   * Implement a **local motion detection system** using ESP32 with a PIR sensor. | **2** |  |
| **12** | **Mobile App for IoT Control**   * Introduction to mobile apps for IoT (Blynk, MIT App Inventor). * Controlling IoT devices via a smartphone app.   **Practical Assignment:**   * Use the **Blynk app** to control a relay connected to ESP32. | **3** |  |
| **13** | **Advanced IoT Concepts (AI and ML in IoT)**   * Introduction to AI/ML in IoT. * Use of TinyML for edge AI on ESP32.   **Practical Assignment:**   * Use Edge Impulse to deploy a TinyML model on ESP32. | **3** |  |
| **14** | **IoT Ethical, Legal, and Privacy Issues**   * Ethical issues (Privacy, Data Ownership, Security Risks). * IoT standards and legal frameworks (GDPR, HIPAA).   **Practical Assignment:**   * Write a 2-page report on privacy concerns of IoT in healthcare. | **3** |  |
| **15 - 16** | **Introduction to Federated Learning for IoT Systems**   * **What is Federated Learning (FL)?** * Definition, Purpose, and Benefits of Federated Learning in IoT * Difference between Centralized Learning and Federated Learning * **Role of Federated Learning in** IoT-enabled Edge Devices * FL Frameworks **(e.g., TensorFlow Federated, PySyft)** * **Security and Privacy in Federated Learning (Differential Privacy, Homomorphic Encryption)** * Case Studies**: FL in Smart Homes, Wearable Devices, and Healthcare IoT**   **Practical Assignment:**   * Simulate a simple Federated Learning model (using Python) with multiple edge nodes to classify IoT sensor data. * Compare the results with a centralized machine learning model. | **3** |  |