# Sana'a University
# Faculty of Engineering
# Department Mechanical Engineering

# Master of Science in Mechanical Engineering

# Program Specifications

## June - 2021


**Faculty of Engineering, Sana'a University**

🖷 01464368, ☎ 01464365, ✉ m.albukhaiti@eng-su.edu.ye, www.eng-su.edu.ye

**University of Sana'a**
**Faculty of Engineering**
**Department: Mechanical Engineering**
**Title of the Program:**
**Master of Science in Mechanical Engineering**

# Program Specification

## 1. Program Description

The Master of Science in Mechanical Engineering Program aims to upgrade the scientific abilities and develop the practical skills of the candidate in the field of Mechanical Engineering to meet the academic, professional, and career needs of engineering graduates. These goals are achieved through advanced academic courses and research applications and by using new techniques and advanced scientific methodologies. The program is delivered through a mix of lectures, seminars, tutorials, industrial presentations and visits, case studies, computer simulations, laboratory sessions and project work to enhance learning from a theoretical and practical aspects. The program also places importance in management skills, communication skills, computational techniques, data handling and analysis, problem solving, decision making and research methodology. Many of these skills will be addressed within an industrial context. Assessment is based on a combination of formal examination, course work, case study, research defense, presentation, and reports. industrial presentations and visits to enhance learning from a practical aspect. The Master of Science in Mechanical Engineering Program is a full-time program which is rated at 36 credit hours. corresponding to the work of a full-time student for two-years.

## 2. Program Identification and General Information

| | |
|---|---|
| Program Title | Master of Science in Mechanical Engineering |
| Awarding Institution | Sana'a University |
| Department | Mechanical Engineering Department |
| Other Departments with major Teaching Contributions | None |
| Language of study | English Language |
| Date of Specification Preparation/Revision | May/June 2021 |
| Mode of Study | Full time |
| Study System | Courses & Thesis |
| Main Location of Study | Faculty of Engineering/Sana'a University |
| Mode of Delivery | Semesters |
| Study Duration | Minimum: 2 Academic years (Two terms each, full-time)<br>Maximum: 4 Academic years |
| Award(s) or Final Award | Master of Science in Mechanical Engineering |
| Qualification required to join the program: | B.Sc. in Mechanical Engineering or any other equivalent field. |
| Minimum grade requirements to enroll in the program | Good - at least 65% of overall grade |
| Other admission requirements | High-skills English language (minimum requirement is Academic TOFEL of 65 overalls, in Writing and in Reading, Listening and Speaking). |

| Head of the Department | Quality Assurance Unit | Dean of the Faculty | Academic Development Center & Quality Assurance |
|---|---|---|---|
| Dr. Hamoud A. Al-Nahari | Assoc. Prof. Dr. Mohammad Algorafi | Prof. Dr. Mohammed AL-Bukhaiti | Assoc. Prof. Dr. Huda Al-Emad |
| Rector of Sana'a University<br>Prof. Dr. Al-Qassim Mohammed Abbas | | | |

**University of Sana'a**
**Faculty of Engineering**
**Department: Mechanical Engineering**
**Title of the Program:**
**Master of Science in Mechanical Engineering**

# Program Specification

| **2. Program Identification and General Information** | |
|---|---|
| Name of the program coordinator | Associate Prof. Dr. Khalil Al-Hatab |
| Approval date: | |

| **3. Program Curriculum Committee:** | |
|---|---|
| Prof. Dr. Mohammed Ahmed Al-Bukhaiti<br>Assoc. Prof. Dr. Khalil Al-Hatab<br>Assoc. Prof. Dr. Abdul Malik Ebrahim Momen<br>Dr. Abdulsalam Naji Almakhlafy<br>Dr. Hamoud Abdulsalam Al-Nehari | Dr. Mneer Al-Quadii<br>Dr. Thabet AL-Ghabri<br>Dr. Abduljalil Ali Al-Abidi<br>Dr. Abdullah Dhaiban |

| **4. Vision, Mission & Aims of the University** |
|---|
| **Vision of the University** |
| Sana'a University aspires to achieve a national leading role in teaching, learning, scientific research and community service; and to be among the best regional universities and the foremost house of expertise and think tank in Yemen. |
| **Mission of the University** |
| To contribute to the sustainable development efforts by providing an accredited higher education environment and excellent research services within a fruitful national partnership based on transparency, professionalism and creativity. |
| **Aims of the University** |
| The University seeks to achieve the following objectives: |
| • To provide specialized and in-depth academic opportunities for students in different fields of knowledge to meet the country's needs of specialties, technicians and experts, with special focus on the following: |
| - To boost the level and quality of preparation and qualification tasks. |
| - To create a general culture aiming at developing the elements of sound Islamic personality and the proper cognitive and scientific training. |
| - To stabilize the true Islamic vision emanating from the broad horizons of Islamic knowledge and its perception of the universe, man and life. |
| - To develop innovative and critical scientific thinking skills. |
| - To provide students with the required knowledge and scientific and applied skills for solving problems effectively and efficiently. |

| **5. Vision, Mission & Aims of the Faculty** |
|---|
| **Vision of the Faculty** |
| To excel in engineering education & scientific research with distinction at the local and regional levels. |
| **Mission of the Faculty** |

| Head of the Department<br>Dr. Hamoud A. Al-Nahari | Quality Assurance Unit<br>Assoc. Prof. Dr. Mohammad Algorafi | Dean of the Faculty<br>Prof. Dr. Mohammed AL-Bukhaiti | Academic Development Center & Quality Assurance<br>Assoc. Prof. Dr. Huda Al-Emad |
|---|---|---|---|
| Rector of Sana'a University<br>Prof. Dr. Al-Qassim Mohammed Abbas | | | |

# Program Specification

| |
|---|
| To provide excellent and accredited engineering education to meet the development needs and match the labor market requirements locally and regionally. |
| **Aims of the Faculty** |
| 1. To offer study programs in various fields of knowledge and equip students with required knowledge and scientific and know-how skills to utilize them in resolving problems effectively and efficiently. |
| 2. To develop positive trends towards engineering science and its accelerating developments and enable students to use the techniques and methods of conducting scientific research in engineering fields. |
| 3. To develop skills of scientific, innovative and critical thinking as well as the concept of continuous self-education. |
| 4. To strengthen scientific ties with national and international colleges, scientific bodies, and research & development centers. |
| 5. To provide technical and specialized studies and consultations to various state bodies and institutions, both public and semi-public, and utilize them in resolving the environment and society issues to promote sustainable development. |
| 6. To develop a spirit of co-operation, group work, effective leadership, sense of responsibility, and ethical commitment. |

| **6. Mission & Aims of the Department** |
|---|
| **Mission of the Department** |
| To prepare engineers having high skills who can meet social needs through delivering higher quality educational programs and scientific research and to deliver required consultancy work for local industry |

| **Aims of the Department** |
|---|
| 1. To prepare graduates in mechanical engineering with high knowledge and skills in different applications of the mechanical engineering. |
| 2. To participate as leaders and contribute locally and regionally. |
| 3. To prepare the ability and skills and to encourage them to work as a teamwork. |
| 4. To establish the soul of innovations in the graduates while conducting small scientific projects and to prepare them for the higher studies. |
| 5. To contribute in the preparation of the scientific papers in the area of mechanical engineering. |

| Head of the Department<br><br>Dr. Hamoud A. Al-Nahari | Quality Assurance Unit<br>Assoc. Prof. Dr. Mohammad Algorafi | Dean of the Faculty<br>Prof. Dr. Mohammed AL-Bukhaiti | Academic Development Center & Quality Assurance<br>Assoc. Prof. Dr. Huda Al-Emad |
|---|---|---|---|
| Rector of Sana'a University<br>Prof. Dr. Al-Qassim Mohammed Abbas | | | |

# Program Specification

## 6. Mission & Aims of the Program

### Mission of the Program

To provide an accredited master program in the mechanical engineering through applying advanced knowledge, skills and research services needed to innovation and leading in providing engineering solutions that address to societal challenges, satisfy the market needs and support the sustainable development and knowledge economy.

### Aims of the Program

1. To prepare graduate to excel in advanced mechanical engineering discipline as well as to extend the boundaries of their professional competence to meet the needs of future industrial development.
2. To prepare graduates with a wide range of knowledge and capacity for successful careers in industry and/or academia.
3. To equipped graduates with spirits of innovation, creativity, adaptability, and critical thinking to solve complex problems using advanced analytical and experimental methods in the mechanical engineering fields.
4. To prepare graduates to function effectively in multi-disciplinary team environments and communicate to a variety of audiences as well as to engage in life-long learning.
5. To provide opportunities for graduates to plan, schedule, manage and conduct tasks within considerations of environmental issues, social impacts and ethical professional practices and codes.
6. To develop awareness of scope, principles, norms and accountabilities of knowledge economy and sustainable development. by engaging in interactive learning environments and individually research studies.

## 8. Program Standards & Benchmarks

### Program Standards

- Post-Graduate Studies Rules and Regulations of the Ministry of Higher Education and Scientific Research, Yemen.
- Prime Minister Resolution No. 40 (2008) and No. 141 (2020).
- Post-Graduate Studies Guide, Sana'a University
- Accreditation Board for Engineering and Technology (ABET)

### Program Benchmarks

1. **University:** United Arab Emirates University (UAEU)
   **Faculty:** College of Engineering
   **Degree Awarded:** Master of Science
   **Major Field:** Mechanical Engineering

| Head of the Department | Quality Assurance Unit | Dean of the Faculty | Academic Development Center & Quality Assurance |
|---|---|---|---|
| Dr. Hamoud A. Al-Nahari | Assoc. Prof. Dr. Mohammad Algorafi | Prof. Dr. Mohammed AL-Bukhaiti | Assoc. Prof. Dr. Huda Al-Emad |

Rector of Sana'a University
Prof. Dr. Al-Qassim Mohammed Abbas

# Program Specification

| **8. Program Standards & Benchmarks** |
|---|
| **Minor Field:** Mechanical Engineering<br>**Total Credit Units:** 30 |
| 2. **University:** Qassim University, Saudi Arabia<br>**Faculty:** College of Engineering<br>**Degree Awarded:** Master of Science degree (MSc)<br>**Major Field:** Mechanical Engineering<br>**Minor Field:** Mechanical Engineering<br>**Total Credit Units:** 30 |
| 3. **University:** Kingston University, London, UK<br>**Faculty:** Science and Engineering College (CSE)<br>**Degree Awarded:** MSc<br>**Major Field:** Mechanical Engineering<br>**Minor Field:** Mechanical Engineering<br>**Total Credit Units:** 180 |
| 4. **University:** Aalborg University (Aalborg), Danish<br>**Faculty:** Faculty of Engineering and Science<br>**Degree Awarded:** MSc<br>**Major Field:** Mechanical Engineering and Manufacturing<br>**Minor Field:** Multiple<br>**Total Credit Units:** 120 |
| 5. **University:** Iowa State University, USA<br>**Faculty:** College of Engineering<br>**Degree Awarded:** Masters of Engineering / Master of Science (Thesis)<br>**Major Field:** Mechanical Engineering<br>**Minor Field:** Multiple<br>**Total Credit Units:** 30 |
| 6. **University:** University Technology<br>**Faculty:** Faculty of Engineering<br>**Degree Awarded:** MSc<br>**Major Field:** Mechanical Engineering<br>**Minor Field:** Mechanical Engineering<br>**Total Credit Units:** 40 |

**University of Sana'a**
**Faculty of Engineering**
**Department: Mechanical Engineering**
**Title of the Program:**
**Master of Science in Mechanical Engineering**

# Program Specification

## 9. Summary of Similar Programs (Benchmarks) for Mechanical Engineering Program

| | The Similar Programs (Benchmarks) | | | | | | Current Program |
|---|---|---|---|---|---|---|---|
| | 1st Program | 2nd Program | 3rd Program | 4th Program | 5th Program | 6th Program | |
| Program Title | Master of Science in Mechanical Engineering | Master of Science in Mechanical Engineering | Master of Science in Mechanical Engineering | MSc in Engineering (Mechanical Engineering) with specialization in: design of mechanical systems/ electro-mechanical system design/ manufacturing technology | Masters of Engineering / Master of Science (Thesis) in Mechanical Engineering | Master of Science (Mechanical Engineering) | MSc. in Mechanical Engineering |
| Faculty | College of Engineering | College of Engineering | Science and Engineering College | Faculty of Engineering and Science/ Mechanical Engineering and Manufacturing, | College of Engineering | Faculty of Engineering | Faculty of Engineering |
| University | United Arab Emirates University (UAEU) | Qassim University | Kingston University | Aalborg University (Aalborg) | Iowa State University | University Technology | Sana'a University |

| Head of the Department<br>Dr. Hamoud A. Al-Nahari | Quality Assurance Unit<br>Assoc. Prof. Dr. Mohammad Algorafi | Dean of the Faculty<br>Prof. Dr. Mohammed AL-Bukhaiti | Academic Development Center & Quality Assurance<br>Assoc. Prof. Dr. Huda Al-Emad |
|---|---|---|---|
| Rector of Sana'a University<br>Prof. Dr. Al-Qassim Mohammed Abbas | | | |

**University of Sana'a**
**Faculty of Engineering**
**Department: Mechanical Engineering**
**Title of the Program:**
**Master of Science in Mechanical Engineering**

# Program Specification

| 9. Summary of Similar Programs (Benchmarks) for Mechanical Engineering Program | | | | | | | |
|---|---|---|---|---|---|---|---|
| Country | United Arab Emirates | SA | UK | Denmark | USA | Malaysia | Yemen |
| Type of Program | Courses + Thesis | Courses + Thesis | Courses + Thesis | Courses + Master Thesis or Master Project | course-work only master's degree /Courses + Thesis | Courses + Research Project | Courses and Research |
| Study Methods in the Program: | Full-Time | Full Time | full-time/ Part-Time | Full Time | Full-Time | Full Time / Part Time | Full-time |
| Number of Semesters | 4 | 4 | | 4 | **4** | 2 long semesters and 1 short semester | 4 |
| Total Credit Hours (without Thesis) | 21 | 24 | 120 | 60-90 | 21/30 | 30 | 30 |
| No. of Compulsory Courses | 6 | 3 | 3 | 8 | 7/10 | 4 | 5 |
| Credit Hours for Compulsory | 12 | 9 | 90 | 60 | 21/30 | 12 | 15 |

| Head of the Department | Quality Assurance Unit | Dean of the Faculty | Academic Development Center & Quality Assurance |
|---|---|---|---|
| Dr. Hamoud A. Al-Nahari | Assoc. Prof. Dr. Mohammad Algorafi | Prof. Dr. Mohammed AL-Bukhaiti | Assoc. Prof. Dr. Huda Al-Emad |
| Rector of Sana'a University<br>Prof. Dr. Al-Qassim Mohammed Abbas | | | |

**University of Sana'a**
**Faculty of Engineering**
**Department: Mechanical Engineering**
**Title of the Program:**
**Master of Science in Mechanical Engineering**

# Program Specification

| 9. Summary of Similar Programs (Benchmarks) for Mechanical Engineering Program | | | | | | | |
|---|---|---|---|---|---|---|---|
| Courses | | | | | | | |
| No. of Elective Courses | 3 | 5 | 3 | 3 | 0/0 | 6 | 5 |
| Credit Hours for Elective Courses | 9 | 15 | 30 | 30 | 0/0 | 18 | 15 |
| Complementary Courses to Join the Program and Their Number | - | - | - | - | - | - | - |
| Credit Hours for Thesis | 9 | 6 | 60 | 30-60 | 9/0 | 10 | 6 |
| Total Credit Hours for Courses & Thesis | 30 | 30 | 180 | 120 | 30/30 | 40 | 30 |
| The Period for Thesis Completion | - | - | - | - | - | - | 2 semesters |
| The Min. Period to Complete the Program | 2 years | 2 | 1-year FT and 2 years PT | 2 | 2 | Min.: 1 year | 2 years |

| Head of the Department<br>Dr. Hamoud A. Al-Nahari | Quality Assurance Unit<br>Assoc. Prof. Dr. Mohammad Algorafi | Dean of the Faculty<br>Prof. Dr. Mohammed AL-Bukhaiti | Academic Development Center & Quality Assurance<br>Assoc. Prof. Dr. Huda Al-Emad |
|---|---|---|---|
| Rector of Sana'a University<br>Prof. Dr. Al-Qassim Mohammed Abbas | | | |

# Program Specification

| **9. Summary of Similar Programs (Benchmarks) for Mechanical Engineering Program** | | | | | | | |
|---|---|---|---|---|---|---|---|
| The max. Period to Complete the Program | 4 years | - | 2-years FT and 4 years PT | - | - | Max.: 4 years | 3 years |

| Head of the Department<br><br>Dr. Hamoud A. Al-Nahari | Quality Assurance Unit<br>Assoc. Prof. Dr. Mohammad Algorafi | Dean of the Faculty<br>Prof. Dr. Mohammed AL-Bukhaiti | Academic Development Center & Quality Assurance<br>Assoc. Prof. Dr. Huda Al-Emad |
|---|---|---|---|
| Rector of Sana'a University<br>Prof. Dr. Al-Qassim Mohammed Abbas | | | |

# Program Specification

## 10. Program Intended Learning Outcomes (PILOs)

### A. Knowledge and Understanding

Upon successful completion of the Master of Science in Mechanical Engineering Program, graduates should be able to:

| | |
|---|---|
| A1. | Acquire advanced concepts and knowledge of mathematics, scientific, mechanical engineering and associated technologies as well as across the boundaries of interdisciplinary disciplines |
| A2. | Identify and critically evaluate contemporary engineering technologies, current developments and emerging trends within the mechanical engineering contexts. |
| A3. | Provide a holistic description of principles, concepts, approaches, techniques and analysis tools to design and development of existing and novel mechanical systems, while taking a sustainable and environmentally-friendly approach. |

### B. Intellectual Skills

Upon successful completion of the Master of Science in Mechanical Engineering Program, graduates should be able to:

| | |
|---|---|
| B1. | Identify and apply specialized knowledge and skills to solve problems that are critical to future growth of industry and business |
| B2. | Creatively thinking and apply analysis tools to formulate and solve complex engineering problems in the mechanical engineering context using modern techniques and tools. |
| B3. | Design and optimize mechanical components, systems and process to meet desired needs within realistic constraints. |
| B4. | Analyze and assess risks of the professional practice in the mechanical engineering contexts. |

### C. Practical and Professional Skills

Upon successful completion of the Master of Science in Mechanical Engineering Program, graduates should be able to:

| | |
|---|---|
| C1. | Use modern manufacturing processes and materials, experimental tests, appropriate software packages and other modern tools for the design analysis and manufacture of mechanical components and systems. |
| C2. | Conduct research and studies to solve mechanical engineering problems professionally, ethically and responsibly within realistic constraints. |
| C3. | Demonstrate an in-depth understanding of the mechanical engineering business environment, including environmental aspects, and apply quality issues, modern operations and business management techniques and good practices in a range of contexts. |

### D. Key Transferrable Skills

Upon successful completion of the Master of Science in Mechanical Engineering Program, graduates should

| be able to: | |
|---|---|
| D1. | Adopt effectively IT capabilities and other different resources of information to develop a scientific research in mechanical engineering fields. |
| D2. | Communicate, present, challenge and defend research ideas, results and conclusions in both orally and writing forms to different audiences in contexts. |
| D3. | Identify a need for the latest relevant knowledge and technologies and undertake life-long learning. |
| D4. | Collaborate effectively within multidisciplinary teams and lead them in different professional contexts |

**11. Teaching Strategy to Achieve Program Learning Outcomes**

| ILOs | Teaching Strategy | Assessment Methods |
|---|---|---|
| A1 | Lectures, Seminars, laboratory works, Self-Learning, Case study, independent study, Active learning, Computer hands-on sessions. | Reports, field work, laboratory report, survey, Written Exam, Assignments |
| A2 | | |
| A3 | | |
| B1 | Lectures, Project supervision, laboratory works, Self-Learning, case study, simulation exercises, independent study, Analysis and Problem Solving, Brainstorming, Presentations, | Reports, field work, laboratory report, survey, Written Exam, Assignments. |
| B2 | | |
| B3 | | |
| B4 | | |
| C1 | Project supervision, lectures, laboratory works, independent study, simulation exercises, Analysis and Problem Solving | Seminar report, written research proposal, thesis and publication. |
| C2 | | |
| C3 | | |
| D1 | Dissertation defenses and presentation, independent study, Presentation, Brainstorming, presenting researches, Publish research papers. | Written research proposal, thesis and publication, Written Exam, Assignments, Experimental and field work, laboratory report, survey, presentation, written report. |
| D2 | | |
| D3 | | |
| D4 | | |

| Teaching Strategy | Description of the Main Strategy Used |
|---|---|
| Lectures. | These are interactive lectures weekly conducted according to course plan in a class-room and supported with variety of teaching formats including, lectures and multimedia presentations, use of whiteboard and solved examples, and class discussions, in which concepts, approaches, and case studies are presented, explored, and shown |

# Program Specification

| Teaching Strategy | Description of the Main Strategy Used |
|---|---|
| | students what they need to know. |
| Independent Study | Independent study is an individualized learning experience that allows students to select a topic focus, define problems or questions, gather and analyze information, apply skills, and create a product to show what has been learned. |
| Self-Learning. | Students are encouraged to undertake independent study to both supplement and consolidate what are being learned. |
| Active Learning | - |
| Computer Hands-on Sessions | Practical Applications using a variety of software before the real design and implementation. A variety of web-based searches students will be assigned to learn how they can search for solutions using the Web. |
| Simulation Exercises | Application of simulation programs. |
| Analysis and Problem Solving | The study of Electrical Power Engineering involves applying knowledge and problem-based learning. This allows students to become more active in their learning as they work out which information, they need to find out how to solve a particular problem. They can work out a problem collaboratively, practice research as well as testing different components to come up with a valid solution. |
| Laboratory Works | During laboratory sessions, students will be given experiments to work in groups where they can apply the theories and principles gained. This gives them the opportunity to have hands-on experience to design and conduct experiments in addition to analyzing, interpreting data obtained from experiments, and maximize their learning through actual simulation |
| Presentations/Presenting research | Students present their work to the whole group, for discussion, criticism and suggestions for improvement. Presentation sessions provide an opportunity to address questions, queries and problems. |
| Project Supervision | The instructor/lecturer needs to set advance work for students, and then have the students present their work to the whole group, for discussion, criticism and suggestions for improvement. Project sessions provide an opportunity to address questions, and problems. |
| Brainstorming | Brainstorming is an effective technique for generating lists of ideas, |

# Program Specification

| Teaching Strategy | Description of the Main Strategy Used |
|---|---|
| | and creating interest and enthusiasm for new concepts or topics. Brainstorming provides teachers and students with an overview of what students know and/or think about a specific topic. Students can use brainstorming to organize their knowledge and ideas. |
| Dissertation | Documentation of research methodology and results. |
| Publish Research Papers | To publish research results in peer-reviewed journals. |
| Seminar | The instructor needs to set advance work for a selected number of students, and then have the selected students present their work to the whole group, for discussion, criticism and suggestions for improvement. Seminar sessions provide an opportunity to address questions, queries and problems. |
| Research Activities | Research-tutored activities envisage activities where students are participants, they are engaged in research discussions and emphasis is put on the research content. |

| Assessment Strategy | Description of the main strategy used. |
|---|---|
| Written Exam | Mid-term test is conducted in the 8$^{th}$ week and final exam is conducted at the end of each course. Both tests are closed or open book, notes and resources. At least two quizzes must be done through the course. |
| Oral Discussion | To know the knowledge of the students. |
| Presentations | For Final Results displaying, to enhance the level of students in different subjects. |
| Quizzes | The entire assessment of Quizzes activities during the teaching period of each course. |
| Laboratory Reports | To demonstrate the personal skills, practical expertise, communication skills, report writing skills, and team work expertise they are expected to be learned and gained through their education. |
| Reports and field work | For evaluation, to demonstrate the personal skills, practical expertise, communication skills, report writing skills, and team work expertise they are expected to be learned and gained through their education. |

| Head of the Department | Quality Assurance Unit | Dean of the Faculty | Academic Development Center & Quality Assurance |
|---|---|---|---|
| Dr. Hamoud A. Al-Nahari | Assoc. Prof. Dr. Mohammad Algorafi | Prof. Dr. Mohammed AL-Bukhaiti | Assoc. Prof. Dr. Huda Al-Emad |
| Rector of Sana'a University<br>Prof. Dr. Al-Qassim Mohammed Abbas | | | |

# Program Specification

| Assessment Strategy | Description of the main strategy used. |
|---|---|
| Survey | For data collection and related field work. |
| Assignments | The entire assessment of coursework activities during the teaching period of each course (which includes group and individual work, tests and presentations, etc.). |
| Seminar | As descried above. |
| Written report | As descried above. |
| Written research proposal | As descried above. |
| Thesis and publications | As descried above. |

## 12. Intended Learning Outcomes Mapping:

| Course Code | Course Name | PILOs | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | A1 | A2 | A3 | B1 | B2 | B3 | B4 | C1 | C2 | C3 | D1 | D2 | D3 | D4 |
| **ME 501** | Advanced Engineering Mathematics | √ | | √ | √ | √ | √ | | | | √ | | √ | | |
| **ME 502** | Applied Finite Element | √ | √ | √ | √ | √ | √ | √ | √ | √ | | √ | √ | √ | √ |
| **ME 511** | Advanced Mechanics of Solid and Materials | √ | √ | √ | √ | √ | √ | √ | √ | √ | | √ | √ | √ | √ |
| **ME 521** | Advanced Thermodynamics | √ | √ | √ | √ | √ | √ | √ | √ | √ | | √ | √ | √ | √ |
| **FR 501** | Research Methodology | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ |
| **ME 503** | Advanced Control System Design | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ |
| **ME 512** | Fatigue and Fracture of Engineering Materials | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ |
| **ME 513** | High Temperature Behavior of Materials | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | | √ | √ | √ |
| **ME 514** | Advanced Dynamics of Machinery | | | √ | | √ | √ | | √ | | | | √ | | √ |
| **ME 515** | Advanced Machine Design & Optimization | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ |
| **ME 516** | Advanced Manufacturing Processes | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ |
| **ME 517** | Automation in Manufacturing Systems | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ |
| **ME 518** | Advanced Studies in Mechanical Engineering | √ | √ | | | √ | √ | √ | √ | √ | √ | | | √ | √ |
| **ME 522** | Advanced Fluid Mechanics | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ |

| Head of the Department | Quality Assurance Unit | Dean of the Faculty | Academic Development Center & Quality Assurance |
|---|---|---|---|
| Dr. Hamoud A. Al-Nahari | Assoc. Prof. Dr. Mohammad Algorafi | Prof. Dr. Mohammed AL-Bukhaiti | Assoc. Prof. Dr. Huda Al-Emad |
| Rector of Sana'a University<br>Prof. Dr. Al-Qassim Mohammed Abbas | | | |

# Program Specification

| Course Code | Course Name | PILOs | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | A1 | A2 | A3 | B1 | B2 | B3 | B4 | C1 | C2 | C3 | D1 | D2 | D3 | D4 |
| **ME 523** | Advanced Heat Transfer | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ |
| **ME 524** | Advanced Energy Conversion | √ | | √ | | √ | | √ | | √ | √ | √ | √ | √ | √ |
| **ME 525** | Engineering Safety and the Environment | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ |
| **ME 526** | Renewable Energy and Application | √ | | √ | | √ | | √ | | √ | √ | √ | √ | √ | √ |
| **ME 527** | Advanced Refrigeration and Air Conditioning Systems | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ |
| **ME 528** | Modeling and Simulation of Engineering Systems | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ |
| **ME 531** | Master Thesis | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ |

## 13. Program Structure

| Program Requirement | No. of Courses | Credit Hours | % |
|---|---|---|---|
| Complementary Courses | See List below. | | |
| Faculty Requirement | 1 | 3 | **8.33%** |
| Compulsory Courses | 4 | 12 | 33.33% |
| Elective Courses | 5 | 15 | 41.66% |
| Thesis | - | 6 | 16.66% |
| Total | | 36 | 100% |

## Complementary Courses (00 CH)

| No. | Course Code | Course Title | L | T | P | CH |
|---|---|---|---|---|---|---|
| 1. | **ME222** | Mechanical Vibrations | 2 | 2 | - | **3** |

| Head of the Department | Quality Assurance Unit | Dean of the Faculty | Academic Development Center & Quality Assurance |
|---|---|---|---|
| Dr. Hamoud A. Al-Nahari | Assoc. Prof. Dr. Mohammad Algorafi | Prof. Dr. Mohammed AL-Bukhaiti | Assoc. Prof. Dr. Huda Al-Emad |
| Rector of Sana'a University<br>Prof. Dr. Al-Qassim Mohammed Abbas | | | |

# Program Specification

| | | | | | | |
|---|---|---|---|---|---|---|
| 2. | **ME233** | CAD/CAM | 2 | - | 2 | **3** |
| 3. | **ME314** | Theory of Metal Forming | 2 | 2 | - | **3** |
| 4. | **ME324** | Automatic Control | 2 | 2 | - | **3** |
| 5. | **ME336** | Machine Design - II | 2 | 2 | - | **3** |
| 6. | **ME353** | Heat and Mass Transfer | 3 | 2 | - | **4** |
| 7. | **ME404** | Renewable Energy Systems | 2 | 2 | - | **3** |
| 8. | **ME457** | Refrigeration and air conditioning systems | 2 | - | - | **2** |
| 9. | **ME458** | Thermal Power Plants | 2 | 2 | - | **3** |

**Compulsory Courses (6 Courses, 15 CH)**

| No. | Course Code | Course Title | L | T | P | CH |
|---|---|---|---|---|---|---|
| 1 | **ME501** | Advanced Engineering Mathematics | 3 | - | - | 3 |
| 2 | **ME502** | Applied Finite Element | 2 | - | 2 | 3 |
| 3 | **ME511** | Advanced Mechanics of Solid and Materials | 3 | - | - | 3 |
| 4 | **ME521** | Advanced Thermodynamics | 3 | - | - | 3 |
| 5 | **FR501** | Research Methodology | 3 | - | - | 3 |
| | | **Total** | | | | **15** |

**Elective Courses: list A (5 Courses, 15 CH)**

| Head of the Department<br>Dr. Hamoud A. Al-Nahari | Quality Assurance Unit<br>Assoc. Prof. Dr. Mohammad Algorafi | Dean of the Faculty<br>Prof. Dr. Mohammed AL-Bukhaiti | Academic Development Center & Quality Assurance<br>Assoc. Prof. Dr. Huda Al-Emad |
|---|---|---|---|
| Rector of Sana'a University<br>Prof. Dr. Al-Qassim Mohammed Abbas | | | |

**University of Sana'a**
**Faculty of Engineering**
**Department: Mechanical Engineering**
**Title of the Program:**
**Master of Science in Mechanical Engineering**

# Program Specification

| No. | Course Code | Course Title | L | T | P | CH |
|---|---|---|---|---|---|---|
| 1 | **ME**512 | Fatigue and Fracture of Engineering Materials | **3** | | | 3 |
| 2 | **ME513** | High Temperature Behavior of Materials | **3** | | | 3 |
| 3 | **ME514** | Advanced Dynamics of Machinery | **3** | | | 3 |
| 4 | **ME515** | Advanced Machine Design & Optimization | **3** | | | 3 |
| 5 | **ME516** | Advanced Manufacturing Processes | **3** | | | 3 |
| 6 | **ME517** | Automation in Manufacturing Systems | **3** | | | 3 |
| 7 | **ME518** | Advanced Studies in Mechanical Engineering | **3** | | | 3 |
| 8 | **ME503** | Advanced Control Systems Design | **2** | | 2 | 3 |

**Elective Courses: list B (5 Courses, 15 CH)**

| No. | Course Code | Course Title | L | T | P | CH |
|---|---|---|---|---|---|---|
| 1 | **ME522** | Advanced Fluid Mechanics | **3** | | | 3 |
| 2 | **ME523** | Advanced Heat Transfer | **3** | | | 3 |
| 3 | **ME524** | Advanced Energy Conversion | **3** | | | 3 |
| 4 | **ME525** | Engineering Safety and the Environment | **3** | | | 3 |
| 5 | **ME526** | Renewable Energy and Application | **3** | | | 3 |

| Head of the Department<br>Dr. Hamoud A. Al-Nahari | Quality Assurance Unit<br>Assoc. Prof. Dr. Mohammad Algorafi | Dean of the Faculty<br>Prof. Dr. Mohammed AL-Bukhaiti | Academic Development Center & Quality Assurance<br>Assoc. Prof. Dr. Huda Al-Emad |
|---|---|---|---|
| Rector of Sana'a University<br>Prof. Dr. Al-Qassim Mohammed Abbas | | | |

# Program Specification

| No. | Course Code | Course Title | L | T | P | CH |
|---|---|---|---|---|---|---|
| 6 | **ME527** | Advanced Refrigeration and Air Conditioning Systems | **3** | | | 3 |
| 7 | **ME528** | Modeling and Simulation of Engineering Systems | **3** | | | 3 |
| 8 | **ME503** | Advanced Control Systems Design | **2** | | 2 | 3 |

| **Thesis** |
|---|
| The student must prepare and discuss a thesis by (6) credit hours (THESIS599 MS Thesis). |
| **Thesis and Its Requirements** |
| 1. Registration of the Thesis:<br>(Requirements/conditions and procedures for registration of the thesis as well as controls, responsibilities and procedures of scientific guidance) |
| - Completion of all required Compulsory & Elective Courses with average grade of more than or equal to 75%.<br>- Completion of all university requirements.<br>- Field of Research and precise research topic with short Description and suggested time plan.<br>- First Department Seminar.<br>- Decision letter (Supervisors) of acceptance of the research topic.<br>- Thesis work should be done in at least 2-semesters.<br>- Thesis work should be done in at most 4-semesters.<br>- Any further requirements and controls based on post-graduate deanship regulations. |
| **2. Scientific Supervision:**<br>(The regulations of the selection of the scientific supervisor and his/her responsibilities, as well as the procedures/ mechanisms of the scientific supervision and follow-up) |
| • At most Two supervisors are selected for the supervision of a thesis.<br>• At least One Associate or Full Professor is appointed as supervisor either from the department or from another department inside or outside the faculty.<br>• Any Assistant Professor appointed as supervisor should have at least 4-year experience in the field of research and have published at least one paper.<br>• Candidates may apply for one-year extension (full-time) for completion of the thesis to the |

**Thesis**

Postgraduate Program Administration at the Faculty of Engineering, which will be granted if the candidate provides a valid reason for extension.

**The Supervisor Responsibilities are:**

- Help and assist the Candidate/researcher in planning the research.
- Guide the Candidate to adhere to the standards of academic integrity and research ethics, including combating plagiarism.
- Monthly follow up and meeting with the researcher (At least One meeting per month).
- Guide the researcher at every step to be done during thesis work.
- Write follow-up (progress report) after each meeting.
- Write a follow-up (evaluation report) every semester.
- The supervisor shall submit copies of these reports to the Postgraduate -Program coordinator, the Head of the Department and the Head of the Post-graduate Deanship.
- Write the final thesis acceptance report in order to prepare the final department seminar and then initiating the preparation for thesis presentation, defense and approval.

**The Candidate/Student Responsibilities** are:

- Commitment to attend regular meetings with supervisor.
- Commitment to keep firm contact with supervisor for consultation and update.
- Present his/her accomplishments by the end of every semester.
- Plan and actively pursue the research under close coordination with supervisor.
- Identify and deal with any research-related problems.
- Comply with administrative requirements.
- Meet and admit to ethical guidelines.
- The length of a 6 credit hours thesis or research portfolio will be appropriate to the discipline and Thesis text/size must not exceed 30,000 words, including bibliography, footnotes or endnotes and essential appendices, unless specific permission has been granted by the post-graduate deanship.

**3.Thesis Defense/Examination:**

(The regulations for selection of the defense/examination committee and the requirements to proceed for thesis defense, the procedures for defense and approval of the thesis, and criteria for evaluation of the thesis)

A Thesis is proceeded for defense after it supports the following:

- At least One research paper in the field of research published or accepted for publication in a scientific journal or conference.
- Final acceptance letters provided by the supervisor(s) and the department final seminar

| **Thesis** |
|---|
| committee.<br>The **Examination Committee** should consist of:<br>- One Associate or Full Professor specialized in the field of research from an external university.<br>- One Associate or Full Professor from the department of Mechanical Engineering.<br>- The supervisor of the thesis.<br><br>A session for presentation, defense and approval of the thesis should be arranged based on the following:<br>• At least two members of the examination committee accept their assignment and reply by acceptance letter approving the thesis for defense within One month.<br>• The session of defense should be declared within two weeks after receiving of examination committee members' approval letters. |

| **14. System of Study** | |
|---|---|
| **Type of program** | Courses and Research |
| **Study methods in the program:** | Regular |
| **The period to complete the program** | Min. 2 Years (4 Terms)<br>Max. 3 Years (6 Terms) |
| **Total Credit Hours for courses & Research** | 36 |

## 15. Study Plan

FR stands for Faculty Requirements.
ME5XX stands for Mechanical Engineering Department Requirements.

**First Semester**

| No. | Course Code | Course Name | اسم المقرر | Credit Hours | | | | Prerequisites |
|---|---|---|---|---|---|---|---|---|
| | | | | Lec. | Pr. | Tut. | Total C.H. | |
| 1 | ME 501 | Advanced Engineering Mathematics | رياضيات هندسية متقدمة | 3 | 0 | 0 | 3 | BR 231 |
| 2 | ME 502 | Applied Finite Element | تطبيقات العناصر المحدودة | 3 | 0 | 0 | 3 | Pre- ME 405<br>Co- ME 501 |
| 3 | ME 511 | Advanced Mechanics of Solid and Materials | الميكانيكا المتقدمة للجوامد والمواد | 3 | 0 | 0 | 3 | Pre- ME 234<br>Co- ME 501 & |

| Head of the Department<br>Dr. Hamoud A. Al-Nahari | Quality Assurance Unit<br>Assoc. Prof. Dr. Mohammad Algorafi | Dean of the Faculty<br>Prof. Dr. Mohammed AL-Bukhaiti | Academic Development Center & Quality Assurance<br>Assoc. Prof. Dr. Huda Al-Emad |
|---|---|---|---|
| Rector of Sana'a University<br>Prof. Dr. Al-Qassim Mohammed Abbas | | | |

# Program Specification

| First Semester | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | ME 502 |
| 4 | ME 521 | Advanced Thermodynamics | دِينَامِيكَا حَرَارِيَّة متقدمة | 3 | 0 | 0 | 3 | Pre- ME 251, ME 252<br>Co- ME 501 |
| 5 | ME xxx | Elective 1(from group A or B) | اختياري 1 (من المجموعة A او B) | 3 | 0 | 0 | 3 | --- |
| | | **Total Credit Hours** | | **15** | | | **15** | |

| Second Semester | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **No.** | **Course Code** | **Course Name** | اسم المقرر | **Credit Hours** | | | | **Prerequisites** |
| | | | | **Lec.** | **Pr.** | **Tut.** | **Total C.H.** | |
| 1 | FR501 | Research Methodology | مناهج بحث | 3 | 0 | 0 | 3 | |
| 2 | ME xxx | Elective 2 (from group A or B) | اختياري 2 (من المجموعة A او B) | 3 | 0 | 0 | 3 | --- |
| 3 | ME xxx | Elective 3 (from group A or B) | اختياري 3 (من المجموعة A او B) | 3 | 0 | 0 | 3 | --- |
| 4 | ME xxx | Elective 4 (from group A or B) | اختياري 4 (من المجموعة A او B) | 3 | 0 | 0 | 3 | --- |
| 5 | ME xxx | Elective 5 (from group A or B) | اختياري 5 (من المجموعة A او B) | 3 | 0 | 0 | 3 | --- |
| | | Total Credit Hours | | 15 | | | 15 | |

| Course Code | Course Name | Cr. Hrs. |
|---|---|---|
| **THESIS599** | **Research** | 6 |

| **16. Admission Requirements:** |
|---|
| 1. Bachelor of Science in Mechanical Engineering or related fields. Certificate with not less than 65 % passing ratio, or equivalent. |
| 2. Interview |
| 3. TOEFL/IBT: 65 OR equivalent |
| 4. ICDL (Computer Skills) |
| 5. Arabic Language |
| 6. Student number capacity of 20 students per year |
| 7. Transfer Requirements and Courses Equivalency |
| 8. Annex -13: shows the Admission Requirements for the Program. |

| Head of the Department<br>Dr. Hamoud A. Al-Nahari | Quality Assurance Unit<br>Assoc. Prof. Dr. Mohammad Algorafi | Dean of the Faculty<br>Prof. Dr. Mohammed AL-Bukhaiti | Academic Development Center & Quality Assurance<br>Assoc. Prof. Dr. Huda Al-Emad |
|---|---|---|---|
| Rector of Sana'a University<br>Prof. Dr. Al-Qassim Mohammed Abbas | | | |

# Program Specification

| **17. Graduation Requirements:** | |
|---|---|
| Student attendance should not be less than 75%. | |
| Student will graduate after successfully passing the 30 credit hours courses and 6 credit hours Research. | |
| The minimum score for the average of all courses is 75%. | |
| The minimum score to pass any credit hours course is 65%. | |
| Grading System: | |
| From 90% to 100% of total marks | Excellent |
| From 80% to less than 90% | Very Good |
| From 75% to less than 80% | Good |
| From 65% to less than 75% | Pass |
| Less than 65% | Poor/Fail |

**18. Learning Resources, Facilities, and Equipment for Running the Program**

**Learning Resources.**

Policies and Procedure for providing and quality assurance of learning resources textbooks, references and other resource materials, including electronic and web-based resources, Journal Database, etc.

- Library (Textbooks, references, … etc)

Library upgrading necessary, List of required new publications to be provided by Master Program teaching staff

- Electronic Library (Existing, allows access to international research papers and publications).

**Required Facilities and Equipment ( not available):**

Policies and Procedure for providing and quality assurance of Facilities and Equipment (Library, laboratories (Structure, material Labs), medical facilities, classrooms, etc.).

**Labs (not available):**

1. Advanced Measurement
2. Engineering Mechanics
3. Machine Dynamic and Vibration
4. Materials Science
5. HVAC
6. Fluid Mechanics
7. Thermodynamics
8. Heat Transfer
9. Mechanical workshop
10. Computer Aided Design (CAD) Lab
11. Renewable Energy

| Head of the Department<br>Dr. Hamoud A. Al-Nahari | Quality Assurance Unit<br>Assoc. Prof. Dr. Mohammad Algorafi | Dean of the Faculty<br>Prof. Dr. Mohammed AL-Bukhaiti | Academic Development Center & Quality Assurance<br>Assoc. Prof. Dr. Huda Al-Emad |
|---|---|---|---|
| Rector of Sana'a University<br>Prof. Dr. Al-Qassim Mohammed Abbas | | | |

# Program Specification

| **19. Teaching Staff** | | | | |
|---|---|---|---|---|
| | **Professor** | **Associate Professor** | **Assistant Professor** | **Technicians/Assistants** |
| **Required Number** | 1 | 3 | 3 | 6 |
| **Available Number** | 1 | 3 | 3 | 0 |
| **Note:** | | | | |

## 20. Program Management and Regulations

### 1. Program Management

### 1.1 Program Structure

(Including boards, councils, units, committees, etc.)

- Mechanical Engineering Department Board
- Postgraduate Studies Administration
- Vice Dean for Postgraduate Studies
- College of Engineering Board
- Vice Presidency of the University for Postgraduate Studies

### 1.2 Stakeholders' Involvement

Describe the representation and involvement of stakeholders in the program planning and development. (Students, professional bodies, scientific societies, alumni, employers, etc.)

The stakeholders, including representatives of universities, research centers, public and private sector, were involved in designing the program through their participation in a workshop, as well as through response to a needs assessment questionnaire.

### 2. Program Regulations

Provide a list of related program regulations, including their link to online version: admission, study and exams, recruitment, appeals and complaint regulations, etc.)

- Prime Minister Resolution No. 40 of 2008.
- Prime Minister Resolution No. 141 of 2020.
- Sana'a University Post-Graduate Studies Guide

## 21. Evaluation of Program Quality Matrix:

| **Evaluation Areas/Aspects** | **Evaluation Sources/References** | **Evaluation Methods** | **Evaluation Time** |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| | | | |

| Head of the Department<br>Dr. Hamoud A. Al-Nahari | Quality Assurance Unit<br>Assoc. Prof. Dr. Mohammad Algorafi | Dean of the Faculty<br>Prof. Dr. Mohammed AL-Bukhaiti | Academic Development Center & Quality Assurance<br>Assoc. Prof. Dr. Huda Al-Emad |
|---|---|---|---|
| Rector of Sana'a University<br>Prof. Dr. Al-Qassim Mohammed Abbas | | | |

# Program Specification

**Note:**
**Evaluation Areas/Aspects** (e.g., leadership, effectiveness of teaching & assessment, learning resources, partnerships, etc.)
**Evaluation Sources** (students, graduates, alumni, faculty, program leaders, administrative staff, employers, independent reviewers, and others (specify)
**Evaluation Methods** (e.g., Surveys, interviews, visits, etc.)
**Evaluation Time** (e.g., beginning of semesters, end of academic year, etc.)

## 22. List of Annexes

| | |
|---|---|
| **Annex (1)** | Academic Standards Curriculum Criteria of Accreditation Board for Mechanical Engineering program. |
| **Annex (2)** | Survey of names of Similar Accredited Programs at International Universities (Benchmarks) for Mechanical Engineering Programs. |
| **Annex (3)** | Survey of Intended Learning Outcomes for similar Accredited Mechanical Engineering Programs at International Universities. |
| **Annex (4)** | Summary of similar Programs (Benchmarks) for Master of Science in Mechanical Engineering Program. |
| **Annex (5)** | Survey of course names of Similar Programs. |
| **Annex (6)** | Survey/Mapping of Vision, Mission and Objectives of similar Accredited Programs at International Universities (Benchmarks) for Masters of Science in Mechanical Engineering programs. |
| **Annex (7)** | Mapping of the mission and objectives of the program with the vision, mission and objectives of faculty, and the university. |
| **Annex (8)** | Main Themes/Sub-Themes with Relative weight for Program (if need) |
| **Annex (9)** | PILOs Distribution to General Themes for Program (if need) |
| **Annex (10)** | Matrix of mapping program P- ILO's with courses |
| **Annex (11)** | Mapping the benchmarks with PILO's (if need) |
| **Annex (12)** | Mapping Program's Goals with Intended Learning Outcomes |
| **Annex (13)** | The Admission Requirements for the Program. |

## 23. Attachment of Courses Specification and Syllabus of the Program

| Head of the Department<br><br>Dr. Hamoud A. Al-Nahari | Quality Assurance Unit<br>Assoc. Prof. Dr. Mohammad Algorafi | Dean of the Faculty<br>Prof. Dr. Mohammed AL-Bukhaiti | Academic Development Center & Quality Assurance<br>Assoc. Prof. Dr. Huda Al-Emad |
|---|---|---|---|
| Rector of Sana'a University<br>Prof. Dr. Al-Qassim Mohammed Abbas | | | |

# Appendix

| | | | |
|---|---|---|---|
| Head of the Department<br><br>Dr. Hamoud A. Al-Nahari | Quality Assurance Unit<br>Assoc. Prof. Dr. Mohammad Algorafi | Dean of the Faculty<br>Prof. Dr. Mohammed AL-Bukhaiti | Academic Development Center & Quality Assurance<br>Assoc. Prof. Dr. Huda Al-Emad |
| Rector of Sana'a University<br>Prof. Dr. Al-Qassim Mohammed Abbas | | | |

**University of Sana'a**
**Faculty of Engineering**
**Department: Mechanical Engineering**
**Title of the Program:**
**Master of Science in Mechanical Engineering**

# Program Specification

**Prepared by:**

| | |
|---|---|
| Associate Prof. Khalil Al-Hatab | Program Coordinator |
| Dr. Mohamed Algorafi | Quality Assurance Unit/Faculty of Engineering |

**Relationship between Program Mission and the Mission of the Faculty.**

Matching

**Relationship between Program Goals and the Goals of the Faculty.**

Matching

| Head of the Department<br><br>Dr. Hamoud A. Al-Nahari | Quality Assurance Unit<br>Assoc. Prof. Dr. Mohammad Algorafi | Dean of the Faculty<br>Prof. Dr. Mohammed AL-Bukhaiti | Academic Development Center & Quality Assurance<br>Assoc. Prof. Dr. Huda Al-Emad |
|---|---|---|---|
| Rector of Sana'a University<br>Prof. Dr. Al-Qassim Mohammed Abbas | | | |

## ملحق (1) المعايير الأكاديمية للمحتوى لهيئة الاعتماد المقترحة لبرنامج ماجستير الهندسة الميكانيكية

## (Annex-1): Academic Standards Curriculum Criteria of Accreditation Board for Master of Science in Mechanical Engineering

- Rules and Regulations of the Ministry of Higher Education and Scientific Research, Yemen.
- Accreditation Board for Engineering and Technology (ABET).

| Head of the Department<br><br>Dr. Hamoud A. Al-Nahari | Quality Assurance Unit<br>Assoc. Prof. Dr. Mohammad Algorafi | Dean of the Faculty<br>Prof. Dr. Mohammed AL-Bukhaiti | Academic Development Center & Quality Assurance<br>Assoc. Prof. Dr. Huda Al-Emad |
|---|---|---|---|
| Rector of Sana'a University<br>Prof. Dr. Al-Qassim Mohammed Abbas | | | |

# Program Specification

## ملحق (2) مسح أسماء البرامج المعتمدة المماثلة لبرنامج ماجستير العلوم في الهندسة الميكانيكية

## Annex (2) Survey of names Similar Accredited Programs at International Universities (Benchmarks) for Master of Science in in Mechanical Engineering

| # | The Academic Program اسم البرنامج المماثل | The University الجامعة | The Faculty الكليّة | The Department القسم | The Country الدولة | Program Accrediting Body جهة اعتماد البرنامج | Degree Award at Program Completion التي يمنحها الدرجة البرنامج للخريج | Year of accreditation سنة الحصول على الاعتماد | Type of program |
|---|---|---|---|---|---|---|---|---|---|
| The 1st Program البرنامج الاول | Master of Science in Mechanical Engineering | United Arab Emirates University (UAEU) | College of Engineering | Mechanical Engineering | United Arab Emirates | --- | MSc | | Courses + Thesis |
| The 2nd Program البرنامج الثاني | Master of Science in Mechanical Engineering | Qassim University | College of Engineering | Mechanical Engineering | SA | -- | MSc | | Courses + Thesis |
| The 3rd Program البرنامج الثالث | MSc Mechanical Engineering | Kingston University | Science and Engineering College | Mechanical & Automotive | UK | Institution of Mechanical Engineers (IMechE) and Engineering | MSc | 2011 | Courses + Thesis |

| Head of the Department<br>Dr. Hamoud A. Al-Nahari | Quality Assurance Unit<br>Assoc. Prof. Dr. Mohammad Algorafi | Dean of the Faculty<br>Prof. Dr. Mohammed AL-Bukhaiti | Academic Development Center & Quality Assurance<br>Assoc. Prof. Dr. Huda Al-Emad |
|---|---|---|---|
| Rector of Sana'a University<br>Prof. Dr. Al-Qassim Mohammed Abbas | | | |

**University of Sana'a**
**Faculty of Engineering**
**Department: Mechanical Engineering**
**Title of the Program: Master of Science in Mechanical Engineering**

# Program Specification

| # | The Academic Program اسم البرنامج المماثل | The University الجامعة | The Faculty الكليّة | The Department القسم | The Country الدولة | Program Accrediting Body جهة اعتماد البرنامج | Degree Award at Program Completion التي يمنحها الدرجة البرنامج للخريج | Year of accreditation سنة الحصول على الاعتماد | Type of program |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Council (EC) | | | |
| The 4th Program البرنامج الرابع | MSc in Engineering (Mechanical Engineering) with specialization in: design of mechanical systems/ electro-mechanical system design/ manufacturing technology | Aalborg University (Aalborg) | Faculty of Engineering and Science | Mechanical Engineering and Manufacturing, | Denmark | | MSc | | Courses + Master Thesis or Master Project |
| The 5th Program البرنامج الخامس | Masters of Engineering / Master of Science (Thesis) | Iowa State University | College of Engineering | Mechanical Engineering | USA | | Masters of Engineering / Master of Science (Thesis) | | course-work only master's |

| Head of the Department<br>Dr. Hamoud A. Al-Nahari | Quality Assurance Unit<br>Assoc. Prof. Dr. Mohammad Algorafi | Dean of the Faculty<br>Prof. Dr. Mohammed AL-Bukhaiti | Academic Development Center & Quality Assurance<br>Assoc. Prof. Dr. Huda Al-Emad |
|---|---|---|---|
| Rector of Sana'a University<br>Prof. Dr. Al-Qassim Mohammed Abbas | | | |

# Program Specification

| # | The Academic Program اسم البرنامج المماثل | The University الجامعة | The Faculty الكليّة | The Department القسم | The Country الدولة | Program Accrediting Body جهة اعتماد البرنامج | Degree Award at Program Completion التي يمنحها الدرجة البرنامج للخريج | Year of accreditation سنة الحصول على الاعتماد | Type of program |
|---|---|---|---|---|---|---|---|---|---|
| | in Mechanical Engineering | | | | | | | | degree /Courses + Thesis |
| The 6th Program البرنامج السادس | Master of Science (Mechanical Engineering) | Universiti Teknologi | College of Engineering | Mechanical Engineering | Malaysia | MQA | MSc | | Courses + Thesis |

| Head of the Department<br>Dr. Hamoud A. Al-Nahari | Quality Assurance Unit<br>Assoc. Prof. Dr. Mohammad Algorafi | Dean of the Faculty<br>Prof. Dr. Mohammed AL-Bukhaiti | Academic Development Center & Quality Assurance<br>Assoc. Prof. Dr. Huda Al-Emad |
|---|---|---|---|
| Rector of Sana'a University<br>Prof. Dr. Al-Qassim Mohammed Abbas | | | |

# Program Specification

ملحق (3) مسح مخرجات التعلم في البرامج المماثلة لبرنامج ماجستير العلوم في الهندسة الميكانيكية

**Annex-3, Survey of Intended Learning Outcomes for Similar Accredited for Master of Science in Mechanical Engineering at International Universities**

| Program Intended Outcomes | Suggested PILOs for the Current Program: Mechanical Engineering Program at Sana'a University | | 1st Program | 2nd Program | 3rd Program | 4th Program | 5th Program | 6th Program |
|---|---|---|---|---|---|---|---|---|
| | **Upon successful completion of a Master of Science in Mechanical Engineering Program, graduates should be able to:** | | | | | | | |
| **A. Knowledge and understanding** | **A1.** | Acquire advanced concepts and knowledge of mathematics, scientific, mechanical engineering and associated technologies as well as across the boundaries of interdisciplinary disciplines | √-(1) | √-(1) | √-(1) | √-(1) | √-(1) | √-(1) |
| | **A2.** | Identify and critically evaluate contemporary engineering technologies, current developments and emerging trends within the mechanical | √-(1) | √-(1) | √-(1) | √-(1) | √-(1) | √-(1) |

| Head of the Department<br>Dr. Hamoud A. Al-Nahari | Quality Assurance Unit<br>Assoc. Prof. Dr. Mohammad Algorafi | Dean of the Faculty<br>Prof. Dr. Mohammed AL-Bukhaiti | Academic Development Center & Quality Assurance<br>Assoc. Prof. Dr. Huda Al-Emad |
|---|---|---|---|
| Rector of Sana'a University<br>Prof. Dr. Al-Qassim Mohammed Abbas | | | |

# Program Specification

| Program Intended Outcomes | Suggested PILOs for the Current Program: Mechanical Engineering Program at Sana'a University | | 1st Program | 2nd Program | 3rd Program | 4th Program | 5th Program | 6th Program |
|---|---|---|---|---|---|---|---|---|
| | | engineering contexts. | | | | | | |
| | **A3.** | Provide a holistic description of principles, concepts, approaches, techniques and analysis tools to design and development of existing and novel mechanical systems, while taking a sustainable and environmentally-friendly approach. | √-(1) | √-(1) | √-(1) | √-(1) | √-(1) | √-(1) |
| **B. Cognitive/ Intellectual Skills** | **Upon successful completion of a Master of Science in Mechanical Engineering program, graduates should be able to:** | | | | | | | |
| | **B1.** | Identify and apply specialized knowledge and skills to solve problems that are critical to future growth of industry and business | √-(1) | √-(1) | √-(1) | √-(1) | √-(1) | √-(1) |

| Head of the Department | Quality Assurance Unit | Dean of the Faculty | Academic Development Center & Quality Assurance |
|---|---|---|---|
| Dr. Hamoud A. Al-Nahari | Assoc. Prof. Dr. Mohammad Algorafi | Prof. Dr. Mohammed AL-Bukhaiti | Assoc. Prof. Dr. Huda Al-Emad |
| Rector of Sana'a University<br>Prof. Dr. Al-Qassim Mohammed Abbas | | | |

**University of Sana'a**
**Faculty of Engineering**
**Department: Mechanical Engineering**
**Title of the Program: Master of Science in Mechanical Engineering**

# Program Specification

| Program Intended Outcomes | Suggested PILOs for the Current Program: Mechanical Engineering Program at Sana'a University | | 1st Program | 2nd Program | 3rd Program | 4th Program | 5th Program | 6th Program |
|---|---|---|---|---|---|---|---|---|
| | **B2.** | Creatively thinking and apply analysis tools to formulate and solve complex engineering problems in the mechanical engineering context using modern techniques and tools. | √-(1) | √-(1) | √-(1) | √-(1) | √-(1) | √-(1) |
| | **B3.** | Design and optimize mechanical components, systems and process to meet desired needs within realistic constraints. | | √-(1) | √-(1) | √-(1) | √-(1) | √-(1) |
| | **B4.** | Assess and analyze risks of the professional practice in the mechanical engineering contexts. | | | √-(1) | | | |
| **C. Practical and** | **Upon successful completion of a Master of Science in Mechanical Engineering program, graduates should be able to:** | | | | | | | |

| Head of the Department | Quality Assurance Unit | Dean of the Faculty | Academic Development Center & Quality Assurance |
|---|---|---|---|
| Dr. Hamoud A. Al-Nahari | Assoc. Prof. Dr. Mohammad Algorafi | Prof. Dr. Mohammed AL-Bukhaiti | Assoc. Prof. Dr. Huda Al-Emad |
| Rector of Sana'a University<br>Prof. Dr. Al-Qassim Mohammed Abbas | | | |

# Program Specification

| Program Intended Outcomes | Suggested PILOs for the Current Program: Mechanical Engineering Program at Sana'a University | | 1st Program | 2nd Program | 3rd Program | 4th Program | 5th Program | 6th Program |
|---|---|---|---|---|---|---|---|---|
| Professional Skills | C1. | Use modern manufacturing processes and materials, experimental tests, appropriate software packages and other modern tools for the design analysis and manufacture of mechanical components and systems. | √-(1) | √-(1) | √-(1) | √-(1) | √-(1) | √-(1) |
| | C2. | Conduct research and studies to solve mechanical engineering problems professionally, ethically and responsibly within realistic constraints. | √-(1) | √-(1) | √-(1) | √-(1) | √-(1) | √-(1) |
| | C3. | Demonstrate an in-depth understanding of the mechanical engineering business environment, including environmental aspects, and apply quality issues, modern operations and business management techniques and good | | √-(1) | √-(1) | | √-(1) | √-(1) |

| Head of the Department | Quality Assurance Unit | Dean of the Faculty | Academic Development Center & Quality Assurance |
|---|---|---|---|
| Dr. Hamoud A. Al-Nahari | Assoc. Prof. Dr. Mohammad Algorafi | Prof. Dr. Mohammed AL-Bukhaiti | Assoc. Prof. Dr. Huda Al-Emad |
| Rector of Sana'a University<br>Prof. Dr. Al-Qassim Mohammed Abbas | | | |

# Program Specification

| Program Intended Outcomes | Suggested PILOs for the Current Program: Mechanical Engineering Program at Sana'a University | | 1st Program | 2nd Program | 3rd Program | 4th Program | 5th Program | 6th Program |
|---|---|---|---|---|---|---|---|---|
| | | practices in a range of contexts. | | | | | | |
| D. General and Transferable Skills | **Upon successful completion of a Master of Science in Mechanical Engineering program, graduates should be able to:** | | | | | | | |
| | **D1.** | Adopt effectively IT capabilities and other different resources of information to develop a scientific research in mechanical engineering fields. | √-(1) | √-(1) | √-(1) | √-(1) | √-(1) | √-(1) |
| | **D2.** | Communicate, present, challenge and defend research ideas, results and conclusions in both orally and writing forms to different audiences in contexts. | √-(1) | √-(1) | √-(1) | √-(1) | √-(1) | √-(1) |
| | **D3.** | Identify a need for the latest relevant knowledge and technologies and undertake | √-(1) | √-(1) | √-(1) | √-(1) | √-(1) | √-(1) |

| Head of the Department | Quality Assurance Unit | Dean of the Faculty | Academic Development Center & Quality Assurance |
|---|---|---|---|
| Dr. Hamoud A. Al-Nahari | Assoc. Prof. Dr. Mohammad Algorafi | Prof. Dr. Mohammed AL-Bukhaiti | Assoc. Prof. Dr. Huda Al-Emad |
| Rector of Sana'a University<br>Prof. Dr. Al-Qassim Mohammed Abbas | | | |

# Program Specification

| Program Intended Outcomes | Suggested PILOs for the Current Program: Mechanical Engineering Program at Sana'a University | | 1st Program | 2nd Program | 3rd Program | 4th Program | 5th Program | 6th Program |
|---|---|---|---|---|---|---|---|---|
| | | life-long learning. | | | | | | |
| | **D4.** | Collaborate effectively within multidisciplinary teams and lead them in different professional contexts | √-(1) | √-(1) | √-(1) | √-(1) | √-(1) | √-(1) |

**Intended Outcomes for Similar Programs**

**Intended Outcomes for Similar Programs:**

**Program 1: United Arab Emirates University (UAEU), UAE - MSc in Mechanical Engineering**

Upon successful completion of this program, students will be able to:

- Apply knowledge and skills ethically for solving mechanical engineering problems and drawing conclusions.
- Conduct mechanical engineering studies utilizing experimental, computer software and other modern tools.
- Communicate effectively, both orally and in writing to present technical and research work.
- Conduct independently and with a team quality scientific and applied research.

**Program 3: Kingston University, London - MSc in Mechanical Engineering**

**A: Knowledge and Understanding:**

With the completion of the master program, the graduate will have knowledge and understanding in

| Head of the Department<br>Dr. Hamoud A. Al-Nahari | Quality Assurance Unit<br>Assoc. Prof. Dr. Mohammad Algorafi | Dean of the Faculty<br>Prof. Dr. Mohammed AL-Bukhaiti | Academic Development Center & Quality Assurance<br>Assoc. Prof. Dr. Huda Al-Emad |
|---|---|---|---|
| Rector of Sana'a University<br>Prof. Dr. Al-Qassim Mohammed Abbas | | | |

# Program Specification

| | |
|---|---|
| A1 | Demonstrate a critical awareness of the current developments in mechanical engineering |
| A2 | Demonstrate good use of engineering design and analysis tools to solve mechanical engineering design problems. |
| A3 | Be able to control projects in respect to time, cost and the risks inherent in engineering. |
| A4 | Demonstrate knowledge of the principles of entrepreneurship and detailed requirements for the management, quality, safety and environmental issues in respect to engineering projects. |

**B: Intellectual skills**
With the completion of the master program, the graduate will be able to

| | |
|---|---|
| B1 | Learn independently, and be able to critically evaluate, analyse and communicate research and data collection/analysis. |
| B2 | Analyse problems and issues, taking due account of any incompleteness of data or information, and arrive at well-reasoned and supportable conclusions |

| Head of the Department | Quality Assurance Unit | Dean of the Faculty | Academic Development Center & Quality Assurance |
|---|---|---|---|
| Dr. Hamoud A. Al-Nahari | Assoc. Prof. Dr. Mohammad Algorafi | Prof. Dr. Mohammed AL-Bukhaiti | Assoc. Prof. Dr. Huda Al-Emad |
| Rector of Sana'a University<br>Prof. Dr. Al-Qassim Mohammed Abbas | | | |

| | |
|---|---|
| B3 | Carry out independent data collection and synthesise it to enable the problems and issues to be successfully resolved. |
| B4 | Identify current issues and trends in mechanical engineering. |
| B5 | Carry out a focused critical literature review. |
| B6 | Develop original thought |

**C: Practical skills**

With the completion of the master program, the graduate will be able to

| | |
|---|---|
| C1 | Select and apply latest CAD/CAM/CAE and CFD computer-based systems to a wide range of mechanical engineering applications. |
| C2 | Select and use appropriate software tools for the design and analysis of mechanical components and systems. |
| C3 | Select modern materials and manufacturing processes for mechanical components |
| C4 | Demonstrate an in-depth understanding of the mechanical engineering business environment, including environmental aspects, and apply modern operations and business management techniques and good practices in a range of contexts. |

# Program Specification

| Head of the Department<br><br>Dr. Hamoud A. Al-Nahari | Quality Assurance Unit<br>Assoc. Prof. Dr. Mohammad Algorafi | Dean of the Faculty<br>Prof. Dr. Mohammed AL-Bukhaiti | Academic Development Center & Quality Assurance<br>Assoc. Prof. Dr. Huda Al-Emad |
|---|---|---|---|
| Rector of Sana'a University<br>Prof. Dr. Al-Qassim Mohammed Abbas | | | |

# Program Specification

| Head of the Department<br><br>Dr. Hamoud A. Al-Nahari | Quality Assurance Unit<br>Assoc. Prof. Dr. Mohammad Algorafi | Dean of the Faculty<br>Prof. Dr. Mohammed AL-Bukhaiti | Academic Development Center & Quality Assurance<br>Assoc. Prof. Dr. Huda Al-Emad |
|---|---|---|---|
| Rector of Sana'a University<br>Prof. Dr. Al-Qassim Mohammed Abbas | | | |

**D: Transferable skills**

With the completion of the post graduate diploma program, the graduate will be able to

| | **Research and information Literacy Skills** | | **Numeracy Skills** | | **Management & Leadership Skills** |
|---|---|---|---|---|---|
| DK1 | Search for and select relevant sources of information | EK1 | Collect data from primary and secondary sources and use appropriate methods to manipulate and analyse this data | FK1 | Determine the scope of a task (or project) |
| DK2 | Critically evaluate information and use it | EK2 | Present and record data in appropriate | FK2 | Identify resources needed to undertake |

# Program Specification

| | | | | | |
|---|---|---|---|---|---|
| | appropriately | | formats | | the task (or project) and to schedule and manage the resources |
| DK3 | Apply the ethical and legal requirements in both the access and use of information | EK3 | Interpret and evaluate data to inform and justify arguments | FK3 | Evidence ability to successfully complete and evaluate a task (or project), revising the plan where necessary |
| DK4 | Accurately cite and reference information sources | EK4 | Be aware of issues of selection, accuracy and uncertainty in the collection and analysis of data | FK4 | Motivate and direct others to enable an effective contribution from all participants |
| DK5 | Use software and IT technology as appropriate | | | | |
| | **Creativity and Problem-Solving Skills** | | | | |
| GK1 | Apply scientific and other knowledge to analyze and evaluate information and data and to find solutions to problems | | | | |
| GK2 | Work with complex ideas and justify judgements made through effective use of evidence | | | | |

| Head of the Department<br><br>Dr. Hamoud A. Al-Nahari | Quality Assurance Unit<br>Assoc. Prof. Dr. Mohammad Algorafi | Dean of the Faculty<br>Prof. Dr. Mohammed AL-Bukhaiti | Academic Development Center & Quality Assurance<br>Assoc. Prof. Dr. Huda Al-Emad |
|---|---|---|---|
| Rector of Sana'a University<br>Prof. Dr. Al-Qassim Mohammed Abbas | | | |

# Program Specification

| Key Skills | | | | | |
|---|---|---|---|---|---|
| | **Self-Awareness Skills** | | **Communication Skills** | | **Interpersonal Skills** |
| AK1 | Take responsibility for own learning and plan for and record own personal development | BK1 | Express ideas clearly and unambiguously in writing and the spoken work | CK1 | Work well with others in a group or team |
| AK2 | Recognise own academic strengths and weaknesses, reflect on performance and progress and respond to feedback | BK2 | Present, challenge and defend ideas and results effectively orally and in writing | CK2 | Work flexibly and respond to change |
| AK3 | Organise self effectively, agreeing and setting realistic targets, accessing support where appropriate and managing time to achieve targets | BK3 | Actively listen and respond appropriately to ideas of others | CK3 | Discuss and debate with others and make concession to reach agreement |
| AK4 | Work effectively with limited supervision in unfamiliar contexts | | | CK4 | Give, accept and respond to constructive feedback |
| | | | | CK5 | Show sensitivity and respect for diverse values and beliefs |

| Head of the Department<br><br>Dr. Hamoud A. Al-Nahari | Quality Assurance Unit<br>Assoc. Prof. Dr. Mohammad Algorafi | Dean of the Faculty<br>Prof. Dr. Mohammed AL-Bukhaiti | Academic Development Center & Quality Assurance<br>Assoc. Prof. Dr. Huda Al-Emad |
|---|---|---|---|
| Rector of Sana'a University<br>Prof. Dr. Al-Qassim Mohammed Abbas | | | |

# Program Specification

**Program4: Aalborg University (Aalborg), Denmark - MSc in Mechanical Engineering Multiple with specialization**

The graduate of the Master's program:

**Knowledge**

- Has attained thorough understanding of a broad range of theoretical, numerical and experimental techniques within the area of mechanical engineering.
- Have knowledge on a scientific basis to reflect over subject areas related to mechanical engineering and identify scientific problems within the area of mechanical engineering.
- Demonstrate insight into the implications of research work, including research ethics.

Students with specialization in Electro Mechanical System Design have:

- Additional knowledge in one or more selected areas within electro mechanical system design, based on the highest level of international research.
- Understanding and, on a scientific basis, are able to reflect over the subject areas related to electro mechanical system design and identify scientific problems within that area.

| Head of the Department<br><br>Dr. Hamoud A. Al-Nahari | Quality Assurance Unit<br>Assoc. Prof. Dr. Mohammad Algorafi | Dean of the Faculty<br>Prof. Dr. Mohammed AL-Bukhaiti | Academic Development Center & Quality Assurance<br>Assoc. Prof. Dr. Huda Al-Emad |
|---|---|---|---|
| Rector of Sana'a University<br>Prof. Dr. Al-Qassim Mohammed Abbas | | | |

- Understanding of the basic elements and concepts involved in designing electro mechanical systems and components, and how they interact in a synergistic way.

Students with specialization in Design of Mechanical Systems have:

- Additional knowledge in one or more subject areas within mechanical system design, based on the highest level of international research.
- Understanding and, on a scientific basis, are able to reflect over the subject area related to mechanical system design and identify scientific problems within that area.
- Understanding of the basic elements and concepts involved in designing mechanical systems and components, and how they interact in a synergistic way.

Students with specialization in Manufacturing Technology have:

- Additional knowledge in one or more subject areas within manufacturing technology, based on the highest level of international research.

| Head of the Department<br><br>Dr. Hamoud A. Al-Nahari | Quality Assurance Unit<br>Assoc. Prof. Dr. Mohammad Algorafi | Dean of the Faculty<br>Prof. Dr. Mohammed AL-Bukhaiti | Academic Development Center & Quality Assurance<br>Assoc. Prof. Dr. Huda Al-Emad |
|---|---|---|---|
| Rector of Sana'a University<br>Prof. Dr. Al-Qassim Mohammed Abbas | | | |

- Understanding and, on a scientific basis, are able to reflect over the subject areas related to manufacturing technology and identify scientific problems within that area.
- Understanding of the relationship between product design and manufacturing.
- The ability to use innovation models which speed up the innovation process, reduce the risk of failure and/or improve the business or societal value.

**Skills**

- Are able to apply scientific methodology for solving a wide variety of problems within the field of mechanical engineering.
- Are able to perform scientific work in relevant topics in the field of mechanical engineering.
- Are able to apply a wide range of engineering methods in research and development projects in the field of mechanical engineering.
- Can evaluate and select among scientific theories, methods, tools and general skills and, on a scientific basis, advance new analyses and solutions within mechanical engineering.
- Can communicate research-based knowledge and discuss professional and scientific problems with peers as well as non-specialists, using the correct terminology in mechanical engineering.
- Can use advanced laboratory test set ups and data collection methods.
- Can apply experimental tests for obtaining input for calibrating computational models and assess uncertainties within mechanical engineering.
- Demonstrate an understanding of research work and be able to become a part of a research environment.

<u>Students with specialization in Electro Mechanical System Design have additional skills in:</u>

| Head of the Department<br><br>Dr. Hamoud A. Al-Nahari | Quality Assurance Unit<br>Assoc. Prof. Dr. Mohammad Algorafi | Dean of the Faculty<br>Prof. Dr. Mohammed AL-Bukhaiti | Academic Development Center & Quality Assurance<br>Assoc. Prof. Dr. Huda Al-Emad |
|---|---|---|---|
| Rector of Sana'a University<br>Prof. Dr. Al-Qassim Mohammed Abbas | | | |

- Designing, modelling and analyzing electro-mechanical systems and components.
- Designing and applying both classical and advanced control methods for electro-mechanical systems and components.

Students with specialization in Design of Mechanical Systems have additional skills in:

- Designing, modelling and analyzing mechanical systems and components.
- Designing, modelling and analyzing lightweight structures.
- Designing, modelling and analyzing dynamic systems.

Students with specialization in Manufacturing Technology have additional skills in:

- Analyzing any given manufacturing system and prescribe measures to improve the efficiency of the facility.
- Formulating suitable models to improve either a specific manufacturing process or manufacturing system.

**Competencies**

- Are able to work independently with a project on a specific problem within their field of interest on the highest possible level within their field of specialization.
- Can, on a highly qualified manner, take part in technical development and research.
- Can manage work and development situations that are complex, unpredictable and require new solutions within their field of specialization.
- Can independently initiate and implement discipline-specific and interdisciplinary cooperation and assume professional responsibility.

| Head of the Department<br><br>Dr. Hamoud A. Al-Nahari | Quality Assurance Unit<br>Assoc. Prof. Dr. Mohammad Algorafi | Dean of the Faculty<br>Prof. Dr. Mohammed AL-Bukhaiti | Academic Development Center & Quality Assurance<br>Assoc. Prof. Dr. Huda Al-Emad |
|---|---|---|---|
| Rector of Sana'a University<br>Prof. Dr. Al-Qassim Mohammed Abbas | | | |

- Can identify scientific problems within their field of specialization and select and apply appropriate scientific theories, methods and tools for their solution.
- Are able to direct the technical management of development projects within the industry.
- Are competent to solve new and complicated technical problems by the use of advanced mathematics, scientific and technological knowledge.
- Can independently take responsibility for own professional development and specialization.
- Have the ability to design and evaluate a technical solution.

Students with specialization in Electro Mechanical System design have additional competencies in:

- Are able to participate in or lead projects in electro mechanical system design, product development, modelling and analysis of electro mechanical systems.

Students with specialization in Design of Mechanical Systems have additional competencies in:

- Are able to participate in or lead projects in mechanical system design, product development, modelling and analysis of mechanical systems, materials technology, structural mechanics and design of lightweight structures.

Students with specialization in Manufacturing Technology have additional competencies in:

- Are able to participate in or lead projects in manufacturing system design, product development, modeling and analysis of manufacturing processes and systems, or materials technology

| Head of the Department<br><br>Dr. Hamoud A. Al-Nahari | Quality Assurance Unit<br>Assoc. Prof. Dr. Mohammad Algorafi | Dean of the Faculty<br>Prof. Dr. Mohammed AL-Bukhaiti | Academic Development Center & Quality Assurance<br>Assoc. Prof. Dr. Huda Al-Emad |
|---|---|---|---|
| Rector of Sana'a University<br>Prof. Dr. Al-Qassim Mohammed Abbas | | | |

# Program Specification

**Program 5: Iowa State University, USA, Masters of Engineering / Master of Science (Thesis) in Mechanical Engineering:**

**Learning Outcomes**

1. **Master of Engineering (no-thesis)**:

Graduates with a Master of Engineering in Mechanical Engineering will be able to

1. Demonstrate a broad knowledge in the field of Mechanical Engineering.
2. Develop and demonstrate through their coursework a deep understanding and expertise in one or more areas of Mechanical Engineering specialization.
3. Discuss and apply an understanding of the current literature in mechanical engineering and related disciplines.
4. Develop the ability to communicate technical material to broad range of audiences through oral and written presentations.
5. Understand and be able to identify their post-graduation career options: industrial or entrepreneurial.
6. Demonstrate a commitment to the thoughtful consideration of fundamental principles of ethical professional conduct.

2. **Master of Science (thesis):**

Graduates with a MS in Mechanical Engineering will be able to

1. Demonstrate a broad knowledge in the field of Mechanical Engineering.
2. Demonstrate a deep understanding and expertise in one area of Mechanical Engineering specialization.
3. Develop and demonstrate through their research projects a strong theoretical and/or experimental and/or computational background.
4. Discuss and apply an understanding of the current literature in mechanical engineering and related disciplines.
5. Conduct independent research project that addresses problem in the area of mechanical engineering
6. Organize results into a coherent thesis and may produce scholarship (articles and/or books and/or conference paper) that appear in peer-reviewed venues.

| Head of the Department<br><br>Dr. Hamoud A. Al-Nahari | Quality Assurance Unit<br>Assoc. Prof. Dr. Mohammad Algorafi | Dean of the Faculty<br>Prof. Dr. Mohammed AL-Bukhaiti | Academic Development Center & Quality Assurance<br>Assoc. Prof. Dr. Huda Al-Emad |
|---|---|---|---|
| Rector of Sana'a University<br>Prof. Dr. Al-Qassim Mohammed Abbas | | | |

7. Develop the ability to communicate technical material to broad range of audiences.
8. Present and defend their research findings effectively through oral and written presentations and through the development of supporting materials.
9. Understand and be able to identify their post-graduation career options: industrial, entrepreneurial, and academic.
10. Demonstrate a commitment to the thoughtful consideration of fundamental principles of ethical professional conduct.

**Program 6: University Technology, Malaysia - MSc in Mechanical Engineering:**

**Program Learning Objectives**

**PLO1:** Demonstrate advanced knowledge and capabilities to further develop or use these for new situations in **mechanical** engineering.
**PLO2:** Demonstrate research skills in appraising available information and research evidence, and applying them in **mechanical** engineering contexts
**PLO3:** Apply critical thinking and problem-solving skills in addressing **mechanical** engineering problems utilizing relevant tools and techniques.
**PLO4:** Perform research on **mechanical** engineering problems professionally, ethically and responsibly.
**PLO5:** Communicate technical knowledge and ideas effectively in written and oral forms.
**PLO6:** Adopt the latest relevant knowledge and technologies through life-long learning.

University of Sana'a
Faculty of Engineering
Department: Mechanical Engineering
Title of the Program: Master of Science in Mechanical Engineering

# Program Specification

## ملحق (4) مسح ملخص البرامج المماثلة لبرنامج ماجستير العلوم في الهندسة الميكانيكية

## Annex-4: Summary of Similar Programs (Benchmarks) for Master of Science in Mechanical Engineering

| Summary of Similar Programs (Benchmarks) for Civil Engineering Program | | | | | | | |
|---|---|---|---|---|---|---|---|
| | The Similar Programs (Benchmarks) | | | | | | Current program |
| | The 1st Program | The 2nd Program | The 3rd Program | The 4th Program | The 5th Program | The 6th Program | |
| **The Program Tittle** | Master of Science in Mechanical Engineering | Master of Science in Mechanical Engineering | Master of Science in Mechanical Engineering | MSc in Engineering (Mechanical Engineering) with multiple specialization | Masters of Engineering / Master of Science (Thesis) in Mechanical Engineering | Master of Science (Mechanical Engineering) | **MSc. in Mechanical Engineering** |
| **The Faculty** | College of Engineering | College of Engineering | Science and Engineering College | Faculty of Engineering and Science/ Mechanical Engineering and Manufacturing, | College of Engineering | Faculty of Engineering | **Faculty of Engineering** |
| **The University** | United Arab Emirates University (UAEU) | Qassim University | Kingston University | Aalborg University (Aalborg) | Iowa State University | University Technology | **Sana'a University** |

| Head of the Department<br>Dr. Hamoud A. Al-Nahari | Quality Assurance Unit<br>Assoc. Prof. Dr. Mohammad Algorafi | Dean of the Faculty<br>Prof. Dr. Mohammed AL-Bukhaiti | Academic Development Center & Quality Assurance<br>Assoc. Prof. Dr. Huda Al-Emad |
|---|---|---|---|
| Rector of Sana'a University<br>Prof. Dr. Al-Qassim Mohammed Abbas | | | |

**University of Sana'a**
**Faculty of Engineering**
**Department: Mechanical Engineering**
**Title of the Program: Master of Science in Mechanical Engineering**

# Program Specification

| Summary of Similar Programs (Benchmarks) for Civil Engineering Program | | | | | | | |
|---|---|---|---|---|---|---|---|
| **The Country** | United Arab Emirates | SA | UK | Denmark | USA | Malaysia | **Yemen** |
| **Type of program** | Courses + Thesis | Courses + Thesis | Courses + Thesis | Courses + Master Thesis or Master Project | course-work only master's degree /Courses + Thesis | Courses + Research Project | Courses and Research |
| **Study methods in the program:** | Full-Time or Part-Time | Full Time | Full-Time/ Part-Time | Full-Time | Full-Time | Full Time / Part Time | **Full-time** |
| **Number of semesters** | 4 | 4 | 2 long sem. +1 short sem. | **4** | **4** | 2 long semesters and 1 short semester | **4** |
| **Total Credit Hours (without Thesis)** | 21 | 24 | 120 | **60-90** | **30/21** | 30 | **30** |
| **Credit Hours for compulsory courses** | 12 | 9 | 90 | **60** | **21/30** | 12 | **15** |
| **Credit Hours for Electives courses** | 9 | 15 | **30** | **30** | **0** | 18 | **15** |
| **No. of Courses for Electives courses** | 3 | 5 | 3 | 3 | 0/0 | 6 | **5** |

| Head of the Department<br><br>Dr. Hamoud A. Al-Nahari | Quality Assurance Unit<br>Assoc. Prof. Dr. Mohammad Algorafi | Dean of the Faculty<br>Prof. Dr. Mohammed AL-Bukhaiti | Academic Development Center & Quality Assurance<br>Assoc. Prof. Dr. Huda Al-Emad |
|---|---|---|---|
| Rector of Sana'a University<br>Prof. Dr. Al-Qassim Mohammed Abbas | | | |

**University of Sana'a**
**Faculty of Engineering**
**Department: Mechanical Engineering**
**Title of the Program: Master of Science in Mechanical Engineering**

# Program Specification

| Summary of Similar Programs (Benchmarks) for Civil Engineering Program | | | | | | | |
|---|---|---|---|---|---|---|---|
| **No. of Courses for compulsory courses** | 6 | 3 | **3** | **8** | **7/10** | 4 | **5** |
| **Complementary courses to join the program and their number** | - | - | - | - | - | - | - |
| **Credit Hours for Thesis** | 9 | 6 | 60 | 30-60 | 9/0 | 10 | 6 |
| **Total Credit Hours for courses & Thesis** | 30 | 30 | 180 | 120 | 30/30 | 40 | 36 |
| **The period for thesis completion** | - | - | - | - | - | - | 2 semesters |
| **The min. period to complete the program** | 2 years | 2 | 1-year FT and 2 years PT | 2 | 2 | Min.: 1 year | 2 years |
| **The max. period to complete the program** | 4 years | - | 2-years FT and 4 years PT | - | - | Max.: 4 years | 3 years |

| Head of the Department<br><br>Dr. Hamoud A. Al-Nahari | Quality Assurance Unit<br>Assoc. Prof. Dr. Mohammad Algorafi | Dean of the Faculty<br>Prof. Dr. Mohammed AL-Bukhaiti | Academic Development Center & Quality Assurance<br>Assoc. Prof. Dr. Huda Al-Emad |
|---|---|---|---|
| Rector of Sana'a University<br>Prof. Dr. Al-Qassim Mohammed Abbas | | | |

# Program Specification

## ملحق (5) مسح أسماء المقررات الدراسية في البرامج المماثلة لبرنامج ماجستير العلوم في الهندسة الميكانيكية

## Annex-5, Survey of Course Names of Similar Master of Science in Mechanical Design

| | 1st Program | 2nd Program | 3rd Program | 4th Program | 5th Program | 6th Program | Current Program |
|---|---|---|---|---|---|---|---|
| **University** | United Arab Emirates University (UAEU) | SA | Kingston University | Aalborg University (Aalborg) | Iowa State University | Universiti Teknologi | **Sana'a University** |
| **Faculty** | College of Engineering | Qassim University | Science and Engineering College | Faculty of Engineering and Science/ Mechanical Engineering and Manufacturing | College of Engineering | College of Engineering | **Faculty of Engineering** |
| **Program** | Master of Science in Mechanical Engineering | College of Engineering | Master of Science in Mechanical Engineering | MSc in Engineering (Mechanical Engineering) with specialization in: Design of Mechanical Systems | Masters of Engineering / Master of Science (Thesis) in Mechanical Engineering | Master of Science in Mechanical Engineering | **MSc. in Mechanical Engineering** |
| **Country** | UAE | Master of Science in Mechanical Engineering | UK | Denmark | USA | Malaysia | Yemen |
| **No. of** | 10 | 9 | 4 | 9-12 | 10/8 | 12 | 10 |

| Head of the Department<br>Dr. Hamoud A. Al-Nahari | Quality Assurance Unit<br>Assoc. Prof. Dr. Mohammad Algorafi | Dean of the Faculty<br>Prof. Dr. Mohammed AL-Bukhaiti | Academic Development Center & Quality Assurance<br>Assoc. Prof. Dr. Huda Al-Emad |
|---|---|---|---|
| Rector of Sana'a University<br>Prof. Dr. Al-Qassim Mohammed Abbas | | | |

**University of Sana'a**
**Faculty of Engineering**
**Department: Mechanical Engineering**
**Title of the Program: Master of Science in Mechanical Engineering**

# Program Specification

| | | 1st Program | 2nd Program | 3rd Program | 4th Program | 5th Program | 6th Program | Current Program |
|---|---|---|---|---|---|---|---|---|
| **Courses** | | | | | | | | |
| **Total Cr. Hrs.** | | 30 | 30 | 180 | 120 | 30/30 | 40 | 36 |
| **Total Years** | | 2-4 | 2 | - Min: 1-year FT & 2 years. PT<br>- Max: 2-year FT & 4 years PT | 2 | 2 | Min: 1 year<br>Max: 4 years | **2** |
| **Term** | **No.** | **Course Name** | | | | | | |
| **1** | 1. | Numerical Methods in Engineering | Engineering Mathematics | | | Advanced Engineering Mathematics (3) | | Advanced Engineering Mathematics |
| | 2. | Analytical Techniques in Engineering | Modeling and Simulation of Engineering Systems | Computational Fluid Dynamics for Engineering Applications | Finite Element Methods | | | Applied Finite Element |
| | 3. | Advanced Solid Mechanics | Experimental Methods and Analysis | Advanced Stress Analysis & Materials | Solid Mechanics with Microstructure | | | Advanced Mechanics of Solid and Materials |
| | | | | | | | | Advanced |

| Head of the Department<br>Dr. Hamoud A. Al-Nahari | Quality Assurance Unit<br>Assoc. Prof. Dr. Mohammad Algorafi | Dean of the Faculty<br>Prof. Dr. Mohammed AL-Bukhaiti | Academic Development Center & Quality Assurance<br>Assoc. Prof. Dr. Huda Al-Emad |
|---|---|---|---|
| Rector of Sana'a University<br>Prof. Dr. Al-Qassim Mohammed Abbas | | | |

**University of Sana'a**
**Faculty of Engineering**
**Department: Mechanical Engineering**
**Title of the Program: Master of Science in Mechanical Engineering**

# Program Specification

| | | 1st Program | 2nd Program | 3rd Program | 4th Program | 5th Program | 6th Program | Current Program |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | Thermodynamics |
| | 4. | | | | | | E1 (3) | Elective 1(from group A or B) |
| | | Advanced Dynamics | | Engineering Research Techniques, Entrepreneurship and Quality Management | Fracture Mechanics and Fatigue | | Research Methodology (3) | |
| | 5. | Advanced Fluid Mechanics | | | System Analysis and Modelling | | University Elective (3) | |
| | | | | | | | Instrumentation Measurement & Control (3) | |
| **Term** | **No.** | **Course Name** | | | | | | |
| **2** | 1. | E1 | E! | Elective: select one course (30 CH):<br>1. Advanced CAD/CAM Systems<br>2. Mechatronics Design & | System Design | | E2 (3) | Advanced Control System Design |

| Head of the Department<br>Dr. Hamoud A. Al-Nahari | Quality Assurance Unit<br>Assoc. Prof. Dr. Mohammad Algorafi | Dean of the Faculty<br>Prof. Dr. Mohammed AL-Bukhaiti | Academic Development Center & Quality Assurance<br>Assoc. Prof. Dr. Huda Al-Emad |
|---|---|---|---|
| Rector of Sana'a University<br>Prof. Dr. Al-Qassim Mohammed Abbas | | | |

# Program Specification

| | | 1st Program | 2nd Program | 3rd Program | 4th Program | 5th Program | 6th Program | Current Program |
|---|---|---|---|---|---|---|---|---|
| | | | | Automation<br>3. Green Engineering & Energy Efficiency | | | | |
| | 2. | E2 | E2 | | Engineering Optimization – Concepts, Methods and Applications | | E3 (3) | Elective 2 (from group A or B) |
| | 3. | E3 | E3 | | Mechanics of Composite Materials and Structures | | E4 (3) | Elective 3 (from group A or B) |
| | 4 | | | | Energy and Variational Methods with Applications | | E5 (3) | Elective 4 (from group A or B) |
| | | | | | | | Master Project I (4) | Elective 5 (from group A or B) |

| Head of the Department<br><br>Dr. Hamoud A. Al-Nahari | Quality Assurance Unit<br>Assoc. Prof. Dr. Mohammad Algorafi | Dean of the Faculty<br>Prof. Dr. Mohammed AL-Bukhaiti | Academic Development Center & Quality Assurance<br>Assoc. Prof. Dr. Huda Al-Emad |
|---|---|---|---|
| Rector of Sana'a University<br>Prof. Dr. Al-Qassim Mohammed Abbas | | | |

# Program Specification

| | | 1st Program | 2nd Program | 3rd Program | 4th Program | 5th Program | 6th Program | Current Program |
|---|---|---|---|---|---|---|---|---|
| | 5. | | | | | | | |
| | | | | | | | | |
| **3** | | Mechanical Engineering Seminar | E4 | Individual Project Dissertation | 1. Option A: Industrial Development (Project 30)<br>2. Option B: Industrial Development (Project 25) Elective courses - Design of Mechanical Systems (course 5)<br>3. Option C: Industrial Development (Project 20) Elective courses - Design of Mechanical Systems (course 10)<br>4. Option D: | | E6 (3) | Research Methodology |

| Head of the Department<br>Dr. Hamoud A. Al-Nahari | Quality Assurance Unit<br>Assoc. Prof. Dr. Mohammad Algorafi | Dean of the Faculty<br>Prof. Dr. Mohammed AL-Bukhaiti | Academic Development Center & Quality Assurance<br>Assoc. Prof. Dr. Huda Al-Emad |
|---|---|---|---|
| Rector of Sana'a University<br>Prof. Dr. Al-Qassim Mohammed Abbas | | | |

# Program Specification

| | | 1st Program | 2nd Program | 3rd Program | 4th Program | 5th Program | 6th Program | Current Program |
|---|---|---|---|---|---|---|---|---|
| | | | | | Industrial Development (Project 15)<br>Elective courses - Design of Mechanical Systems (course 15) | | | |
| | | Thesis | E5 | | 5. Option E:<br>Project-oriented Study in an External Organization (Project 30)<br>6. Option F:<br>Project-oriented Study in an External Organization (Project 25)<br>Elective courses - Design of Mechanical Systems (course 5)<br>7. Option G:<br>Project-oriented Study in an External Organization (Project 20)<br>Elective courses - Design of Mechanical | | Master Project II (6) | Master Thesis |

| Head of the Department<br>Dr. Hamoud A. Al-Nahari | Quality Assurance Unit<br>Assoc. Prof. Dr. Mohammad Algorafi | Dean of the Faculty<br>Prof. Dr. Mohammed AL-Bukhaiti | Academic Development Center & Quality Assurance<br>Assoc. Prof. Dr. Huda Al-Emad |
|---|---|---|---|
| Rector of Sana'a University<br>Prof. Dr. Al-Qassim Mohammed Abbas | | | |

# Program Specification

| | | 1st Program | 2nd Program | 3rd Program | 4th Program | 5th Program | 6th Program | Current Program |
|---|---|---|---|---|---|---|---|---|
| | | | | | Systems (course 10)<br>8. Option H:<br>Project-oriented Study in an External Organization (Project 15)<br>Elective courses - Design of Mechanical Systems (course 15) | | | |
| | | | | | **3-4 Semester**<br>9. Option I:<br>Master's Thesis (Project 45)<br>Elective courses - Design of Mechanical Systems (course 15)<br>10. Option J:<br>Master's Thesis (Project 50)<br>Elective courses - Design of Mechanical Systems (course 10)<br>11. Option K:<br>Master's Thesis | | | |

| Head of the Department | Quality Assurance Unit | Dean of the Faculty | Academic Development Center & Quality Assurance |
|---|---|---|---|
| Dr. Hamoud A. Al-Nahari | Assoc. Prof. Dr. Mohammad Algorafi | Prof. Dr. Mohammed AL-Bukhaiti | Assoc. Prof. Dr. Huda Al-Emad |
| Rector of Sana'a University<br>Prof. Dr. Al-Qassim Mohammed Abbas | | | |

# Program Specification

| | | 1st Program | 2nd Program | 3rd Program | 4th Program | 5th Program | 6th Program | Current Program |
|---|---|---|---|---|---|---|---|---|
| | | | | | (Project 60) | | | |
| | | | | | | | | |
| **4** | | Mechanical Engineering Seminar | M. Sc. Thesis | | Master's Thesis (Project 30) | | | |
| | | Thesis | | | | | | |
| | | | | | | | | |
| **Total CH** | | **30** | **30** | **180** | **120** | **30/30** | **40** | **36** |

| Head of the Department | Quality Assurance Unit | Dean of the Faculty | Academic Development Center & Quality Assurance |
|---|---|---|---|
| Dr. Hamoud A. Al-Nahari | Assoc. Prof. Dr. Mohammad Algorafi | Prof. Dr. Mohammed AL-Bukhaiti | Assoc. Prof. Dr. Huda Al-Emad |
| Rector of Sana'a University<br>Prof. Dr. Al-Qassim Mohammed Abbas | | | |

# Program Specification

## ملحق ( 6 ) مسح الرؤية والرسالة والاهداف البرامج المعتمدة المماثلة لبرنامج ماجستير العلوم في الهندسة الميكانيكية

## Annex ( 6 ) Survey/ Mapping of Vision, Mission and Objectives of Similar Accredited Programs at International Universities (Benchmarks) for Master of Science in Mechanical Engineering

| | The 1st Program | The 2nd Program | The 3rd Program | The 4th Program | The 5th Program | The 6th Program |
|---|---|---|---|---|---|---|
| **Country** | United Arab Emirates | **SA** | UK | Denmark | USA | Malaysia |
| **University** | United Arab Emirates University (UAEU) | Qassim University | Kingston University | Aalborg University (Aalborg) | Iowa State University | Universiti Teknologi |
| **Faculty** | College of Engineering | College of Engineering | Science and Engineering College | Faculty of Engineering and Science | College of Engineering | College of Engineering |
| **Department/ Program** | Mechanical Engineering/ Master of Science in Mechanical Engineering | Master of Science in Mechanical Engineering | Mechanical & Automotive/ MSc Mechanical Engineering | Mechanical Engineering and Manufacturing/ MSc in Engineering (Mechanical Engineering) with Multiple specialization | Masters of Engineering / Master of Science (Thesis) in Mechanical Engineering | Mechanical Engineering/ Master of Science in Mechanical Engineering |

| Head of the Department<br>Dr. Hamoud A. Al-Nahari | Quality Assurance Unit<br>Assoc. Prof. Dr. Mohammad Algorafi | Dean of the Faculty<br>Prof. Dr. Mohammed AL-Bukhaiti | Academic Development Center & Quality Assurance<br>Assoc. Prof. Dr. Huda Al-Emad |
|---|---|---|---|
| Rector of Sana'a University<br>Prof. Dr. Al-Qassim Mohammed Abbas | | | |

**University of Sana'a**
**Faculty of Engineering**
**Department: Mechanical Engineering**
**Title of the Program: Master of Science in Mechanical Engineering**

# Program Specification

| | The 1st Program | The 2nd Program | The 3rd Program | The 4th Program | The 5th Program | The 6th Program |
|---|---|---|---|---|---|---|
| **Study Duration** | 2 years-4 years | 2 | Minimum period of registration: 1-year FT and 2 years PT Maximum period of registration: 2-years FT and 4 years PT | 2 year | 2 | Min: 1 year Max: 4 years |
| **Program Accrediting Body** | - | - | Institution of Mechanical Engineers (IMechE) and Engineering Council (EC) | | | MQA |
| **Website Link** | https://eng.uaeu.ac.ae//en/programs/graduate/master-of-science-in-mechanical-engineering.shtml | https://qec.qu.edu.sa/content/pages/1580 | http://www.kingston.ac.uk/postgraduate-course/mechanical-engineering-msc/ | https://www.mp.aau.dk/study-board | https://www.me.iastate.edu/graduate-program/graduate-degrees-and-programs/ms-degree/ | https://engineering.utm.my/mechanical/mkmm/?_gl=1*hzukmd*_ga*MTkzNDE4MzcxMy4xNjE3NzE5MjEz*_ga_N3HJ |

| Head of the Department | Quality Assurance Unit | Dean of the Faculty | Academic Development Center & Quality Assurance |
|---|---|---|---|
| Dr. Hamoud A. Al-Nahari | Assoc. Prof. Dr. Mohammad Algorafi | Prof. Dr. Mohammed AL-Bukhaiti | Assoc. Prof. Dr. Huda Al-Emad |
| Rector of Sana'a University<br>Prof. Dr. Al-Qassim Mohammed Abbas | | | |

# Program Specification

| | The 1st Program | The 2nd Program | The 3rd Program | The 4th Program | The 5th Program | The 6th Program |
|---|---|---|---|---|---|---|
| | | | | | | W8G3P7*MTYxNzcyMzgzMy4yLjEuMTYxNzcyMzg0NS4w |
| **Department Vision** | The department's vision is to be recognized among internationally reputed programs in its class in research and education. | **Vision**<br>The mechanical engineering department aims to be recognized locally, regionally and internationally as a leading department providing high quality programs and services in mechanical engineering fields. | | | through the excellence of its people, the Department of Mechanical Engineering will be recognized as a leader of its discipline in a manner that exemplifies the land-grant traditions of learning, discovery, and engagement. The department will be | |

| Head of the Department<br>Dr. Hamoud A. Al-Nahari | Quality Assurance Unit<br>Assoc. Prof. Dr. Mohammad Algorafi | Dean of the Faculty<br>Prof. Dr. Mohammed AL-Bukhaiti | Academic Development Center & Quality Assurance<br>Assoc. Prof. Dr. Huda Al-Emad |
|---|---|---|---|
| Rector of Sana'a University<br>Prof. Dr. Al-Qassim Mohammed Abbas | | | |

# Program Specification

| | The 1st Program | The 2nd Program | The 3rd Program | The 4th Program | The 5th Program | The 6th Program |
|---|---|---|---|---|---|---|
| | | | | | a desirable place to study and work, with our community comprising the best and the brightest, because of research and educational programs grounded in the mechanical engineering sciences and set within the context of meeting important societal needs. | |
| **Department Mission** | The mission of the Mechanical Engineering Department is to provide a | **Mission** The mechanical engineering | | - | The mission of the Department of Mechanical | |

| Head of the Department | Quality Assurance Unit | Dean of the Faculty | Academic Development Center & Quality Assurance |
|---|---|---|---|
| Dr. Hamoud A. Al-Nahari | Assoc. Prof. Dr. Mohammad Algorafi | Prof. Dr. Mohammed AL-Bukhaiti | Assoc. Prof. Dr. Huda Al-Emad |
| Rector of Sana'a University<br>Prof. Dr. Al-Qassim Mohammed Abbas | | | |

# Program Specification

| | The 1st Program | The 2nd Program | The 3rd Program | The 4th Program | The 5th Program | The 6th Program |
|---|---|---|---|---|---|---|
| | leading national and internationally competitive undergraduate and graduate education, research, and service. Through a student-focused experience, the department prepares graduates to engage in leadership, innovation, and the enhancement of social and economic growth in the UAE. | department seeks to meet the needs of the Saudi society and the region with outstanding mechanical engineering programs in education, research, and community service. | | | Engineering has three tenets that center on the principle of improving lives and livelihoods: to create knowledge through research in the science and technology of mechanical engineering; to share knowledge through educational programs and the dissemination of our new discoveries; and to develop the professional potential of faculty, staff, and students. | |
| **Department Objectives** | **Goals** | **Program Educational** | | | To ensure the success of students | |

| Head of the Department<br>Dr. Hamoud A. Al-Nahari | Quality Assurance Unit<br>Assoc. Prof. Dr. Mohammad Algorafi | Dean of the Faculty<br>Prof. Dr. Mohammed AL-Bukhaiti | Academic Development Center & Quality Assurance<br>Assoc. Prof. Dr. Huda Al-Emad |
|---|---|---|---|
| Rector of Sana'a University<br>Prof. Dr. Al-Qassim Mohammed Abbas | | | |

# Program Specification

| | The 1st Program | The 2nd Program | The 3rd Program | The 4th Program | The 5th Program | The 6th Program |
|---|---|---|---|---|---|---|
| | 1. Student-focused activities: Maintain student-centered activities.<br>2. Provide a leading national and internationally competitive undergraduate and graduate education.<br>3. Community outreach and service.<br>4. Research: Achieve and sustain a high level of diversity in research and scholarship.<br>5. Resource diversification: Diversify funding resources from external | **Objectives**<br>1) Preparation of the graduates to have a successful career as mechanical engineers in governmental and private sectors.<br>2) Preparation of the graduates to pursue their professional developm | | | completing the curriculum in mechanical engineering, the department has established the following educational objectives:<br><br>1. The department provides a sound foundation for graduates to pursue a variety of careers. Most graduates will find immediate employment in industry, government laboratories or consulting, but some | |

| Head of the Department<br><br>Dr. Hamoud A. Al-Nahari | Quality Assurance Unit<br>Assoc. Prof. Dr. Mohammad Algorafi | Dean of the Faculty<br>Prof. Dr. Mohammed AL-Bukhaiti | Academic Development Center & Quality Assurance<br>Assoc. Prof. Dr. Huda Al-Emad |
|---|---|---|---|
| Rector of Sana'a University<br>Prof. Dr. Al-Qassim Mohammed Abbas | | | |

# Program Specification

| | The 1st Program | The 2nd Program | The 3rd Program | The 4th Program | The 5th Program | The 6th Program |
|---|---|---|---|---|---|---|
| | and internal funding agencies.<br>6. Faculty and staff quality: Recruit, hire, develop and retain the highest quality of faculty and staff.<br>7. Identity clarification: Develop a clear sense of vision and mission and communicate it to faculty, staff and community in a consistent and professional manner.<br>8. Performance excellence: Realize a nationally leading and internationally | ent through self-learning and advanced degrees.<br>3) Preparation of the graduates to progress to positions of leadership in their profession.<br>4) Preparation of the graduates to | | | will pursue graduate or professional studies in such fields as engineering, business, law or medicine.<br><br>2. Graduates will apply the problem solving skills they have learned at Iowa State University to meet the challenging demands and increasing responsibilities of a successful career.<br><br>3. Graduates will continue to learn as they grow in their profession, using | |

| Head of the Department<br><br>Dr. Hamoud A. Al-Nahari | Quality Assurance Unit<br>Assoc. Prof. Dr. Mohammad Algorafi | Dean of the Faculty<br>Prof. Dr. Mohammed AL-Bukhaiti | Academic Development Center & Quality Assurance<br>Assoc. Prof. Dr. Huda Al-Emad |
|---|---|---|---|
| Rector of Sana'a University<br>Prof. Dr. Al-Qassim Mohammed Abbas | | | |

# Program Specification

| | The 1st Program | The 2nd Program | The 3rd Program | The 4th Program | The 5th Program | The 6th Program |
|---|---|---|---|---|---|---|
| | competing department. | effectively participate in the sustainable development of the Saudi Society. | | | modern technology and communication skills to contribute as team members or leaders in solving important problems for their employers and for society. | |
| **Program Mission** | | **Vision**<br>A locally and regionally distinguished academic program in Mechanical engineering education and research that supports the sustainable development in the | | | | |

| Head of the Department<br>Dr. Hamoud A. Al-Nahari | Quality Assurance Unit<br>Assoc. Prof. Dr. Mohammad Algorafi | Dean of the Faculty<br>Prof. Dr. Mohammed AL-Bukhaiti | Academic Development Center & Quality Assurance<br>Assoc. Prof. Dr. Huda Al-Emad |
|---|---|---|---|
| Rector of Sana'a University<br>Prof. Dr. Al-Qassim Mohammed Abbas | | | |

# Program Specification

| | The 1st Program | The 2nd Program | The 3rd Program | The 4th Program | The 5th Program | The 6th Program |
|---|---|---|---|---|---|---|
| | | Kingdom<br><br>**Mission**<br>Mechanical engineering master program seeks to offer accredited developed higher studies to satisfy the needs of the job market, and to provide research services which support the sustainable development in the kingdom and contribute to the knowledge economy. | | | | |

| Head of the Department<br><br>Dr. Hamoud A. Al-Nahari | Quality Assurance Unit<br>Assoc. Prof. Dr. Mohammad Algorafi | Dean of the Faculty<br>Prof. Dr. Mohammed AL-Bukhaiti | Academic Development Center & Quality Assurance<br>Assoc. Prof. Dr. Huda Al-Emad |
|---|---|---|---|
| Rector of Sana'a University<br>Prof. Dr. Al-Qassim Mohammed Abbas | | | |

**University of Sana'a**
**Faculty of Engineering**
**Department: Mechanical Engineering**
**Title of the Program: Master of Science in Mechanical Engineering**

# Program Specification

| | The 1st Program | The 2nd Program | The 3rd Program | The 4th Program | The 5th Program | The 6th Program |
|---|---|---|---|---|---|---|
| **Program Objectives** | • Foster high quality graduate level mechanical engineering education and research and generate graduates with high levels of competence in fundamental and applied concepts of mechanical engineering.<br>• Prepare graduates for successful careers in industry and/or academia and to promote and instill ethical practice and life-long learning.<br>• Enrich the research collaboration between | **Objectives**<br>1. Preparing graduates to have a successful career in the industry research and development centers and in the universities and research institutions.<br>2. Encouraging graduates to pursue their professional development through self-learning and graduate studies.<br>3. Well Preparation of graduates to | The main aims of the MSc Mechanical Engineering are:<br>• To provide students with knowledge, skills and a critical appreciation of the principles of engineering.<br>• To give an awareness of the environment, business, social and ethical implications of professional | | | **PEO1:** Graduate are able to apply the knowledge gained to identify, develop solution and solve problems related to **mechanical** engineering in various situations, effectively and ethically.<br>**PEO2:** Graduates are able to communicate and present ideas intellectually and effectively.<br>**PEO3:** Graduates are able to conduct research, manage and publish information and |

| Head of the Department<br>Dr. Hamoud A. Al-Nahari | Quality Assurance Unit<br>Assoc. Prof. Dr. Mohammad Algorafi | Dean of the Faculty<br>Prof. Dr. Mohammed AL-Bukhaiti | Academic Development Center & Quality Assurance<br>Assoc. Prof. Dr. Huda Al-Emad |
|---|---|---|---|
| Rector of Sana'a University<br>Prof. Dr. Al-Qassim Mohammed Abbas | | | |

# Program Specification

| | The 1st Program | The 2nd Program | The 3rd Program | The 4th Program | The 5th Program | The 6th Program |
|---|---|---|---|---|---|---|
| | the university and the industrial sectors in the country and worldwide.<br>• Graduate professionals and leaders in the global industries | advance positions of leadership in their profession.<br>4. Preparing graduates to effectively participate in the sustainable development of the Saudi Society.<br>5. Preparing graduates to effectively establish the knowledge economy in Saudi Society. | practice and professional codes of conduct.<br>• To provide a "period of further learning", which is a requirement of the Institution of Mechanical Engineers for Chartered Engineer status for students with an accredited BEng. The Field complies with UK Spec as | | | continue life-long learning |

| Head of the Department<br>Dr. Hamoud A. Al-Nahari | Quality Assurance Unit<br>Assoc. Prof. Dr. Mohammad Algorafi | Dean of the Faculty<br>Prof. Dr. Mohammed AL-Bukhaiti | Academic Development Center & Quality Assurance<br>Assoc. Prof. Dr. Huda Al-Emad |
|---|---|---|---|
| Rector of Sana'a University<br>Prof. Dr. Al-Qassim Mohammed Abbas | | | |

# Program Specification

| | The 1st Program | The 2nd Program | The 3rd Program | The 4th Program | The 5th Program | The 6th Program |
|---|---|---|---|---|---|---|
| | | | published by the Engineering Council.<br>• To give students the professional attitudes and a range of transferable skills which would enable them to develop and exploit their knowledge and technical expertise in the furtherance of their career.<br>• To provide students with a | | | |

| Head of the Department<br>Dr. Hamoud A. Al-Nahari | Quality Assurance Unit<br>Assoc. Prof. Dr. Mohammad Algorafi | Dean of the Faculty<br>Prof. Dr. Mohammed AL-Bukhaiti | Academic Development Center & Quality Assurance<br>Assoc. Prof. Dr. Huda Al-Emad |
|---|---|---|---|
| Rector of Sana'a University<br>Prof. Dr. Al-Qassim Mohammed Abbas | | | |

# Program Specification

| | The 1st Program | The 2nd Program | The 3rd Program | The 4th Program | The 5th Program | The 6th Program |
|---|---|---|---|---|---|---|
| | | | strategic overview of management issues in engineering.<br>• To develop an awareness of work in a multi-disciplinary team within an engineering organization with real industrial constraints.<br>• To be able to initiate, plan and develop research and investigative | | | |

| Head of the Department<br>Dr. Hamoud A. Al-Nahari | Quality Assurance Unit<br>Assoc. Prof. Dr. Mohammad Algorafi | Dean of the Faculty<br>Prof. Dr. Mohammed AL-Bukhaiti | Academic Development Center & Quality Assurance<br>Assoc. Prof. Dr. Huda Al-Emad |
|---|---|---|---|
| Rector of Sana'a University<br>Prof. Dr. Al-Qassim Mohammed Abbas | | | |

# Program Specification

| | The 1st Program | The 2nd Program | The 3rd Program | The 4th Program | The 5th Program | The 6th Program |
|---|---|---|---|---|---|---|
| | | | skills and a critical and research-oriented approach to the study of a relevant engineering project. | | | |

-

| Head of the Department<br>Dr. Hamoud A. Al-Nahari | Quality Assurance Unit<br>Assoc. Prof. Dr. Mohammad Algorafi | Dean of the Faculty<br>Prof. Dr. Mohammed AL-Bukhaiti | Academic Development Center & Quality Assurance<br>Assoc. Prof. Dr. Huda Al-Emad |
|---|---|---|---|
| Rector of Sana'a University<br>Prof. Dr. Al-Qassim Mohammed Abbas | | | |

# Program Specification

ملحق ( 7 ) مؤامة رسالة وأهداف البرنامج مع رؤية ورسالة واهداف الكلية والجامعة

Annex (7 ) Mapping of mission and objective of the program with vision, mission and objectives of faculty, and university

| Mapping of program vision with Department, faculty, and university vision | | | |
|---|---|---|---|
| **University Vision** | **Faculty Vision** | **Department vision** | **Program vision** |
| Sana'a University aspires to achieve a national leading role in teaching, learning, scientific research and community service; and to be among the best regional universities and the foremost house of expertise and think tank in Yemen. | To excel in engineering education & scientific research with distinction at the local and regional levels. | | To be a locally and regionally distinguished academic program in mechanical engineering education and research. |

| Mapping of program mission with Department, faculty and university mission | | | |
|---|---|---|---|
| **University Mission** | **Faculty Mission** | **Department Mission** | **Program Mission** |
| To contribute to the sustainable development efforts by providing an accredited higher education environment and excellent research services within a fruitful | To provide excellent and accredited engineering education to meet the development needs and match the labor market requirements | To prepare engineers having high skills who can meet social needs through delivering higher quality educational programs and scientific | To provide an accredited master program in the mechanical engineering through applying advanced knowledge, skills and research services needed to innovation and leading in providing engineering |

| Head of the Department<br>Dr. Hamoud A. Al-Nahari | Quality Assurance Unit<br>Assoc. Prof. Dr. Mohammad Algorafi | Dean of the Faculty<br>Prof. Dr. Mohammed AL-Bukhaiti | Academic Development Center & Quality Assurance<br>Assoc. Prof. Dr. Huda Al-Emad |
|---|---|---|---|
| Rector of Sana'a University<br>Prof. Dr. Al-Qassim Mohammed Abbas | | | |

# Program Specification

| | | | |
|---|---|---|---|
| national partnership based on transparency, professionalism and creativity. | locally and regionally. | research and to deliver required consultancy work for local industry. | solutions that address to societal challenges, satisfy the market needs and support the sustainable development and knowledge economy. |

**Mapping of program objectives with Department, faculty, and university objectives**

| University Objectives | Faculty Objectives | Department Objectives | Program Objectives |
|---|---|---|---|
| 1. To provide specialized and in-depth academic opportunities for students in different fields of knowledge to meet the country's needs of specialties, technicians and experts, with special focus on the following: | 7. To offer study programs in various fields of knowledge and equip students with required knowledge and scientific and know-how skills to utilize them in resolving problems effectively and efficiently. | 1. To prepare graduates in mechanical engineering with high knowledge and skills in different applications of the mechanical engineering. | 1. To prepare graduate to excel in advanced mechanical engineering discipline as well as to extend the boundaries of their professional competence to meet the needs of future industrial development. |

| Head of the Department<br>Dr. Hamoud A. Al-Nahari | Quality Assurance Unit<br>Assoc. Prof. Dr. Mohammad Algorafi | Dean of the Faculty<br>Prof. Dr. Mohammed AL-Bukhaiti | Academic Development Center & Quality Assurance<br>Assoc. Prof. Dr. Huda Al-Emad |
|---|---|---|---|
| Rector of Sana'a University<br>Prof. Dr. Al-Qassim Mohammed Abbas | | | |

# Program Specification

| | | | |
|---|---|---|---|
| 2. To boost the level and quality of preparation and qualification tasks. | 1. To develop positive trends towards engineering science and its accelerating developments and enable students to use the techniques and methods of conducting scientific research in engineering fields. | 2. To participate as leaders and contribute locally and regionally. | 2. To prepare graduates with a wide range of knowledge and capacity for successful careers in industry and/or academia. |
| 3. To create a general culture aiming at developing the elements of sound Islamic personality and the proper cognitive and scientific training. | 2. To develop skills of scientific, innovative and critical thinking as well as the concept of continuous self-education. | 3. To prepare the ability and skills and to encourage them to work as a teamwork. | 3. To equipped graduates with spirits of innovation, creativity, adaptability, and critical thinking to solve complex problems using advanced analytical and experimental methods in the mechanical engineering fields. |
| 4. To stabilize the true Islamic vision | 3. To strengthen scientific ties with | **4.** To establish the soul of innovations in the | 4. To prepare graduates to function effectively in multi-disciplinary team environments and |

| | | | |
|---|---|---|---|
| Head of the Department<br>Dr. Hamoud A. Al-Nahari | Quality Assurance Unit<br>Assoc. Prof. Dr. Mohammad Algorafi | Dean of the Faculty<br>Prof. Dr. Mohammed AL-Bukhaiti | Academic Development Center & Quality Assurance<br>Assoc. Prof. Dr. Huda Al-Emad |
| Rector of Sana'a University<br>Prof. Dr. Al-Qassim Mohammed Abbas | | | |

# Program Specification

| | | | |
|---|---|---|---|
| emanating from the broad horizons of Islamic knowledge and its perception of the universe, man and life. | national and international colleges, scientific bodies, and research & development centers. | graduates while conducting small scientific projects and to prepare them for the higher studies. | communicate to a variety of audiences as well as to engage in life-long learning. |
| 5. To develop innovative and critical scientific thinking skills. | 4. To provide technical and specialized studies and consultations to various state bodies and institutions, both public and semi-public, and utilize them in resolving the environment and society issues to promote sustainable development. | 5. To contribute in the preparation of the scientific papers in the area of mechanical engineering. | 5. To provide opportunities for graduates to plan, schedule, manage and conduct tasks within considerations of environmental issues, social impacts and ethical professional practices and codes. |
| 6. To provide students with the required | 5. To develop a spirit of co-operation, group | | 6. To develop awareness of scope, principles, norms, accountabilities of knowledge economy and |

| | | | |
|---|---|---|---|
| knowledge and scientific and applied skills for solving problems effectively and efficiently. | work, effective leadership, sense of responsibility, and ethical commitment. | | sustainable development. practice by engaging in interactive learning environments and individually research studies. |

| Head of the Department<br><br>Dr. Hamoud A. Al-Nahari | Quality Assurance Unit<br>Assoc. Prof. Dr. Mohammad Algorafi | Dean of the Faculty<br>Prof. Dr. Mohammed AL-Bukhaiti | Academic Development Center & Quality Assurance<br>Assoc. Prof. Dr. Huda Al-Emad |
|---|---|---|---|
| Rector of Sana'a University<br>Prof. Dr. Al-Qassim Mohammed Abbas | | | |

# Program Specification

## ملحق (8) المساقات الرئيسية واوزانها الفرعية لبرنامج ماجستير الهندسة الميكانيكية

## Appendix (8) Main Themes/Sub-Themes with Relative weight for Program of Master of Science in Mechanical Engineering.

| No. | Themes | Credit Hours | Courses Number | Relative weight for Theme | Sub-Themes |
|---|---|---|---|---|---|
| 0 | General | 9 | 3 | 25% | - |
| 1 | Design and Manufacturing Technology | 27 | 8 | 75% | - |
| 2 | Power Plants and Thermo-Fluid Sciences | 27 | 8 | 75% | - |
| | **Total** | **36** | **11** | **100%** | |

* This total is the overall total of both Compulsory and Elective courses.

| Head of the Department<br>Dr. Hamoud A. Al-Nahari | Quality Assurance Unit<br>Assoc. Prof. Dr. Mohammad Algorafi | Dean of the Faculty<br>Prof. Dr. Mohammed AL-Bukhaiti | Academic Development Center & Quality Assurance<br>Assoc. Prof. Dr. Huda Al-Emad |
|---|---|---|---|
| Rector of Sana'a University<br>Prof. Dr. Al-Qassim Mohammed Abbas | | | |

University of Sana'a
Faculty of Engineering
Department: Mechanical Engineering
Title of the Program: Master of Science in Mechanical Engineering

# Program Specification

## ملحق (9) توزيع مخرجات التعلم لبرنامج ماجستير الهندسة الميكانيكية مع المساقات الرئيسية

## Appendix (9) P- ILOs Distribution to Main Themes for Master of Science in Mechanical Engineering program

| No | PILOs | Themes | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 1st Theme | 2nd Theme | 3rd Theme | 4th Theme | 5th Theme | 6th Theme | 7th Theme | 8th Theme |
| 1 | A1 | ✓ | ✓ | ✓ | | | | | |
| 2 | A2 | ✓ | ✓ | ✓ | | | | | |
| 3 | A3 | ✓ | ✓ | ✓ | | | | | |
| 4 | B1 | ✓ | ✓ | ✓ | | | | | |
| 5 | B2 | ✓ | ✓ | ✓ | | | | | |
| 6 | B3 | ✓ | ✓ | ✓ | | | | | |
| 7 | B4 | ✓ | ✓ | ✓ | | | | | |
| 8 | C1 | ✓ | ✓ | ✓ | | | | | |
| 9 | C2 | ✓ | ✓ | ✓ | | | | | |
| 10 | C3 | ✓ | ✓ | ✓ | | | | | |
| 11 | D1 | ✓ | ✓ | ✓ | | | | | |

| Head of the Department<br>Dr. Hamoud A. Al-Nahari | Quality Assurance Unit<br>Assoc. Prof. Dr. Mohammad Algorafi | Dean of the Faculty<br>Prof. Dr. Mohammed AL-Bukhaiti | Academic Development Center & Quality Assurance<br>Assoc. Prof. Dr. Huda Al-Emad |
|---|---|---|---|
| Rector of Sana'a University<br>Prof. Dr. Al-Qassim Mohammed Abbas | | | |

# Program Specification

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 12 | D2 | ✓ | ✓ | ✓ | | | | | |
| 13 | D3 | ✓ | ✓ | ✓ | | | | | |
| 14 | D4 | ✓ | ✓ | ✓ | | | | | |

## ملحق (10) موائمة مخرجات تعلم برنامج ماجستير الهندسة الميكانيكية مع المقررات

## Appendix (10) Mapping Program Intended Learning Outcomes with courses for Master of Science in Mechanical Engineering program

| Course Name | PILOs | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | A1 | A2 | A3 | B1 | B2 | B3 | B4 | C1 | C2 | C3 | D1 | D2 | D3 | D4 |
| Advanced Engineering Mathematics | √ | | √ | √ | √ | √ | | | | √ | | √ | | |
| Applied Finite Element | √ | √ | √ | √ | √ | √ | √ | √ | √ | | √ | √ | √ | √ |
| Advanced Mechanics of Solid and Materials | √ | √ | √ | √ | √ | √ | √ | √ | √ | | √ | √ | √ | √ |
| Advanced Thermodynamics | √ | √ | √ | √ | √ | √ | √ | √ | √ | | √ | √ | √ | √ |
| Research Methodology | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ |

| Head of the Department<br>Dr. Hamoud A. Al-Nahari | Quality Assurance Unit<br>Assoc. Prof. Dr. Mohammad Algorafi | Dean of the Faculty<br>Prof. Dr. Mohammed AL-Bukhaiti | Academic Development Center & Quality Assurance<br>Assoc. Prof. Dr. Huda Al-Emad |
|---|---|---|---|
| Rector of Sana'a University<br>Prof. Dr. Al-Qassim Mohammed Abbas | | | |

**University of Sana'a**
**Faculty of Engineering**
**Department: Mechanical Engineering**
**Title of the Program: Master of Science in Mechanical Engineering**

# Program Specification

| Course Name | PILOs | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | A1 | A2 | A3 | B1 | B2 | B3 | B4 | C1 | C2 | C3 | D1 | D2 | D3 | D4 |
| Advanced Control System Design | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ |
| Fatigue and Fracture of Engineering Materials | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ |
| High Temperature Behavior of Materials | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | | √ | √ | √ |
| Advanced Dynamics of Machinery | | | √ | | √ | √ | | √ | | | | √ | | √ |
| Advanced Machine Design & Optimization | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ |
| Advanced Manufacturing Processes | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ |
| Automation in Manufacturing Systems | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ |
| Advanced Studies in Mechanical Engineering | √ | √ | | | √ | √ | √ | √ | √ | √ | | | √ | √ |
| Advanced Fluid Mechanics | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ |

| Head of the Department | Quality Assurance Unit | Dean of the Faculty | Academic Development Center & Quality Assurance |
|---|---|---|---|
| Dr. Hamoud A. Al-Nahari | Assoc. Prof. Dr. Mohammad Algorafi | Prof. Dr. Mohammed AL-Bukhaiti | Assoc. Prof. Dr. Huda Al-Emad |
| Rector of Sana'a University<br>Prof. Dr. Al-Qassim Mohammed Abbas | | | |

**University of Sana'a**
**Faculty of Engineering**
**Department: Mechanical Engineering**
**Title of the Program: Master of Science in Mechanical Engineering**

# Program Specification

| Course Name | PILOs | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | A1 | A2 | A3 | B1 | B2 | B3 | B4 | C1 | C2 | C3 | D1 | D2 | D3 | D4 |
| Advanced Heat Transfer | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ |
| Advanced Energy Conversion | √ | | √ | | √ | | √ | | √ | √ | √ | √ | √ | √ |
| Engineering Safety and the Environment | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ |
| Renewable Energy and Application | √ | | √ | | √ | | √ | | √ | √ | √ | √ | √ | √ |
| Advanced Refrigeration and Air Conditioning Systems | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ |
| Modeling and Simulation of Engineering Systems | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ |
| Master Thesis | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ |

| Head of the Department<br><br>Dr. Hamoud A. Al-Nahari | Quality Assurance Unit<br>Assoc. Prof. Dr. Mohammad Algorafi | Dean of the Faculty<br>Prof. Dr. Mohammed AL-Bukhaiti | Academic Development Center & Quality Assurance<br>Assoc. Prof. Dr. Huda Al-Emad |
|---|---|---|---|
| Rector of Sana'a University<br>Prof. Dr. Al-Qassim Mohammed Abbas | | | |

University of Sana'a
Faculty of Engineering
Department: Mechanical Engineering
Title of the Program: Master of Science in Mechanical Engineering

# Program Specification

## ماجستير الهندسة الميكانيكية مع المرجعيات ملحق (11) موائمة مخرجات تعلم برنامج

## Appendix (11) Mapping Program Intended Learning Outcomes with the benchmarks for Master of Science in Mechanical Engineering program

| (IOLs) Intended Learning Outcomes | | | | | | | | | | | | | | | | Standards and Benchmarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (A) | | | | (B) | | | | (c) | | | | (D) | | | | |
| A1 | A2 | A3 | A4 | B1 | B2 | B3 | B4 | C1 | C2 | C3 | C4 | D1 | D2 | D3 | D4 | |
| | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | |

| Head of the Department | Quality Assurance Unit | Dean of the Faculty | Academic Development Center & Quality Assurance |
|---|---|---|---|
| Dr. Hamoud A. Al-Nahari | Assoc. Prof. Dr. Mohammad Algorafi | Prof. Dr. Mohammed AL-Bukhaiti | Assoc. Prof. Dr. Huda Al-Emad |
| Rector of Sana'a University<br>Prof. Dr. Al-Qassim Mohammed Abbas | | | |

# Program Specification

## ملحق (12) مواءمة أهداف البرنامج مع مخرجات التعلم المقصودة لبرنامج ماجستير الهندسة الميكانيكية

## Annex-12, Alignment of Mechanical Engineering Program Objectives with Program Intended Learning Outcomes

| Program Objectives<br>رقم ونص المعيار | Program Intended Learning Outcomes (PILOs)<br>رموز مخرجات التعلم للبرنامج PILOs | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | A1 | A2 | A3 | | B1 | B2 | B3 | B4 | C1 | C2 | C3 | D1 | D2 | D3 | D4 |
| 1. To prepare graduate to excel in advanced mechanical engineering discipline as well as to extend the boundaries of their professional competence to meet the needs of future industrial development. | √ | √ | √ | | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ |

| Head of the Department<br><br>Dr. Hamoud A. Al-Nahari | Quality Assurance Unit<br>Assoc. Prof. Dr. Mohammad Algorafi | Dean of the Faculty<br>Prof. Dr. Mohammed AL-Bukhaiti | Academic Development Center & Quality Assurance<br>Assoc. Prof. Dr. Huda Al-Emad |
|---|---|---|---|
| Rector of Sana'a University<br>Prof. Dr. Al-Qassim Mohammed Abbas | | | |

**University of Sana'a**
**Faculty of Engineering**
**Department: Mechanical Engineering**
**Title of the Program: Master of Science in Mechanical Engineering**

# Program Specification

| Program Objectives<br>رقم ونص المعيار | Program Intended Learning Outcomes (PILOs)<br>رموز مخرجات التعلم للبرنامج PILOs | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | A1 | A2 | A3 | | B1 | B2 | B3 | B4 | C1 | C2 | C3 | D1 | D2 | D3 | D4 |
| 2. To prepare graduates with a wide range of knowledge and capacity for successful careers in industry and/or academia. | √ | √ | √ | | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ |
| 3. To equipped graduates with spirits of innovation, creativity, adaptability, and critical thinking to solve complex problems using advanced analytical and experimental methods in the mechanical engineering fields. | √ | √ | √ | | √ | √ | √ | √ | √ | √ | √ | | | | |

| Head of the Department<br><br>Dr. Hamoud A. Al-Nahari | Quality Assurance Unit<br>Assoc. Prof. Dr. Mohammad Algorafi | Dean of the Faculty<br>Prof. Dr. Mohammed AL-Bukhaiti | Academic Development Center & Quality Assurance<br>Assoc. Prof. Dr. Huda Al-Emad |
|---|---|---|---|
| Rector of Sana'a University<br>Prof. Dr. Al-Qassim Mohammed Abbas | | | |

University of Sana'a
Faculty of Engineering
Department: Mechanical Engineering
Title of the Program: Master of Science in Mechanical Engineering

# Program Specification

| Program Objectives<br>رقم ونص المعيار | Program Intended Learning Outcomes (PILOs)<br>رموز مخرجات التعلم للبرنامج PILOs | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | A1 | A2 | A3 | | B1 | B2 | B3 | B4 | C1 | C2 | C3 | D1 | D2 | D3 | D4 |
| 4. To prepare graduates to function effectively in multi-disciplinary team environments and communicate to a variety of audiences as well as to engage in life-long learning. | | | | | | | | | | | | √ | √ | √ | √ |
| 5. To provide opportunities for graduates to plan, schedule, manage and conduct tasks within considerations of environmental issues, social impacts and ethical professional practices and codes. | | | | | | | | | √ | √ | √ | √ | √ | √ | √ |

| Head of the Department<br><br>Dr. Hamoud A. Al-Nahari | Quality Assurance Unit<br>Assoc. Prof. Dr. Mohammad Algorafi | Dean of the Faculty<br>Prof. Dr. Mohammed AL-Bukhaiti | Academic Development Center & Quality Assurance<br>Assoc. Prof. Dr. Huda Al-Emad |
|---|---|---|---|
| Rector of Sana'a University<br>Prof. Dr. Al-Qassim Mohammed Abbas | | | |

University of Sana'a
Faculty of Engineering
Department: Mechanical Engineering
Title of the Program: Master of Science in Mechanical Engineering

# Program Specification

| Program Objectives<br>رقم ونص المعيار | Program Intended Learning Outcomes (PILOs)<br>رموز مخرجات التعلم للبرنامج PILOs | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | A1 | A2 | A3 | | B1 | B2 | B3 | B4 | C1 | C2 | C3 | D1 | D2 | D3 | D4 |
| 6. To develop awareness of scope, principles, norms, accountabilities of knowledge economy and sustainable development. practice by engaging in interactive learning environments and individually research studies. | √ | √ | √ | | √ | √ | √ | √ | √ | √ | √ | √ | | √ | |
| | | | | | | | | | | | | | | | |

| Head of the Department<br><br>Dr. Hamoud A. Al-Nahari | Quality Assurance Unit<br>Assoc. Prof. Dr. Mohammad Algorafi | Dean of the Faculty<br>Prof. Dr. Mohammed AL-Bukhaiti | Academic Development Center & Quality Assurance<br>Assoc. Prof. Dr. Huda Al-Emad |
|---|---|---|---|
| Rector of Sana'a University<br>Prof. Dr. Al-Qassim Mohammed Abbas | | | |

**University of Sana'a**
**Faculty of Engineering**
**Department: Mechanical Engineering**
**Title of the Program: Master of Science in Mechanical Engineering**

# Program Specification

**Program Intended Learning Outcomes (PILOs):**

| | |
|---|---|
| E. Knowledge and Understanding<br>Upon successful completion of the Master of Science in Mechanical Engineering Program, graduates should be able to: | |
| A1. | Acquire advanced concepts and knowledge of mathematics, scientific, mechanical engineering and associated technologies as well as across the boundaries of interdisciplinary disciplines |
| A2. | Identify and critically evaluate contemporary engineering technologies, current developments and emerging trends within the mechanical engineering contexts. |
| A3. | Provide a holistic description of principles, concepts, approaches, techniques and analysis tools to design and development of existing and novel mechanical systems, while taking a sustainable and environmentally-friendly approach. |
| F. Intellectual Skills<br>Upon successful completion of the Master of Science in Mechanical Engineering Program, graduates should be able to: | |
| B1. | Identify and apply specialized knowledge and skills to solve problems that are critical to future growth of industry and business |
| B2. | Creatively thinking and apply analysis tools to formulate and solve complex engineering problems in the mechanical engineering context using modern techniques and tools. |
| B3. | Design and optimize mechanical components, systems and process to meet desired needs within realistic constraints. |
| B4. | Assess and analyze risks of the professional practice in the mechanical engineering contexts. |
| G. Practical and Professional Skills<br>Upon successful completion of the Master of Science in Mechanical Engineering Program, graduates should be able to: | |
| C1. | Use modern manufacturing processes and materials, experimental tests, appropriate software packages and other modern tools for the design analysis and manufacture of mechanical components and systems. |
| C2. | Conduct research and studies to solve mechanical engineering problems professionally, ethically and responsibly within realistic constraints. |

| Head of the Department | Quality Assurance Unit | Dean of the Faculty | Academic Development Center & Quality Assurance |
|---|---|---|---|
| Dr. Hamoud A. Al-Nahari | Assoc. Prof. Dr. Mohammad Algorafi | Prof. Dr. Mohammed AL-Bukhaiti | Assoc. Prof. Dr. Huda Al-Emad |
| Rector of Sana'a University<br>Prof. Dr. Al-Qassim Mohammed Abbas | | | |

# Program Specification

| | |
|---|---|
| C3. | Demonstrate an in-depth understanding of the mechanical engineering business environment, including environmental aspects, and apply quality issues, modern operations and business management techniques and good practices in a range of contexts. |
| H. Key Transferrable Skills<br>Upon successful completion of the Master of Science in Mechanical Engineering Program, graduates should be able to: | |
| D1. | Adopt effectively IT capabilities and other different resources of information to develop a scientific research in mechanical engineering fields. |
| D2. | Communicate, present, challenge and defend research ideas, results and conclusions in both orally and writing forms to different audiences in contexts. |
| D3. | Identify a need for the latest relevant knowledge and technologies and undertake life-long learning. |
| D4. | Collaborate effectively within multidisciplinary teams and lead them in different professional contexts |

| Head of the Department<br><br>Dr. Hamoud A. Al-Nahari | Quality Assurance Unit<br>Assoc. Prof. Dr. Mohammad Algorafi | Dean of the Faculty<br>Prof. Dr. Mohammed AL-Bukhaiti | Academic Development Center & Quality Assurance<br>Assoc. Prof. Dr. Huda Al-Emad |
|---|---|---|---|
| Rector of Sana'a University<br>Prof. Dr. Al-Qassim Mohammed Abbas | | | |

# Program Specification

| Head of the Department<br><br>Dr. Hamoud A. Al-Nahari | Quality Assurance Unit<br>Assoc. Prof. Dr. Mohammad Algorafi | Dean of the Faculty<br>Prof. Dr. Mohammed AL-Bukhaiti | Academic Development Center & Quality Assurance<br>Assoc. Prof. Dr. Huda Al-Emad |
|---|---|---|---|
| Rector of Sana'a University<br>Prof. Dr. Al-Qassim Mohammed Abbas | | | |