برنامج هندسة الحاسب الآلي والشبكات

**Computer Engineering and Networks Program**

# Quality Manual

## 2023 - 2027

# Abstract

The objective of this document is to provide a quality manual of the Computer Engineering and Networks Program in College of Computers for the period 2023-2027. It provides a comprehensive roadmap for all the accreditation and quality related tasks.

The plan begins (Section 1) by briefly describing the strategic objectives of the Program which are then further mapped on the strategic objectives of the college. Subsequently, Section 2 comprehensively describes the required tasks for each strategic objective. The tasks in Section 2 are also linked with the key performance indicators (total numbers of key performance indicators are 17), mentioned in annual report of the program. All the tasks in each objective of Section 2 are mapped to a particular committee. There are 15 committees in total. In other words, this document explains the identification and communication of committees in Section 3.

Finally, a mapping matrix is provided to show an end-to-end linkage between performance indicator for strategic objectives (total 8 objectives) with the key performance indicators in annual report (total 17 performance indicators).

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# 1. Introduction

This document describes the operational plan (Document 2.2) of Computer Engineering and Networks Program in College of Computers for the period 2023-2027. The operational plan in this document is in line with the operational plan of the college (College of Computers).

## 1.1. Vision

To be one of the best and creative Computer Engineering and Networks Program from education as well as research point of view in the Arab world.

## 1.2. Methodology

The main steps are:

- Identification and mapping of objectives
- Identification of tasks based on the target performance indicators
- Identification of tasks based on the annual report
- Identification and communication of committees
- Mapping between top level objectives and bottom level performance indicators

## 1.3. Strategic Objectives

Strategic objectives of the program for 2023 - 2027 are given below:

1. Providing an environment which should support faculty members and students
2. Focusing on students' learning outcomes and enhancing their skills through outcome-based education
3. Updating curriculum with a systematic methodology
4. Serving community through education and research
5. Promoting and encouraging scientific research
6. Development and execution of a continuous improvement plan
7. National and international collaborations in education and research
8. Obtaining national academic accreditation and renewing the International Academic Accreditation Certificate

# 1.4. Mapping of Program Strategic Objectives on the College Strategic Objectives

The mapping of program strategic objectives on the college strategic objectives are given as:

| Strategic Objectives of University | Strategic Objectives of College | Strategic Objectives of Program | Related To |
|---|---|---|---|
| Raising the efficiency of resources and wisdom to achieve excellence at institutional work | Provide students with ethical and professional skills to keep pace with the labor market | 1. Providing an environment which should support faculty members and students | Resources/ Environment |
| Providing quality education programs to prepare a globally accepted student | Providing quality education programs to prepare a globally accepted student | 2. Focusing on students' learning outcomes and enhancing their skills through outcome-based education | Students |
| | | 3. Updating curriculum with a systematic methodology | Curriculum |
| Developing an innovation system and directing it to enhance the knowledge-based economy | Produce knowledge through research and development activities | 4. Serving community through education and research | Community |
| Improving the quality of scientific research outcomes | Produce innovative world-class scientific research | 5. Promoting and encouraging scientific research | Research |
| Strengthening the university position globally with its Arab and Islamic values and activating its societal role | Strengthening the college role and influence in industry and society | 6. Development and execution of an institutional support plan | Administration |
| | | 7. National and international collaborations in education and research | Collaboration |
| | | 8. Obtaining national academic accreditation and renewing the International Academic Accreditation Certificates | Quality Assurance |

## 1.5. Mapping of Program Strategic Objectives with Program Educational Objectives

| Program Educational Objectives (Goals) | Strategic Objectives of Program | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| Practice as computer engineers in problem-solving, designing, implementing and maintaining computing systems | | ✓ | ✓ | | | | | |
| Practice as network engineers in network planning, designing, implementing, securing and troubleshooting | | ✓ | ✓ | | | | | |
| Utilize their professional education/ knowledge for the benefits of society or/and the profession | | | | ✓ | | | | |
| Keep their professional knowledge updated through further education or exploring available resources and through engineering educational seminars or workshops. | ✓ | | | | | | | |
| Assume leadership positions in industry, academia and public service, and/or contribute positively to their growth and sustainability. | | | | | ✓ | ✓ | ✓ | ✓ |

## 1.6. SWOT (Strengths, Weaknesses, Opportunities and Challenges) Analysis

The SWOT analysis is given as:

### 1.6.1. Strengths

- Due to a very important strategic location (MAKKAH), the program is continuously serving Hajj and Umra operations by incorporating state-of-the-art technologies
- The curriculum is appropriate to the labor market and is consistent with The Kingdom's Vision 2030.
- Faculty members are highly qualified in terms of education and research
- The accreditation and quality assurance process is creative, and therefore, sharing the results with international engineering education community
- The presence of faculty members with administrative experience
- Publications in web of science indexed journals as well as proceedings of international conferences (IEEE, ACM and Springer)

### 1.6.2. Weaknesses

- Lack of post graduate programs
- Lack of administrative and technical staff in laboratories
- Lack of periodic assessment and evaluation of facilities/laboratories
- Lack of laboratory equipment for students
- Lack of research support for faculty

### 1.6.3. Opportunities

- There is an opportunity to open post graduate programs in the domain of sensors, internet of things, cyber physical systems, system engineering. These programs may enable the faculty to serve in crowed and transportation management as the strategic location (Makkah) of the program is critical.
- Expertise is available for quality assurance in high education sector. It may lead to the development of software tools which may automate the entire accreditation and quality assurance process
- Third-party advisory services in the field of cyber security and artificial intelligence.
- Open diploma programs and paid postgraduate studies
- Accept international students at graduate and undergraduate level
- Technical and professional programs to satisfy the needs of labor market needs
- The possibility of partnerships with industry

### 1.6.4. Challenges

- Hiring of adequate faculty members from system development point of view
- Adoption of creative teaching methods
- Execution of a continuous improvement plan
- Collection of feedback from employers and alumni
- Formation of research groups
- Collaboration with industry

# 2. Discussion for Strategic Objectives

This section provides appropriate details about each strategic objective of the program.

## 2.1. Objective 1: Providing an environment which should support faculty members and students

As mentioned in Section 1.2 that the tasks in each objective are identified according to the performance indicator provided by the university (total = 17). The list of these tasks for objective 1 is given in the following table.

| Performance indicators for completion | Target performance | Linkage with key performance indicator provided by the university | Committee |
|---|---|---|---|
| 1.1:<br>Quality of learning experience in the program from final year students: It indicates the average of overall rating of final year students for the quality of learning experience in the program on a five-point scale in an annual survey | 4 | 2 | Student affairs and guidance |
| 1.2<br>Completion rate: It indicates the proportion of undergraduate students who completed the program in minimum time in each cohort | 50% | 4 | Student affairs and guidance |
| 1.3<br>First-year students retention rate: It indicates the percentage of first-year undergraduate students who continue at the program the next year to the total number of first-year students in the same year | 80% | 5 | Student affairs and guidance |
| 1.4:<br>Average number of students in the class: It indicates the average number of students per class (in each teaching session/activity: lecture, small group, tutorial, laboratory (or clinical session | Theory: 30<br>Lab: 15 | 8 | Quality Assurance Committee |
| 1.5:<br>Students' satisfaction with the offered services: It indicates the average of students' satisfaction rate with the various services offered by the program (restaurants, transportation, sports facilities, academic advising, ...) on a five-point scale in an annual survey | 3.5 | 10 | Laboratories and Facilities Committee |
| 1.6:<br>Satisfaction of students with the learning resources: It describes the average of students' satisfaction rate with the adequacy and diversity of learning resources (references, journals, databases… etc.) on a five-point scale in an annual survey. | 3.5 | 17 | Laboratories and Facilities Committee |

| | | | |
|---|---|---|---|
| 1.7:<br>Satisfaction of faculty with the learning resources: It describes the average of faculty satisfaction rate with the adequacy and diversity of learning resources (references, journals, databases… etc.) on a five-point scale in an annual survey. | 3.5 | 17 | Laboratories and Facilities Committee |

It is also mentioned in Section 1.2 that the tasks in each objective are identified which are not directly linked with the key performance indicators. However, these tasks are essential for preparing the annual report for quality assurance (accreditation). The list of these tasks for objective 1 is given in the following table.

| Required Tasks | Responsibility | Start Date | End Date |
|---|---|---|---|
| PS-1 (Program Statistics – 1):<br>Comprehensive analysis of program statistics: The following students' statistics is required in each year: | Student affairs and guidance | M1 | M12 |
| PS-2 (Program Statistics – 2):<br>Cohort Analysis of Current Graduate Batch | Student affairs and guidance | M1 | M12 |
| AA-1: (Academic Advising – 1):<br>Advising for students: The objective is to determine a mechanism for distributing students to academic guides and preparing the digital file of the student by the academic guide. It provides the foundation for pursuing academic guidance. Moreover, introductory meetings for academic guidance for students should be scheduled. | Student Affairs and Guidance Committee | First week of each semester | Second week of each semester |
| AA-2: (Academic Advising – 2):<br>Help for faculty in advising:<br>The purpose is to establish training programs for academic guidance for faculty members. It also includes the preparation of manuals for academic guidance. | Student Affairs and Guidance Committee | First week of each semester | Second week of each semester |
| AA-3: (Academic Advising – 3):<br>Report on advising process<br>The objective is to Prepare a report for each semester on the process of academic supervision in the program. | Student Affairs and Guidance Committee | First week of each semester | Second week of each semester |
| FL-1: (Facilities and Laboratories -1)<br>Overall environment: It requires a process which can ensure that the overall environment in offices, classroom and laborites is supporting the attainment of POs. | Laboratories and Facilities Committee | M1 | M3 |
| FL-2: (Facilities and Laboratories -2)<br>Laboratory equipment: In addition to the overall environment, the availability of appropriate equipment and tools is particularly important for students to design and conduct experiments. Consequently, this task advocates. the development of a methodology which can evaluate the laboratories on regular basis. | Laboratories and Facilities Committee | M1 | M3 |
| FL-3: (Facilities and Laboratories -3) | Laboratories and Facilities Committee | M1 | M12 |

| | | | |
|---|---|---|---|
| Computing resources and services: Although, the laboratory equipment is of paramount importance for an engineering program, a procedure should also be developed to measure the appropriate range of computing and information resources. | | | |
| FL-4: (Facilities and Laboratories -4) Maintenance: Finally, there should be a documented procedure/policy to handle the maintenance issues for laboratory equipment and computing resources. | Laboratories and Facilities Committee | M1 | M3 |

This objective includes activities related to students' statistics, advising and facilities. In the following tasks for each activity are discussed one by one:

Students' statistics is one of the good measures to evaluate the Learning and Teaching Resources/Environment. The following two tasks are identified:

PS-1 Comprehensive analysis of program statistics: The following students' statistics is required in each year:

| |
|---|
| 1. Number of students who started the program |
| 2. Number of students who graduated |
| 3. Number of students who completed major tracks within the program |
| 4. Number of students who completed the program in the minimal time |
| 5. Percentage of students who completed the program in the minimal time (Completion rate) |
| 6. Number of students who completed an intermediate award specified as an early exit point (if any) |
| 7. Percentage of students who completed an intermediate award specified as an early exit point (if any) |

In addition to the aforementioned statistics, a report is needed to describe the Strengths, Areas for Improvement and Priorities for Improvement. Comment on any special or unusual factors that might have affected the completion rates should be provided. Moreover, a summary of Students Statistics is also needed.

PS-2: Cohort Analysis of Current Graduate Batch: The following information is needed:

| Number of Students | Two Years Ago | | Last Year | Current Year | Expected Next Year |
|---|---|---|---|---|---|
| Proposed Number of Enrolled Students | Male | | | | |
| | Female | | | | |
| | Total | | | | |
| Total number of Enrolled Students | Male | | | | |
| | Female | | | | |
| | Total | | | | |
| | Male | | | | |
| | Female | | | | |

| | | | | | |
|---|---|---|---|---|---|
| Number of Enrolled International Students | Total | | | | |
| Average Class Size | Male | | | | |
| | Female | | | | |
| | Total | | | | |
| Ratio of Students to Teaching Staff | Male | | | | |
| | Female | | | | |
| | Total | | | | |

Similarly, in order to provide an effective learning environment, monitoring and advising of student, from the admission to the graduation, is a necessary requirement. Therefore, the three major requirements are as follows:

AA-1: Advising for students:

The objective is to determine a mechanism for distributing students to academic guides and preparing the digital file of the student by the academic guide. It provides the foundation for pursuing academic guidance. Moreover, introductory meetings for academic guidance for students should be scheduled.

AA-2: Help for faculty:

The purpose is to establish training programs for academic guidance for faculty members. It also includes the preparation of manuals for academic guidance.

AA-3: Report on advising process:

The objective is to Prepare a report for each semester on the process of academic supervision in the program.

In addition to advising, facilities are also very important. Facilities include offices, classrooms and laboratories. Moreover, other facilities such as computing resources and library services are also needed. Consequently, the four major requirements are as follows:

FL-1: Overall environment: It requires a process which can ensure that the overall environment in offices, classroom and laborites is supporting the attainment of POs.

FL-2: Laboratory equipment: In addition to the overall environment, the availability of appropriate equipment and tools is particularly important for students to design and conduct experiments. Consequently, this task advocates. the development of a methodology which can evaluate the laboratories on regular basis.

FL-3: Computing resources and services: Although, the laboratory equipment is of paramount importance for an engineering program, a procedure should also be developed to measure the appropriate range of computing and information resources.

FL-4: Maintenance: Finally, there should be a documented procedure/policy to handle the maintenance issues for laboratory equipment and computing resources.

## 2.2. Objective 2: Focusing on students' learning outcomes and enhancing their skills through outcome-based education

As mentioned in Section 1.2 that the tasks in each objective are identified according to the performance indicator provided by the university. The list of these tasks for objective 2 is given in the following table.

| Performance indicators for completion | Target performance | Linkage with key performance indicator provided by the university | Responsibility |
|---|---|---|---|
| 2.1: Students' evaluation of the quality of the courses: It indicates the average students overall rating for the quality of courses on a five-point scale in an annual survey | 4 | 3 | Quality Assurance Committee |
| 2.2: Students' performance in the professional and/or national examinations: It indicates the percentage of students or graduates who were successful in the professional and / or national examinations, or their score average and median (if any | 70% | 6 | Post Graduate Studies Committee |
| 2.3: Graduates' employability and enrolment in postgraduate programs: It indicates the percentage of graduates from the program who within a year of graduation were: a. employed b. enrolled in postgraduate programs during the first year of their graduation to the total number of graduates in the same year | 70% | 7 | Advisory Committee |
| 2.4: Employers' evaluation of the program graduates' proficiency in terms of skills: It indicates the average of overall rating of employers for the proficiency of the program graduates on a five-point scale in an annual survey | 4.0 | 9 | Advisory Committee |

There are certain tasks which are not directly linked with the key performance indicators. The list of these tasks for objective 2 is given in the following table.

| Required Tasks | Responsibility | Start Date | End Date |
|---|---|---|---|
| PO-1: (Program Objectives -1) Alignment of POs: It is critical to ensure that the POs are aligned with the requirements of all the constituencies (faculty, graduating engineering students, alumni, employers, and external advisory board) and are mapped on PLOs in an appropriate way. Therefore, this task requires the feedback from all the concerned constituencies on a regular basis. | Quality Assurance Committee | M1 | M2 |

| | | | |
|---|---|---|---|
| PO-2: (Program Objectives -2) Assessment of POs: In order to ensure an appropriate alignment of POs, it is important to update them, based on the feedback from various constituencies in the form of surveys. The exit survey (from graduating engineering students) is conducted annually while the alumni and employer surveys are conducted after 3 to 4 years. In addition to the collection of feedbacks about POs, this task also gathers the feedbacks from different stakeholders about PLOs, curriculum and facilities. | Quality Assurance Committee | M3 | M8 |
| PO-3: (Program Objectives -3) Revision of POs: Based on the survey data, a process for the revision of POs is employed. It implies that the successful execution of aforementioned tasks ensures the alignment of POs. | Quality Assurance Committee | M9 | M12 |
| CR-1: (Course Reports -1) Collection of course folders and prepare a summary of course reports. | Quality Assurance Committee | Last week of each semester | First week of each semester |
| CR-2: (Course Reports -2) Data extraction from course reports | Quality Assurance Committee | Second week of each semester | Fourth week of each semester |
| CR-3: (Course Reports -3) Analysis of Program Learning Outcomes Assessment (Strengths, Areas for Improvement, Priorities for Improvement) | Quality Assurance Committee | Fifth week of each semester | Sixth week of each semester |
| AQ-1: (Accreditation and Quality -1) Operational Plan of the Program | Quality Assurance Committee | M1 | M4 |
| AQ-2: (Accreditation and Quality -2) Performance indicators, measurement and statistics | Quality Assurance Committee | M1 | M4 |
| AQ-3: (Accreditation and Quality -3) Measurements of Learning Outcomes Plan | Quality Assurance Committee | M5 | M6 |
| PC-1: (Project Committee -1) Preparation of Graduation Project Manual | Capstone Design Projects Committee | M1 | M4 |
| PC-2: (Project Committee -2) Preparation of annual report covering the description of projects and statistics | Capstone Design Projects Committee | M1 | M4 |

The program objectives (POs) are broad statements that describe, with input from all the program constituents, the expected achievements of graduating students within a few years of graduation. On the other hand, program learning outcomes (PLOs) describe what students are expected to know or be able to do by the time of graduation from the program. Therefore, the three major tasks, related to POs and their mapping on PLOs, have been identified. The identified tasks discuss the alignment, assessment and revision of POs.

- PO-1: Alignment of POs: It is critical to ensure that the POs are aligned with the requirements of all the constituencies (faculty, graduating engineering students, alumni, employers, and external advisory board) and are mapped on PLOs in an appropriate

way. Therefore, this task requires the feedback from all the concerned constituencies on a regular basis.

- PO-2: Assessment of POs: In order to ensure an appropriate alignment of POs, it is important to update them, based on the feedback from various constituencies in the form of surveys. The exit survey (from graduating engineering students) is conducted annually while the alumni and employer surveys are conducted after 3 to 4 years. In addition to the collection of feedbacks about POs, this task also gathers the feedbacks from different stakeholders about PLOs, curriculum and facilities.
- PO-3: Revision of POs: Based on the survey data, a process for the revision of POs is employed. It implies that the successful execution of aforementioned tasks ensures the alignment of POs.

## 2.3. Objective 3: Updating curriculum with a systematic methodology

For this objective, there are no tasks which can be directly linked with key performance indicators.

There are certain tasks which are not directly linked with the key performance indicators. The list of these tasks for objective 3 are given as:

| Required Tasks | Responsibility | Start Date | End Date |
|---|---|---|---|
| CU-1: (Curriculum – 1)<br>Alignment of the curriculum: The purpose of this task is to describe that how the curriculum is aligned with POs and PLOs. The inputs to this task are the revised POs and the output is updated curriculum. | Curricula and Study Plans Committee | M1 | M3 |
| CU-2: (Curriculum – 2)<br>Design of courses and their interconnection: The objective of this task is to ensure that the course contents have been designed in a holistic way such that the curriculum should serve as a system to mold all the technical evolutions in a field into a unified course of study that proceeds from fundamental concepts to a final project experience. The relationship between various courses is generally shown in the form of a pre-requisite chart. | Curricula and Study Plans Committee | M1 | M3 |
| CU-3: (Curriculum – 3)<br>Integrated design experiences: This task focuses on the integrated delivery of laboratory sessions, and therefore, two types of laboratory integration have been identified: vertical integration and horizontal integration. The vertical integration is defined as the continuous and coherent development of engineering students' | Curricula and Study Plans Committee | M1 | M3 |

| | | | |
|---|---|---|---|
| design skills throughout the entire undergraduate curriculum while the horizontal integration describes the relationship between a laboratory practical and the theory lecture. | | | |
| CU-4: (Curriculum – 4)<br>Design and mapping of CLOs: The objective of this task is to design a set of CLOs for each theory course and laboratory session in the curriculum. These CLOs must be appropriately linked to the course contents. Furthermore, the mapping of CLOs to PLOs must be defined. | Quality Assurance Committee | M1 | M3 |
| CU-5: (Curriculum – 5)<br>Collection of data: Finally, the direct assessment data, in terms of CLOs and PLOs for each course, is required to be collected (direct assessment). Furthermore, a course-wise faculty and students' survey for each course are also needed (indirect assessment). The direct and indirect assessments are then combined into a course folder. | Quality Assurance Committee | End of each semester | start of each semester |
| CI-1: (Continuous Improvement – 1)<br>Extraction and synthesis of PLOs Data: The inputs to this task are the data from CU-5 (direct assessment data extracted from course folders) and PO-2 (collected from various stakeholders through surveys). The output of this task is in the form of some performance figures for all the PLOs (entire curriculum). More the faculty members are aware of the accreditation related terminologies, higher are the chances to obtain a meaningful data in this task. | Quality Assurance Committee | End of each semester | start of each semester |
| CI-2: (Continuous Improvement – 2)<br>Improvement planning: Based on the PLOs data, extracted and synthesized in task CI-1, some recommendations are provided for further improvement. The effectiveness of these recommendations is purely based on the fact that how much the data in CI-1 is realistic and meaningful. The successful achievement of this task ensures that the continuous improvement process has been executed. | Quality Assurance Committee | End of each semester | start of each semester |

Description of tasks are as follows:

CU-1: Alignment of the curriculum: The purpose of this task is to describe that how the curriculum is aligned with POs and PLOs. The inputs to this task are the revised POs and the output is updated curriculum.

CU-2: Design of courses and their interconnection: The objective of this task is to ensure that the course contents have been designed in a holistic way such that the curriculum

should serve as a system to mold all the technical evolutions in a field into a unified course of study that proceeds from fundamental concepts to a final project experience. The relationship between various courses is generally shown in the form of a pre-requisite chart.

CU-3: Integrated design experiences: This task focuses on the integrated delivery of laboratory sessions, and therefore, two types of laboratory integration have been identified: vertical integration and horizontal integration. The vertical integration is defined as the continuous and coherent development of engineering students' design skills throughout the entire undergraduate curriculum while the horizontal integration describes the relationship between a laboratory practical and the theory lecture.

CU-4: Design and mapping of CLOs: The objective of this task is to design a set of CLOs for each theory course and laboratory session in the curriculum. These CLOs must be appropriately linked to the course contents. Furthermore, the mapping of CLOs to PLOs must be defined.

CU-5: Collection of data: Finally, the direct assessment data, in terms of CLOs and PLOs for each course, is required to be collected (direct assessment). Furthermore, a course-wise faculty and students' survey for each course are also needed (indirect assessment). The direct and indirect assessments are then combined into a course folder.

The data collected in CU-5 (only the direct assessment data which is organized in terms of PLOs for different courses), along with the survey data related to the PLOs (collected in task PO-2), are used for the execution of continuous improvement process. However, the collected data in CU-5 describes the attainment of PLOs in a particular course. Therefore, it is critical to represent and analyze the PLO data for the entire curriculum so that the loop can be closed. Consequently, the two major tasks for continuous improvement process are as follows:

CI-1: Extraction and synthesis of PLOs Data: The inputs to this task are the data from CU-5 (direct assessment data extracted from course folders) and PO-2 (collected from various stakeholders through surveys). The output of this task is in the form of some performance figures for all the PLOs (entire curriculum). More the faculty members are aware of the accreditation related terminologies, higher are the chances to obtain a meaningful data in this task.

CI-2: Improvement planning: Based on the PLOs data, extracted and synthesized in task CI-1, some recommendations are provided for further improvement. The effectiveness of these recommendations is purely based on the fact that how much the data in CI-1 is realistic and meaningful. The successful achievement of this task ensures that the continuous improvement process has been executed.

## 2.4. Objective 4: Serving community through education and research

The tasks for objective 4 are as follows:

| Required Tasks | Responsibility | Start Date | End Date |
|---|---|---|---|
| CS-1 (Community Services -1)<br>Target real-world problems for the betterment of society through capstone design projects | Capstone Design Projects Committee | M1 | M12 |
| CS-2 (Community Services -2)<br>Collection of community services from faculty members | Quality Assurance Committee | M11 | M12 |

## 2.5. Objective 5: Promoting and encouraging scientific research

The tasks for objective 5 which are directly linked with key performance indicators are given as:

| Performance indicators for completion | Target performance | Linkage with performance indicator | Responsibility |
|---|---|---|---|
| 5.1<br>Percentage of publications of faculty members. It indicates the percentage of full-time faculty members who published at least one research during the year to total faculty members in the program | 80 %<br>There is no automatic process to calculate this value. It is therefore recommended to device a mechanism to compute this important performance indicator | 14 | Scientific Research Committee |
| 5.2<br>Rate of published research per faculty member: It indicates the average number of refereed and/or published research per each faculty member during the year (total number of refereed and/or published research to the total number of full-time or equivalent faculty members during the year) | 4 | 15 | Scientific Research Committee |
| 5.3<br>Maximize the impact of published research. It can be computed by measuring citations rate in refereed journals per faculty member. It describes the average number of citations in refereed journals from published research per faculty member in the program (total number of citations in refereed journals from published research for full-time or equivalent faculty members to the total research published | 12<br>There is no automatic process to calculate this value. It is therefore recommended to device a mechanism to compute this important performance indicator | 16 | Scientific Research Committee |

It is important to note that there are no particular tasks for objective 5 which are required for writing the annual report.

## 2.6. Objective 6: Development and execution of an institutional support plan

The tasks for objective 6 which are linked with performance indicators are given as:

| Performance indicators for completion | Target performance | Linkage with performance indicator |
|---|---|---|
| 6.1:<br>Ratio of students to teaching staff: It indicates the ratio of the total number of students to the total number of fulltime and fulltime equivalent teaching staff in the program | 10 | 11 |
| 6.2:<br>Percentage of teaching staff distribution.<br>It indicates the percentage of teaching staff distribution based on gender and academic ranking | Male: 100%<br>Females: 0%<br>Prof: 20%<br>Assoc. Prof: 30%<br>Assist. Prof: 40%<br>Lect:10% | 12 |
| 6.3:<br>Proportion of teaching staff leaving the program. It indicates the proportion of teaching staff leaving the program annually for reasons other than age retirement to the total number of teaching staff | 0<br>It indicates that teaching staff is not leaving the program, and therefore, ready to provide long term commitment. | 13 |

The tasks which are not directly linked with performance indicators are given as:

| Required Tasks | Responsibility | Start Date | End Date |
|---|---|---|---|
| FT-1: (Faculty -1)<br>Adequacy of faculty: The purpose of this task is to execute a process to ensure that there is always an adequate faculty to cover all the curricular areas.<br>FT-2: (Faculty -2)<br>Role of faculty in curricular activities: This task confirms that the role of faculty members is well defined for the improvement of POs, CLOs and their mapping on PLOs.<br>FT-3: (Faculty -3)<br>Interaction of faculty with various stakeholders: While the task FT-2 is related to the role of faculty in curricular activities, the purpose of the task FT-3 is to develop a mechanism for describing the interaction of faculty with various stakeholders such as students, employers etc. | Faculty Affairs Committee | M1 | M12 |
| IS-1: (Institutional Support -1)<br>Identification of leadership hierarchy: The purpose of this task is to identify and implement a hierarchy for promoting the program interests and creating a productive environment.<br>IS-2: (Institutional Support -2)<br>Hiring and development of faculty: It ensures the development and implementation of hiring new faculty as well as the professional development of existing members.<br>IS-3: (Institutional Support -3)<br>Financial planning and management: All the tasks related to facilities and faculties are based on an appropriate financial planning and management. | Faculty Affairs Committee | M1 | M12 |

| | | | |
|---|---|---|---|
| The objective is to execute the cost estimation and cost management activities to ensure the in-time availability of all the appropriate resources (manpower as well as equipment). | | | |

Institutional/administrative support for faculty development and other services is mandatory to run the program effectively. The faculty plays an important role in increasing the effectiveness of an engineering program. The three major tasks in this context are listed below:

FT-1: Adequacy of faculty: The purpose of this task is to execute a process to ensure that there is always an adequate faculty to cover all the curricular areas.

FT-2: Role of faculty in curricular activities: This task confirms that the role of faculty members is well defined for the improvement of POs, CLOs and their mapping on PLOs.

FT-3: Interaction of faculty with various stakeholders: While the task FT-2 is related to the role of faculty in curricular activities, the purpose of the task FT-3 is to develop a mechanism for describing the interaction of faculty with various stakeholders such as students, employers etc.

For other institutional support, the three identified requirements/tasks are as follows:

IS-1: Identification of leadership hierarchy: The purpose of this task is to identify and implement a hierarchy for promoting the program interests and creating a productive environment.

IS-2: Hiring and development of faculty: It ensures the development and implementation of hiring new faculty as well as the professional development of existing members.

IS-3: Financial planning and management: All the tasks related to facilities and faculties are based on an appropriate financial planning and management. The objective is to execute the cost estimation and cost management activities to ensure the in-time availability of all the appropriate resources (manpower as well as equipment).

## 2.7. Objective 7: National and international collaborations in education and research

There are no tasks which can be directly linked with key performance indicators or annual report. Therefore, in order to achieve this objective, the concerned program committee will specify the tasks.

## 2.8. Objective 8: Obtaining national academic accreditation and renewing the International Academic Accreditation Certificates

| Required Tasks | Responsibility | Start Date | End Date |
|---|---|---|---|
| AQ-4: (Accreditation and Quality -4)<br><br>Preparation of annual report with planned actions for the next year | Quality Assurance Committee | M1 | M4 |
| AQ-5: (Accreditation and Quality -5) Execution of planned actions in annual report of the previous year | Quality Assurance Committee | M5 | M12 |

# 3. Identification and Communication of Committees

After the identification of tasks to accomplish various objectives (Section 2), the next step is to map the identified tasks on a set of resources (committees). The following table shows the list of 15 different resources. Each resource has been assigned a particular set of tasks, and therefore, the scope of each resource/committee is explicit.

| S.NO | Name of the Resource | Assignment of Tasks | Total Tasks |
|---|---|---|---|
| 1. | Quality Assurance Committee | CI-1, CI-2,<br>CU-4<br>AQ-1, AQ-2, AQ-3 | 6 |
| 2. | Student affairs and guidance | 1.2, 1.3<br>PS-1, PS-2<br>AA-1, AA-2, AA-3 | 7 |
| 3. | Scientific Research Committee | 5.1, 5.2, 5.3 | 3 |
| 4. | Academic Scheduling Committee | There are not particular tasks which are required for accreditation and quality assurance | 0 |
| 5. | Coordination<br>Committee | There are not particular tasks which are required for accreditation and quality assurance | 0 |
| 6. | Student affairs and guidance | 1.1 | 1 |
| 7. | Capstone Design Projects Committee | PC-1, PC-2, CS-1 | 3 |
| 8. | Advisory Committee | 2.3, 2.4 | 2 |
| 9. | Laboratories and Facilities Committee | FL-1, FL-2, FL-3, FL-4<br>1.5, 1.6, 1.7 | 7 |
| 10. | Faculty Affairs Committee | FT-1, FT-2, FT-3<br>IS-1, IS-2, IS-3 | 6 |
| 11. | Examination Committee | There are not particular tasks which are required for | 0 |

| | | | |
|---|---|---|---|
| | | accreditation and quality assurance | |
| 12. | Quality Assurance Committee | 2.1<br>PO-1, PO-2, PO-3<br>CR-1, CR-2, CR-3<br>CU-5<br>AQ1, AQ2, AQ3, AQ4, AQ5<br>1.4, | 11 |
| 13. | Curricula and Study Plans Committee | CU-1, CU-2, CU-3 | 3 |
| 14. | Post Graduate Studies Committee | | |

# 3.1. Program Management Committee

- Task 2.1: Students' evaluation of the quality of the courses: It indicates the average students overall rating for the quality of courses on a five-point scale in an annual survey.
- PO-1: Alignment of POs: It is critical to ensure that the POs are aligned with the requirements of all the constituencies (faculty, graduating engineering students, alumni, employers, and external advisory board) and are mapped on PLOs in an appropriate way. Therefore, this task requires the feedback from all the concerned constituencies on a regular basis.
- PO-2: Assessment of POs: In order to ensure an appropriate alignment of POs, it is important to update them, based on the feedback from various constituencies in the form of surveys. The exit survey (from graduating engineering students) is conducted annually while the alumni and employer surveys are conducted after 3 to 4 years. In addition to the collection of feedbacks about POs, this task also gathers the feedback from different stakeholders about PLOs, curriculum and facilities.

- PO-3: Revision of POs: Based on the survey data, a process for the revision of POs is employed. It implies that the successful execution of aforementioned tasks ensures the alignment of POs.
- CR-1: Collection of course folders and prepare a summary of course reports.
- CR-2: Data extraction from course reports
- CR-3: Analysis of Program Learning Outcomes Assessment (Strengths, Areas for Improvement, Priorities for Improvement)
- CU-5: Collection of data: Finally, the direct assessment data, in terms of CLOs and PLOs for each course, is required to be collected (direct assessment). Furthermore, a course-wise faculty and students' survey for each course are also needed (indirect assessment). The direct and indirect assessments are then combined into a course folder.

- CS-2: Collection of community services from faculty members: Collection of community services from faculty members
- AQ-4: Preparation of annual report with planned actions for the next year
- AQ-5: Execution of planned actions in annual report of the previous year
- Task 1.4: Average number of students in the class: It indicates the average number of students per class (in each teaching session/activity: lecture, small group, tutorial, laboratory (or clinical session
- Task 1.5: Students' satisfaction with the offered services: It indicates the average of students' satisfaction rate with the various services offered by the program (restaurants, transportation, sports facilities, academic advising, ...) on a five-point scale in an annual survey

- Task 1.6: Satisfaction of students with the learning resources: It describes the average of students' satisfaction rate with the adequacy and diversity of learning resources (references, journals, databases… etc.) on a five-point scale in an annual survey.

## 3.2. Quality Assurance Committee

This committee performs the following tasks:

- CI-1: Extraction and synthesis of PLOs Data: The inputs to this task are the data from CU-5 (direct assessment data extracted from course folders) and PO-2 (collected from various stakeholders through surveys). The output of this task is in the form of some performance figures for all the PLOs (entire curriculum). More the faculty members are aware of the accreditation related terminologies, higher are the chances to obtain a meaningful data in this task.
- CI-2: Improvement planning: Based on the PLOs data, extracted and synthesized in task CI-1, some recommendations are provided for further improvement. The effectiveness of these recommendations is purely based on the fact that how much the data in CI-1 is realistic and meaningful. The successful achievement of this task ensures that the continuous improvement process has been executed.
- CU-4: Design and mapping of CLOs: The objective of this task is to design a set of CLOs for each theory course and laboratory session in the curriculum. These CLOs must be appropriately linked to the course contents. Furthermore, the mapping of CLOs to PLOs must be defined.
- AQ-1: Operational Plan of the Program: The objective of this document is to provide an operational plan of Computer Engineering and Networks Program in College of Computers. It provides a comprehensive roadmap for all the accreditation and quality related tasks. The plan begins by briefly describing the strategic objectives of the program which are then further mapped on the strategic objectives of the college. Subsequently, it comprehensively describes the required tasks for each strategic objective. The tasks are also linked with the key performance indicators (total numbers of key performance indicators are 17), mentioned in annual report of the program. All the tasks in each objective are mapped to a particular committee. There are 15 committees in total. In other words, this document explains the identification and communication of

committees. Finally, a mapping matrix is provided to show an end-to-end linkage between performance indicator for strategic objectives (total 8 objectives) with the key performance indicators in annual report (total 17 performance indicators).

- AQ-2: Performance indicators, measurement and statistics: The objective of this document (Document 18.1) is to describe performance indicators along with their measurement method. Furthermore, an analysis is performed based on the available statistics. The major steps are: Formulation of performance indicators, measurement methods and target performance levels, Mapping of performance indicators on operational (strategic) objectives and Comparing performance (internally as well as externally).
- AQ-3: Measurements of Learning Outcomes Plan: Program Learning Outcomes (PLOs) program learning outcomes (PLOs) describe what students are expected to know or be able to do by the time of graduation from the program. The PLOs are further classified in terms of knowledge, skills and values. The following are the main steps: Formulation of Course Learning Outcomes (CLOs) and their mapping on course contents, Formulation of Program Learning Outcomes (PLOs) and their Mapping on of CLOs, Mapping of PLOs on learning outcomes areas (knowledge, skills and values), Mapping of learning outcomes area with educational strategies.

## 3.3. Student Affairs and Guidance Committee

This committee performs the following tasks:

- AA-1: Advising for students: The objective is to determine a mechanism for distributing students to academic guides and preparing the digital file of the student by the academic guide. It provides the foundation for pursuing academic guidance. Moreover, introductory meetings for academic guidance for students should be scheduled.
- AA-2: Help for faculty: The purpose is to establish training programs for academic guidance for faculty members. It also includes the preparation of manuals for academic guidance.
- AA-3: Report on advising process: The objective is to Prepare a report for each semester on the process of academic supervision in the program.
-
- Task 1.2: Completion rate: It indicates the proportion of undergraduate students who completed the program in minimum time in each cohort.
- Task 1.3: First-year students retention rate: It indicates the percentage of first-year undergraduate students who continue at the program the next year to the total number of first-year students in the same year.

- PS-1: Comprehensive analysis of program statistics: The following students' statistics is required in each year:
- PS-2: Cohort Analysis of Current Graduate Batch

It coordinates with the college's alumni and urges them to fill out the required forms and assessments. This committee performs the following tasks:

- Task 1.1: Quality of learning experience in the program from final year students: It indicates the average of overall rating of final year students for the quality of learning experience in the program on a five-point scale in an annual survey.

## 3.4. Scientific Research Committee

This committee performs the following tasks:

- Task 5.1: Percentage of publications of faculty members. It indicates the percentage of full-time faculty members who published at least one research during the year to total faculty members in the program
- Task 5.2: Rate of published research per faculty member: It indicates the average number of refereed and/or published research per each faculty member during the year (total number of refereed and/or published research to the total number of full-time or equivalent faculty members during the year)
- Task 5.3: Maximize the impact of published research. It can be computed by measuring citations rate in refereed journals per faculty member. It describes the average number of citations in refereed journals from published research per faculty member in the program (total number of citations in refereed journals from published research for full-time or equivalent faculty members to the total research published

## 3.5. Academic Scheduling Committee

This committee is responsible for all the tasks related to academic scheduling. In the current version, there is no quality and accreditation related task linked with this committee.

## 3.6. Coordination Committee

The objective of this committee is to consider the applications of equivalency. This committee can be considered as a sub-part of curriculum committee.

## 3.7. Capstone Design Projects Committee

This committee performs the following tasks:

- PC-1: Preparation of Graduation Project Manual
- PC-2: Preparation of annual report covering the description of projects and statistics
- CS-1: Target real-world problems for the betterment of society through capstone design projects.

## 3.8. Advisory Committee

- Task 2.3: Graduates' employability and enrolment in postgraduate programs: It indicates the percentage of graduates from the program who within a year of graduation were: a. employed b. enrolled in postgraduate programs during the first year of their graduation to the total number of graduates in the same year
- Task 2.4: Employers' evaluation of the program graduates' proficiency in terms of skills: It indicates the average of overall rating of employers for the proficiency of the program graduates on a five-point scale in an annual survey

## 3.9. Laboratories and Facilities Committee

Facilities include offices, classrooms and laboratories. Moreover, other facilities such as computing resources and library services are also needed. Consequently, the four major requirements are as follows:

- FL-1: Overall environment: It requires a process which can ensure that the overall environment in offices, classroom and laborites is supporting the attainment of POs.
- FL-2: Laboratory equipment: In addition to the overall environment, the availability of appropriate equipment and tools is particularly important for students to design and conduct experiments. Consequently, this task advocates. the development of a methodology which can evaluate the laboratories on regular basis.
- FL-3: Computing resources and services: Although, the laboratory equipment is of paramount importance for an engineering program, a procedure should also be developed to measure the appropriate range of computing and information resources.
- FL-4: Maintenance: Finally, there should be a documented procedure/policy to handle the maintenance issues for laboratory equipment and computing resources.
- Satisfaction of faculty with the learning resources: It describes the average of faculty satisfaction rate with the adequacy and diversity of learning resources (references, journals, databases… etc.) on a five-point scale in an annual survey.

## 3.10. Faculty Affairs Committee

- FT-1: Adequacy of faculty: The purpose of this task is to execute a process to ensure that there is always an adequate faculty to cover all the curricular areas.
- FT-2: Role of faculty in curricular activities: This task confirms that the role of faculty members is well defined for the improvement of POs, CLOs and their mapping on PLOs.
- FT-3: Interaction of faculty with various stakeholders: While the task FT-2 is related to the role of faculty in curricular activities, the purpose of the task FT-3 is to develop a

mechanism for describing the interaction of faculty with various stakeholders such as students, employers etc.

- IS-1: Identification of leadership hierarchy: The purpose of this task is to identify and implement a hierarchy for promoting the program interests and creating a productive environment.
- IS-2: Hiring and development of faculty: It ensures the development and implementation of hiring new faculty as well as the professional development of existing members.
- IS-3: Financial planning and management: All the tasks related to facilities and faculties are based on an appropriate financial planning and management. The objective is to execute the cost estimation and cost management activities to ensure the in-time availability of all the appropriate resources (manpower as well as equipment).

## 3.11. Examination Committee

There are not particular tasks which are required for accreditation and quality assurance.

## 3.12. Curricula and Study Plans Committee

This committee performs the following tasks:

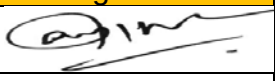
- CU-1: Alignment of the curriculum: The purpose of this task is to describe that how the curriculum is aligned with POs and PLOs. The inputs to this task are the revised POs and the output is updated curriculum.
- CU-2: Design of courses and their interconnection: The objective of this task is to ensure that the course contents have been designed in a holistic way such that the curriculum should serve as a system to mold all the technical evolutions in a field into a unified course of study that proceeds from fundamental concepts to a final project experience. The relationship between various courses is generally shown in the form of a pre-requisite chart.
- CU-3: Integrated design experiences: This task focuses on the integrated delivery of laboratory sessions, and therefore, two types of laboratory integration have been identified: vertical integration and horizontal integration. The vertical integration is defined as the continuous and coherent development of engineering students' design skills throughout the entire undergraduate curriculum while the horizontal integration describes the relationship between a laboratory practical and the theory lecture.

## 3.13. Post Graduate Studies Committee

- Task 2.2: Students' performance in the professional and/or national examinations: It indicates the percentage of students or graduates who were successful in the professional and / or national examinations, or their score average and median (if any).

# 4. Summary: Mapping Matrix

| S. No | Performance indicator for objectives | Key performance Indicators in Annual Report | Related to: |
|---|---|---|---|
| 1. | 1.1 | 2 | Resources/Environment |
| 2. | 1.2 | 4 | |
| 3. | 1.3 | 5 | |
| 4. | 1.4 | 8 | |
| 5. | 1.5 | 10 | |
| 6. | 1.6 | 17 | |
| 7. | 1.7 | 17 | |
| 8. | 2.1 | 3 | Students' skills and learning outcomes |
| 9. | 2.2 | 6 | |
| 10. | 2.3 | 7 | |
| 11. | 2.4 | 9 | |
| 12. | 5.1 | 14 | Research |
| 13. | 5.2 | 15 | |
| 14. | 5.3 | 16 | |
| 15. | 6.1 | 11 | Administration |
| 16. | 6.2 | 12 | |
| 17. | 6.3 | 13 | |

| Action | Name | Date | Signature |
|---|---|---|---|
| Prepared by | Prof. Muhammad Rashid | 10-11-2023 |  |
| Reviewed and Presented by | Quality Guarantee Committee – 2023/2024<br>Prof. Imran Tasaduq<br>Dr. Amr Munshi | 12-11-2023 | |
| Approved by | Head of Computer Engineering and Networks Department<br>Dr. Amar Jaffar | 14-11-2023 | |