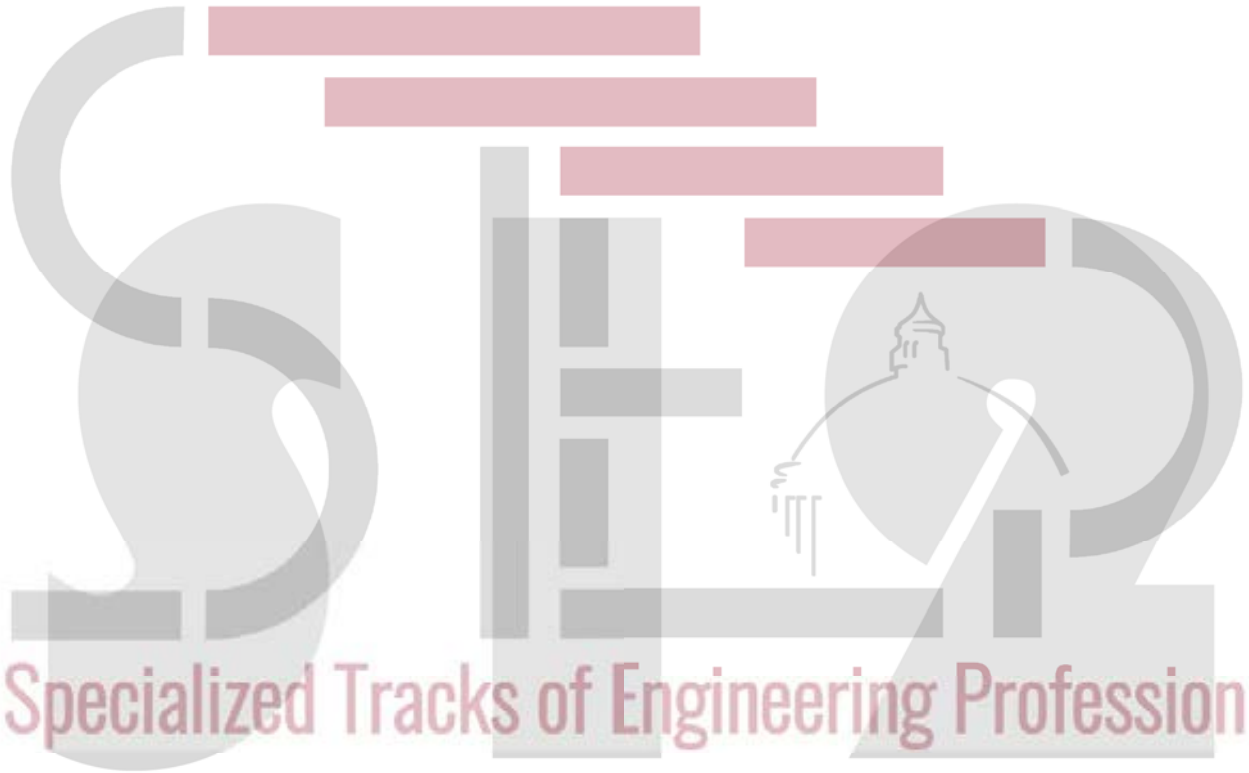


# PART [C]: SPECIALIZED PROGRAMS

## (12) MECHATRONICS ENGINEERING Program (MEE)

## برنامج هندسة الميكاترونكس

# (12) Mechatronics Engineering Program (MEE)

برنامج هندسة الميكاترونكس

## VISION رؤية البرنامج

The vision of the mechatronics engineering program is offering educational program where education, learning and scientific research synergize to provide the society with the innovative mechatronics engineer capable of providing optimal solutions and leading improvement in his profession and contributing to the country's progress.

طرح برنامج تعليمي يتكاتف فيه التعليم والتعلم والبحث العلمي على إمداد المجتمع بمهندس ميكاترونكس مبتكر وقادر على تقديم الحلول المثلى وقيادة التطوير في مهنته والمساهمة في تقدم البلاد.

## MISSION رسالة البرنامج

The mission of the mechatronics engineering program is to offer distinguished academic services to provide the labor sector and the community with qualified mechatronics engineers capable of competing locally, regionally, and internationally and effectively applying the acquired scientific, technical knowledge and skills to resolve industrial problems and provide solutions and have the capacity for professional self-career development.

تقديم خدمة تعليمية متميزة لإمداد قطاع الأعمال والمجتمع باحتياجاتهم من مهندسي الميكاترونكس القادرين على المنافسة محليا وإقليمياً ودوليا وعلى الاستخدام الكفء والفعال للعلوم والمعارف التقنية والمهارات لحل مشاكل الصناعة وتقديم الحلول والقادرين على التطوير الذاتي مهنياً.

## GRADUATE ATTRIBUTES مواصفات الخريج



The mechatronics engineering program has the following set of educational objectives:

1. Attracting outstanding local, regional, and international students by providing distinguished academic services and encouraging competitive scientific activities.
2. Providing the students with the fundamentals and foundation of basic and engineering sciences to solve technical problems.
3. Providing the students with broad professional education that covers the contemporary and growing aspects in the field of mechatronics engineering.
4. Upgrading students' skills in the areas of effective communication with others and working effectively within a team, as well as raising the skills of innovative and creative thinking, with an emphasis on adherence to professional ethics

5. Providing an attractive working environment for distinguished faculty members and providing them with the facilities for improving performance and continuous development.
6. Developing the program's courses to keep pace with the successive developments in science and raise the competitiveness of the graduates.
7. Improving laboratory facilities to support effective learning and research activities.
8. Seeking cooperation with local, regional, and international educational and professional bodies to improve student's realization capacities and practical skills.

| NARS 2018 | LEVEL A | LEVEL B | LEVEL C | LEVEL D |
|---|---|---|---|---|
| √ | Totally Adopted | Totally Adopted | See below | NA |

**The MEE program has adopted the National Academic Reference Standards (NARS) for Engineering issued by the National Authority for Quality Assurance and Accreditation for Education (NAQAAE) as the program objects to ensure the satisfaction of the national quality assurance standards. The NARS 2018 for Engineering are broad statements that define the main characteristics and performance expected from all engineering students (LEVEL A) upon their graduation so that the graduate attributes of the MEE program can be achieved as follows:**

1. Master a wide spectrum of engineering knowledge and specialized skills and can apply acquired knowledge using theories and abstract thinking in real life situations.
2. Apply analytic critical and systemic thinking to identify, diagnose and solve engineering problems with a wide range of complexity and variation.
3. Behave professionally and adhere to engineering ethics and standards.
4. Work in and lead a heterogeneous team of professionals from different engineering specialties and assume responsibility for own and team performance.
5. Recognize his/her role in promoting the engineering field and contribute to the development of the profession and the community.
6. Value the importance of the environment, both physical and natural, and work to promote sustainability principles.
7. Use techniques, skills, and modern engineering tools necessary for engineering practice.
8. Assume full responsibility for own learning and self-development, engage in lifelong learning and demonstrate the capacity to engage in post- graduate and research studies.

9. Communicate effectively using different modes, tools, and languages with various audiences; to deal with academic/professional challenges in a critical and creative manner.
10. Demonstrate leadership qualities, business administration and entrepreneurial skills.

**In addition to the Competencies for All Engineering Programs the BASIC MECHANICAL Engineering graduate (LEVEL B) must be able to:**

1. Model, analyze and design physical systems applicable to the specific discipline by applying the concepts of: Thermodynamics, Heat Transfer, Fluid Mechanics, solid Mechanics, Material Processing, Material Properties, Measurements, Instrumentation, Control Theory and Systems, Mechanical Design and Analysis, Dynamics and Vibrations.
2. Plan, manage and carry out designs of mechanical systems and machine elements using appropriate materials both traditional means and computer-aided tools and software contemporary to the mechanical engineering field.
3. Select conventional mechanical equipment according to the required performance.
4. Adopt suitable national and international standards and codes; and integrate legal, economic, and financial aspects to design, build, operate, inspect and maintain mechanical equipment and systems.

**In addition to the competencies of all engineering and basic mechanical engineering, the Mechatronics Engineering (LEVEL C) graduate must be able to:**

1. Design, model, build, and evaluate integrated electromechanical and mechatronic systems or components for a specific application; and identify the essential hardware and software tools required to optimize this design.
2. Operate, inspect, and maintain integrated electromechanical and mechatronic systems to ensure their optimal performance and availability using state-of-the-art technological and professional tools.

## SPECIALIZED COURSES CONTENTS توصيف المقررات

| Code | Name | Credit Hours | Category | Pre-requisite |
|---|---|---|---|---|
| MEES280 | Engineering Seminar | 1 | DR | 30 CR.HRS. + AA APROVAL |
| MEES281 | Industrial Training-1 | 1 | FR | 60 CR.HRS. + AA APPROVAL |
| MEES381 | Industrial Training-2 | 2 | DR | MEES281. + AA APROVAL |
| MEES481 | Graduation Project-1 | 1 | FR | 110 CR.HRS. + SOPHOMORE |
| MEES482 | Graduation Project-2 | 3 | DR | MEES481 + AA APROVAL |
| **Total** | | **2+6** | | |

## COURSES CONTENTS توصيف المقررات

| Code | Name/Content | Credit Hours | Contact Hours | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Lec | Tut (2) | App. Tut | Lab | Stud | Off. Tut | Off. Hrs | Total |
| **Faculty Requirements** | | | | | | | | | | |
| MEES280 | Engineering Seminar | 1 | 1 | 0 | | | | | | 1 |
| | Pre-requisites: 30 CR.HRS. + AA APROVAL | | | | | | | | | |
| | Talks and presentations are invited from industrial establishments relevant to the program. The guest speaker should discuss the organization, management, and recent technologies implemented in his/her industrial establishment. Students exercise writing brief technical reports on the guest presentation and deliver their own presentation about the topic. *The course is graded as Pass/Fail grade-system.* | | | | | | | | | |
| MEES281 | Industrial Training-1 | 1 | 0 | 0 | | | | | | 1 |
| | Pre-requisites: 60 CR.HRS. + AA APPROVAL | | | | | | | | | |
| | Training on industrial establishments relevant to the program. Training lasts for total of 90 hours, during a minimum period about of three weeks. The program training advisor schedules at least one follows up visit to the training venue and formally report on performance of trainee(s). A Mentor in the industrial establishment provides a formal report on the student's performance during training. The student submits a formal report and presentation to be evaluated by a panel of three members with one member being an external examiner appointed from industry or other colleges of engineering. *The course is graded as Pass/Fail grade-system.* | | | | | | | | | |

| Code | Name/Content | Credit Hours | Contact Hours | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Lec | Tut (2) | App. Tut | Lab | Stud | Off. Tut | Off. Hrs | Total |
| MEES381 | Industrial Training-2 | 2 | 0 | 0 | | | | | | 2 |
| | Pre-requisites: MEES281 + AA Approval | | | | | | | | | |
| | Training on industrial establishments relevant to the program. Training lasts for total of 180 hours, during a minimum period of six weeks. The program training advisor schedules at least two follow-up visits to the training venue and formally report on performance of trainee(s). A Mentor in the industrial establishment prcvides a formal report on the student's performance during training. The student submits a formal report and presentation to be evaluated by a panel of three members with one member being an external examiner appointed from industry or other colleges of engineering. *The course is graded as Pass/Fail grade-system.* | | | | | | | | | |
| MEES481 | Graduation Project-1 | 1 | 0 | 2 | | | | | | 3 |
| | Pre-requisites: 110 credits + SOPHOMORE | | | | | | | | | |
| | Students – in groups (or individually in some programs) - undertake a final project as part of the program. In GP1, students provide a clear identification of a real-life problem that represents an actual need for the industry or the community and reflects the mission and strategic objective of CUFE. Students are expected to survey the related literature, collect and interpret market data, and proposed an approach for the solution, using the engineering knowledge and skills acquired. The course is graded as Pass/Fail based upon a report/oral presentation stating the expected cost and required material, tools, and facilities as well as a timed list of deliverables. | | | | | | | | | |
| MEES482 | Graduation Project-2 | 3 | 1 | 4 | | | | | | 5 |
| | Pre-requisites: MEES481 + AA Approval | | | | | | | | | |
| | Graduation Project-2 is the second phase of the graduation project. The aim is to develop innovative solutions to problems encountered during the implementation process thus fulfilling the deliverables stated in Graduation Project-1. A dissertation on the project is submitted taking into consideration technical, economic, social, and environmental requirements while analysing the major results and presenting direct conclusions. | | | | | | | | | |

## PROGRAM REQUIREMENTS متطلبات البرنامج

| Category | | No. of courses | Course Credit Hour | Total Credit Hours |
|---|---|---|---|---|
| Discipline Requirements (DR) | core/ compulsory | 0 | 4 | 0 |
| | | 21 | 3 | 63 |
| | | 0 | 2 | 0 |
| | Elective | 0 | 0 | 0 |
| Total DR courses | | 21 | | 63 |
| Program Requirement (PR) | core/ compulsory | 1 | 4 | 4 |
| | | 5 | 3 | 15 |
| | | 2 | 2 | 4 |
| | Elective | 7 | 3 | 21 |
| Total PR courses | | 15 | | 44 |
| Total Elective courses (DR & PR) | | 7 | 3 | 21 |

- **Discipline Requirements (DR) core/compulsory courses list**

| Code | Name | Credit Hours | Pre-requisite |
|---|---|---|---|
| MTHS102 | Linear Algebra and Multivariable Integrals | 3 | MTHS003 |
| MTHS104 | Differential Equations | 3 | MTHS003 |
| MTHS114 | Numerical Analysis | 3 | MTHS102, MTHS104 |
| EPES201 | Electrical Engineering Fundamentals | 3 | PHYS002 |
| EPES303 | Electric Drive Systems | 3 | EPES201 |
| EPES305 | Industrial Instrumentation | 3 | EPES303 |
| EPES450 | Programmable Logic Controllers | 3 | EPES303 |
| MCNS101 | Thermodynamics | 3 | PHYS001 |
| MCNS202 | Fluid Mechanics | 3 | MTHS002 |
| MCNS326 | Heat Transfer | 3 | MCNS101 |
| MDPS133 | Materials for Mechatronics | 3 | NONE |
| MDPS217 | Machine Drawing | 3 | INTS001 |
| MDPS241 | Manufacturing Processes I | 3 | PHYS001 |
| MDPS242 | Manufacturing Processes II | 3 | MDPS133 |

| Code | Name | Credit Hours | Pre-requisite |
|---|---|---|---|
| MDPS251 | Kinematics of Machine Components | 3 | EMCS001 |
| MDPS261 | Stress Analysis | 3 | EMCS002 |
| MDPS352 | Machine Design | 3 | MDPS261 |
| MDPS355 | Dynamics of Machine Components | 3 | MDPS251 |
| MDPS371 | Mechanical Vibrations | 3 | MDPS355 |
| MDPS372 | Control System Dynamics | 3 | MDPS355 |
| MDPS473 | Automatic Control I | 3 | MDPS372 |
| **Total** | | **63** | |

- **Program Requirements (PR) core/compulsory courses list**

| Code | Name | Credit Hours | Pre-requisite |
|---|---|---|---|
| CMPS102 | Programming Techniques | 3 | INTS005 |
| CMPS118 | Introduction to Logic Design | 3 | INTS005 |
| CMPS201 | Microprocessor Systems | 3 | CMPS118 |
| MDPS479 | Embedded systems for Mechatronics Applications | 2 | CMPS201 |
| EPES451 | Industrial Communication and Network | 3 | EPES305 |
| MDPS374 | Design of Mechatronic Systems | 4 | MDPS352 + MDPS355 |
| MDPS423 | Robotics Engineering | 3 | MDPS251 |
| MDPS470 | Mechatronics Lab | 2 | 108 credits |
| **Total** | | **23** | |



- **Program Requirements (PR) elective courses list**

| Code | Name | Credit Hours | Pre-requisite |
|---|---|---|---|
| **ELECTIVES (E2) 5 courses (15 Credits)** | | | |
| CMPS103 | Data Structures and Algorithms | 3 | INTS005+ CMPS102 |
| CMPS202 | Introduction to Database Management Systems | 3 | CMPS102 |
| CMPS302 | Algorithms Design & Analysis | 3 | CMPS103 |
| CMPS402 | Machine Intelligence | 3 | CMPS202 |
| CMPS446 | Image Processing and Computer Vision | 3 | MTHS204 |
| EECS303 | Signal Analysis for Mechatronic Systems | 3 | EPES201 + MTHS102 |

| Code | Name | Credit Hours | Pre-requisite |
|---|---|---|---|
| EPES452 | Digital Control of Mechatronic Systems | 3 | EECS303+ MDPS473 |
| EPES453 | Intelligent Control of Mechatronic Systems | 3 | EECS303+ MDPS473 |
| MDPS353 | Mechanism Design | 3 | MDPS355 |
| MDPS363 | Finite Element Analysis | 3 | MDPS261 |
| MDPS457 | Fluid Power Systems | 3 | MCNS202 + MDPS372 |
| MDPS458 | Hydraulic Servo Control | 3 | MDPS457 + MDPS473 |
| MDPS474 | Automatic Control II | 3 | MDPS473 |
| MDPS476 | Mobile Robots and Autonomous Systems | 3 | MDPS423 |
| MDPS477 | Micro and Nano-Electromechanical Systems | 3 | MDPS372 |
| MDPS478 | Vehicle System Dynamics and Control | 3 | MDPS372 |
| MDPS492 | Computer Integrated Manufacturing CIM | 3 | MDPS381 + MDPS242 |

| Code | Name | Credit Hours | Pre-requisite |
|---|---|---|---|
| **ELECTIVES (E3) 2 courses (6 Credits)** | | | |
| MDPS323 | Modern Manufacturing Processes | 3 | MDPS241 + MDPS242 |
| MDPS332 | Computer Aided Design and Manufacturing CAD/CAM | 3 | MDPS241 |
| MDPS444 | Sheet Metal Processing | 3 | MDPS242 |
| MDPS381 | Fundamentals of Industrial Engineering | 3 | None |
| MDPS390 | Project Management | 3 | MDPS381 |
| MDPS432 | Pressure Vessels and Piping | 3 | 85 Credits+ AA Approval |
| MEPS415 | Power Generation | 3 | 85 Credits+ AA Approval |
| MEPS425 | Renewable Energy | 3 | 85 Credits+ AA Approval |
| MDPS482 | Quality Management | 3 | MTHS204 |
| MDPS490 | Design for Manufacturing | 3 | MDPS242 + MDPS381 |

## Proposed Study Plan - 8 semesters - Including Freshman Level

| S | Code | Name | Credit Hours | Contact Hours | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Lec | Tut (2) | App Tut | Lab | Stud | Off Tut | Off Hr | Total |
| SEMESTER 1 | PHYS001 | Mechanical Properties of Matter and Thermodynamics | 3 | 2 | | 2 | 1 | | | | 5 |
| | MTHS002 | Calculus I | 3 | 2 | 2 | | | | | | 4 |
| | EMCS001 | Engineering Mechanics - Dynamics | 3 | 1 | 2 | | 1 | | | | 4 |
| | CHES001 | Chemistry for Engineers | 2 | 1 | 2 | | | | | | 3 |
| | INTS001 | Engineering Graphics | 3 | 2 | | | | 3 | | | 5 |
| | INTS005 | Information Technology | 2 | 1 | | | 3 | | | | 4 |
| | GENS004 | Proficiency and Capacity Building | 1 | 1 | | | | | | | 1 |
| | GENS001 | Critical and Creative Thinking | 2 | 2 | | | | | | | 2 |
| | | **Sub-Total** | **19** | **13** | **6** | **2** | **4** | **3** | **0** | **0** | **28** |

| S | Code | Name | Credit Hours | Contact Hours | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Lec | Tut (2) | App. Tut | Lab | Stud | Off Tut | Off. Hrs | Total |
| SEMESTER 2 | MTHS003 | Calculus 2 | 3 | 2 | 2 | | | | | | 4 |
| | EMCS002 | Engineering Mechanics - Statics | 2 | 1 | 2 | | | | | | 3 |
| | PHYS002 | Electricity and Magnetism | 3 | 2 | | 2 | 1 | | | | 5 |
| | MCNS202 | Fluid Mechanics | 3 | 2 | 2 | | | | | | 4 |
| | MCNS101 | Thermodynamics | 3 | 2 | 2 | | | | | | 4 |
| | MDPS133 | Materials for Mechatronics | 3 | 2 | 0 | 2 | 1 | | | | 5 |
| | E-A (GENS005) | Elective E-A (Writing and Presentation Skills) | 2 | 2 | | | | | | | 2 |
| | | **Sub-Total** | **19** | **13** | **8** | **4** | **2** | **0** | **0** | **0** | **27** |

| S | Code | Name | Credit Hours | Contact Hours | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Lec | Tut (2) | App Tut | Lab | Stud | Off Tut | Off Hr | Total |
| SEMESTER 3 | MDPS261 | Stress Analysis | 3 | 2 | 2 | 0 | 0 | | | | 4 |
| | MDPS217 | Machine Drawing | 3 | 1 | 2 | 0 | 2 | | | | 5 |
| | MDPS241 | Manufacturing Processes I | 3 | 2 | 0 | 1 | 2 | | | | 5 |
| | MTHS102 | Linear Algebra and Multivariable Integrals | 3 | 2 | 2 | 0 | 0 | | | | 4 |
| | MTHS104 | Ordinary Differential Equations & Mathematical Equations | 3 | 2 | 2 | 0 | 0 | | | | 4 |
| | E-A (GENS110) | Elective E-A (Fundamental of Management, Risk and Environment) | 2 | 2 | 0 | 0 | 0 | | | | 2 |
| | E-A (GENS120) | Elective E-A (Fund. of Economics and Accounting) | 2 | 2 | 0 | 0 | 0 | | | | 2 |
| | | **Sub-Total** | **19** | **13** | **10** | **1** | **2** | **0** | **0** | **0** | **26** |

| S | Code | Name | Credit Hours | Contact Hours | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Lec | Tut (2) | App. Tut | Lab | Stud | Off Tut | Off. Hrs | Total |
| SEMESTER 4 | EPES201 | Electrical Engineering Fundamentals | 3 | 2 | 0 | 3 | | | | | 5 |
| | MTHS005 | Introduction to Probability and Statistics | 3 | 2 | 2 | 0 | | | | | 4 |
| | MDPS251 | Kinematics of Machine Components | 3 | 2 | 0 | 3 | | | | | 5 |
| | CMPS118 | Introduction to Logic Design | 3 | 2 | 2 | 0 | | | | | 4 |
| | MTHS114 | Numerical Analysis | 3 | 2 | 2 | 0 | | | | | 4 |
| | MDPS242 | Manufacturing Processes II | 3 | 2 | 0 | 2 | 1 | | | | 5 |
| | MEES280 | Seminar | 1 | 1 | 0 | 0 | | | | | 1 |
| | | **Sub-Total** | **19** | **13** | **6** | **8** | **1** | **0** | **0** | **0** | **28** |

| S | Code | Name | Credit Hours | Contact Hours | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Lec | Tut (2) | App Tut | Lab | Stud | Off Tut | Off Hr | Total |
| SEMESTER 5 | MDPS352 | Machine Design | 3 | 2 | 0 | 3 | | | | | 5 |
| | MCNS326 | Heat Transfer | 3 | 2 | 2 | 0 | | | | | 4 |
| | CMPS102 | Programming Techniques | 3 | 2 | 0 | 0 | 3 | | | | 5 |
| | MDPS355 | Dynamics of Machine Components | 3 | 2 | 0 | 3 | | | | | 5 |
| | EPES303 | Electric Drive Systems | 3 | 2 | 0 | 3 | | | | | 5 |
| | GENS0XX | E-0 | 2 | 2 | 0 | 0 | | | | | 2 |
| | GENS3XX | E-1 | 2 | 2 | 0 | 0 | | | | | 2 |
| | | **Sub-Total** | **19** | **14** | **2** | **9** | **3** | **0** | **0** | **0** | **28** |

| S | Code | Name | Credit Hours | Contact Hours | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Lec | Tut (2) | App. Tut | Lab | Stud | Off Tut | Off. Hrs | Total |
| SEMESTER 6 | MDPS372 | Control System Dynamics | 3 | 2 | 0 | 2 | 1 | 0 | | | 5 |
| | MDPS374 | Design of Mechatronic Systems | 4 | 2 | 4 | 0 | 0 | 0 | | | 6 |
| | MDPS423 | Robotics Engineering | 3 | 2 | 2 | 0 | 0 | 0 | | | 4 |
| | EPES305 | Industrial Instrumentation | 3 | 2 | 2 | 0 | 0 | 0 | | | 4 |
| | XXXSXXX | Program Elective 1 (E2) | 3 | 2 | 2 | 0 | 0 | 0 | | | 4 |
| | XXXSXXX | Program Elective 2 (E2) | 3 | 2 | 2 | 0 | 0 | 0 | | | 4 |
| | | **Sub-Total** | **19** | **12** | **12** | **2** | **1** | **0** | **0** | **0** | **27** |

| S | Code | Name | Credit Hours | Contact Hours | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Lec | Tut (2) | App Tut | Lab | Stud | Off Tut | Off Hr | Total |
| SEMESTER 7 | CMPS201 | Microprocessor Systems | 3 | 2 | 0 | 1 | 2 | | | | 5 |
| | EPES450 | Programmable Logic Controllers | 3 | 2 | 2 | | | | | | 4 |
| | EPES451 | Industrial Communications and Network | 3 | 2 | 2 | | | | | | 4 |
| | MDPS473 | Automatic Control I | 3 | 2 | 2 | 0 | 0 | | | | 4 |
| | XXXSXXX | Program Elective 3 (E2) | 3 | 2 | 2 | 0 | | | | | 4 |
| | XXXSXXX | Program Elective 4 (E3) | 3 | 2 | 2 | 0 | | | | | 4 |
| | MEES481 | Graduation Project I | 1 | 0 | 2 | 0 | | | | | 2 |
| | | **Sub-Total** | **19** | **12** | **12** | **1** | **2** | **0** | **0** | **0** | **27** |

| S | Code | Name | Credit Hours | Contact Hours | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Lec | Tut (2) | App. Tut | Lab | Stud | Off Tut | Off. Hrs | Total |
| SEMESTER 8 | MDPS470 | Mechatronics Lab | 2 | 1 | | | 3 | | | | 4 |
| | MDPS371 | Mechanical Vibrations | 3 | 2 | 2 | | | | | | 4 |
| | MDPS479 | Embedded systems for Mechatronic Applications | 2 | 1 | 2 | | | | | | 3 |
| | XXXSXXX | Program Elective 5 (E2) | 3 | 2 | 2 | 0 | | | | | 4 |
| | XXXSXXX | Program Elective 6 (E2) | 3 | 2 | 2 | 0 | | | | | 4 |
| | XXXSXXX | Program Elective 7 (E3) | 3 | 2 | 2 | 0 | | | | | 4 |
| | MEES482 | Graduation Project 2 | 3 | 1 | 4 | 0 | | | | | 5 |
| | | **Sub-Total** | **19** | **11** | **14** | **0** | **3** | **0** | **0** | **0** | **28** |

# COURSES CONTENTS توصيف المقررات

| Code | Name/Content | Credit Hours | Contact Hours | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Lec | Tut (2) | App. Tut | Lab | Stud | Off. Tut | Off. Hrs | Total |
| **Discipline Courses (Compulsory)** | | | | | | | | | | |
| MTHS102 | Linear Algebra and Multivariable Integrals | 3 | 2 | 2 | 0 | | | | | 4 |
| | Pre-requisites: MTHS003 | | | | | | | | | |
| | Solving Linear Systems, Vector Spaces and Subspaces, Inner Product Spaces and Orthonormal Bases, The Eigenvalue Problem; Diagonalization of Matrices, Computing Functions of Matrices. Functions of Several Variables, The Gradient of a Scalar Function and its Applications, Vector Fields, Curl and Divergence, Double and Triple Integrals with Applications, Line and Surface Integrals with Applications. | | | | | | | | | |
| References | - Calculus Early Transcendentals", by J. Stewart, 8th edition, 2015, Cengage Learning<br>- Elementary Linear Algebra with Applications" by B. Kolman and D. Hill, 2013, Pearson. | | | | | | | | | |
| MTHS104 | Differential Equations | 3 | 2 | 2 | | | | | | 4 |
| | Pre-requisites: MTHS002 | | | | | | | | | |
| | First-order differential equations, separable, exact, linear, homogeneous and Bernoulli equations; modeling with first order differential equations; higher-order differential equations; method of undetermined coefficients; variation of parameters; modeling with higher order differential equations; series solutions; Laplace transform; properties and applications, shifting theorems, convolution theorem; solutions of differential equations using Laplace transform; Fourier series; Fourier transform. | | | | | | | | | |
| References | 1- "A First Course in Differential Equations with Modeling Applications" 11th Edition 2017, by Dennis G. Zill<br>2- "Fundamentals of Differential Equations", 9th Edition, 2017, by R. Nagle, Edward Saff, Arthur Snider | | | | | | | | | |
| MTHS114 | Numerical Analysis | 3 | 2 | 2 | 0 | | | | | 4 |
| | Pre-requisites: MTHS102 + MTHS104 | | | | | | | | | |
| | Basic concepts of floating- point arithmetic- Conditioning of a problem-Numerical stability of an algorithm – Linear systems: direct methods (Gauss elimination, LU factorization, Choleski) – Iterative methods (Jacobi –Gauss-Seidle – SOR). Approximation of Functions: polynomials and piecewise polynomial interpolation, splines, discrete least squares. Nonlinear equations: Newton's method and its discrete variants, fixed point iteration. Numerical integration: Newton- Cotes formulas, Gaussian quadrature rules, composite rules. Initial value problems for ordinary differential equation: one-step methods (Runge-Kutta methods) and multistep (Adams) methods. Stiff problems. | | | | | | | | | |
| References | S. Chapra and R. Canali, Numerical Methods for Engineers, 7th ed., McGraw Hill, 2014. | | | | | | | | | |

| Code | Name/Content | Credit Hours | Contact Hours | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Lec | Tut (2) | App. Tut | Lab | Stud | Off. Tut | Off. Hrs | Total |
| EPES201 | Electrical Engineering Fundamentals | 3 | 2 | 0 | 3 | | | | | 5 |
| | Pre-requisites: PHYS002 | | | | | | | | | |
| | Electrical elements and electrical quantities. Basic electrical laws (voltage and current divider rules, star-delta transformation). Analysis of DC circuits (branch currents, node voltages and Thevenin's theorem). First order capacitive transients. Time varying signals (average and RMS values, voltage and current waveforms). Analysis of AC circuits (vector and complex representations of sine waves, concept of impedance, power analysis, power factor correction). Three phase circuits (line and phase voltages, star and delta connected balanced loads, three phase power). Transformers circuits. Course project. | | | | | | | | | |
| References | A. R. Hambley, Electrical Engineering: Principles and Applications, 7th ed. Pearson, 2018. | | | | | | | | | |
| EPES303 | Electric Drive Systems | 3 | 2 | 0 | 3 | | | | | 5 |
| | Pre-requisites: EPES201 | | | | | | | | | |
| | Power Electronic Converters for Motor Drives: Controlled Rectifiers, DC Choppers, Inverters. DC Motor Drives: Structure and Operation of DC Motors, Types of DC Motors, Thyristor and Chopper DC Drives. Induction Motor Drives: Motor Structure and Operation, Speed Control, Inverter-fed Drives. Stepper Motor Drives: Principle of Operation, Motor Characteristics, Drive Circuits. Course Project. | | | | | | | | | |
| References | P. C. Sen, Principles of Electric Machines and Power Electronics, 3rd ed., Wiley, 2013 | | | | | | | | | |
| EPES305 | Industrial Instrumentation | 3 | 2 | 2 | | | | | | 4 |
| | Pre-requisites: EPES303 | | | | | | | | | |
| | Logic gates, circuit design with logic gates. Operational amplifier circuits and applications. Digital electronics. Performance of analogue and digital transducers; selecting a proper transducer for a given application. Analogue transducers: solenoids, thermocouples, pressure transducers. Digital transducers: optical encoders, ultrasonic sensors. Signal conditioning: signal analysis, frequency response, filter design, op-amp circuits. Data acquisition systems (A/D and D/A converters). Stepper motors: microprocessors: structure, programming, applications. Course project. | | | | | | | | | |
| References | William Dunn, Fundamentals of Industrial Instrumentation and Process Control,2nd Edition, McGraw Hill, 2018. | | | | | | | | | |

| Code | Name/Content | Credit Hours | Contact Hours | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Lec | Tut (2) | App. Tut | Lab | Stud | Off. Tut | Off. Hrs | Total |
| EPES450 | Programmable Logic Controllers | 3 | 2 | 2 | 0 | 0 | | | | 4 |
| | Pre-requisites: EPES303 | | | | | | | | | |
| | Selecting a proper PLC configuration for a given application. Hardware structure and wiring techniques. Basics of programming (bit and word programming, analogue values processing). Programming sequential control tasks. Structured programming techniques. Networking. Building simple supervisory control and data acquisition (SCADA) system integrated with a PLC for sequential control problems. Course project. | | | | | | | | | |
| References | F. Petruzella, Programmable Logic Controllers, 5th ed., McGraw Hill, 2016. | | | | | | | | | |
| MCNS101 | Thermodynamics | 3 | 2 | 2 | | | | | | 4 |
| | Pre-requisites: PHYS001 | | | | | | | | | |
| | Basic concepts. Pure substances - First law of thermodynamics and applications – second law of thermodynamics and corollaries – entropy. May include a visit to a power plant, course project | | | | | | | | | |
| References | Claus Borgnakke and Richard E. Sonntag, Fundamentals of Thermodynamics, 10th Edition, Wiley, 2019. | | | | | | | | | |
| MCNS202 | Fluid Mechanics | 3 | 2 | 2 | | | | | | 4 |
| | Pre-requisites: MTHS002 | | | | | | | | | |
| | Fluid kinematics. flow types. Integral analysis of flow: Continuity, Linear momentum, Angular momentum and Energy equations, Applications. Similitude and dimensional analysis and modeling, Viscous flow in pipes anc ducts. Flow measurement. General applications. Course project computer oriented. | | | | | | | | | |
| References | Philip M. Gerhart, Andrew L. Gerhart, John I. Hochstein, Munson, Young and Okiishi's Fundamentals of Fluid Mechanics, 8th Edition, Wiley, 2018. | | | | | | | | | |
| MCNS326 | Heat Transfer | 3 | 2 | 2 | | | | | | 4 |
| | Pre-requisites: MCNS101 | | | | | | | | | |
| | Conduction: General equation of conduction, one dimensional steady-state conduction, steady-state conduction with internal heat generation, steady conduction with variable thermal conductivity, fins and extended surfaces, unsteady conduction. Convection: fundamentals of convection, dimensionless groups, natural and forced convection, use of empirical correlations. Radiation: Fundamentals of heat transfer by radiation. Case studies and computer applications. | | | | | | | | | |
| References | Frank P. Incropera, David P. DeWitt, Theodore L. Bergman, Adrienne S. Lavine, Fundamentals of Heat and Mass Transfer, 6th Edition, John Wiley & Sons, 2006. | | | | | | | | | |

| Code | Name/Content | Credit Hours | Contact Hours | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Lec | Tut (2) | App. Tut | Lab | Stud | Off. Tut | Off. Hrs | Total |
| MDPS133 | Materials for Mechatronics | 3 | 2 | 0 | 2 | 1 | | | | 5 |
| | Pre-requisites: NONE | | | | | | | | | |
| | Introduction to materials engineering used in mechatronics applications, atomic structure and interatomic bonding, Crystal structures, crystal imperfections, Diffusion, Mechanical properties. Mechanical testing of metals: tension, compression, bending, torsion, hardness. Heat treatments of steel, Classification of Alloy steels, Non-ferrous metals and alloys: copper and its alloys and aluminum and its alloys, Age hardening, Introduction to Polymers, Introduction to Composites, Introduction to Ceramics. | | | | | | | | | |
| References | William D. Callister Jr., David G. Rethwisch, Materials Science and Engineering: An Introduction, 10th Edition, Wiley, 2018. | | | | | | | | | |
| MDPS217 | Machine Drawing | 3 | 1 | 2 | 0 | 2 | | | | 5 |
| | Pre-requisites: INTS001 | | | | | | | | | |
| | Sketching and drafting of actual Mechanical components and Assemblies - Assembly drawing, working drawing, dimensioning, limits, fits, Geometrical and dimensional tolerances, surface roughness. Standard machine elements (threads, fasteners, locking devices, keys, splines, gears, pulleys, bearings, pipe connections, etc.) - Welding and riveting conventions. Standardization and designation of machine elements. Computer aided graphics application. | | | | | | | | | |
| References | David A. Madsen, David P. Madsen, Engineering Drawing and Design, 6th Edition, Cengage Learning, 2016. | | | | | | | | | |
| MDPS241 | Manufacturing Processes I | 3 | 2 | 0 | 1 | 2 | | | | 5 |
| | Pre-requisites: PHYS001 for MEE – MDPS001 for MDE, IEM, and MEM | | | | | | | | | |
| | Examination of metal cutting processes including turning, shaping, drilling and milling. Mechanics of cutting, chip formation, shear plane, velocity relations, merchant circle, tool material, tool wear, tool life, economy in metal cutting. Introduction and definitions of metrology – Gauges – Errors in measurement – Linear and angle measuring instruments test of geometrical shape: straightness and flatness. | | | | | | | | | |
| References | Fundamentals of Machining and Machine Tools, Geoffrey Boothroyd, 3rd edition, Taylor & Francis Inc | | | | | | | | | |

| Code | Name/Content | Credit Hours | Contact Hours | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Lec | Tut (2) | App. Tut | Lab | Stud | Off. Tut | Off. Hrs | Total |
| MDPS242 | Manufacturing Process II | 3 | 2 | 0 | 2 | 1 | | | | 5 |
| | Pre-requisites: MDPS133 for MEE –MDPS132 for MDE, IEM, and MEM | | | | | | | | | |
| | Casting: Types of foundries, steps in making a casting; cast metals; types, materials and allowances of patterns; Moulding processes and materials; gating and risering; casting defects.<br>Forming: Metal forming process classification, basic metal working concepts and plasticity; yield criterion; slip line fields; estimation of force and energy requirements; technology of bulk and sheet metal forming processes; precision forming processes; features of different types of metal forming dies; principles of powder forming.<br>Welding: Welding processes; welding energy sources and their characteristics; fluxes and coatings; weldability and welding of various metals and alloys; metallurgical characteristics of welded joints; weld testing and inspection. Course project. | | | | | | | | | |
| References | Manufacturing Technology, Vol. 1 Foundry, Forming and Welding, RAO, 4th Edition. McGraw Hill 2013. | | | | | | | | | |
| MDPS251 | Kinematics of Machine Components | 3 | 2 | 0 | 3 | | | | | 5 |
| | Pre-requisites: EMCS001 | | | | | | | | | |
| | Kinematics fundamentals: geometry of motion and mechanism topology, Machine components, Indexing mechanisms, inkage mechanisms and planar robots: (position, velocity and acceleration), Cam-follower mechanisms: design and analysis, standard cams and equivalent mechanisms, Gear trains (simple, compound and planetary): Kinematics, geometry and assembly conditions, Simulation using Computer Graphics and MATLAB Software and case studies, Course project | | | | | | | | | |
| References | Russell C. Hibbeler, Mechanics of Materials in SI Units, 10th edition, Pearson, 2018. | | | | | | | | | |
| MDPS261 | Stress Analysis | 3 | 2 | 2 | 0 | | | | | 4 |
| | Pre-requisites: EMCS002 | | | | | | | | | |
| | Equilibrium, continuity, material mechanical behavior. Normal force, shearing force, bending and twisting moment diagrams. Stresses in simply loaded elastic bars: axial loading, bending and torsion, deformation, stiffness, strain energy. Stresses in elastic and elasto-plastic bars, residual stresses. Combined loading, eccentric normal load, oblique bending, combined bending and torsion. Two-dimensional stresses, principal stresses, maximum shear stress, allowable stresses, Mohr's circle representation. Application to simple frames, thin-walled vessels, springs, load and cisplacement measurement. Course project computer oriented. | | | | | | | | | |
| References | R.L. Norton, Design of Machinery, 6th ed. McGraw Hill, 2019. | | | | | | | | | |

| Code | Name/Content | Credit Hours | Contact Hours | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Lec | Tut (2) | App. Tut | Lab | Stud | Off. Tut | Off. Hrs | Total |
| MDPS352 | Machine Design | 3 | 2 | 0 | 3 | | | | | 5 |
| | Pre-requisites: MDPS261 | | | | | | | | | |
| | Design procedures – Factors affecting design details – Selection of materials – Modes of loading – Safety factors and allowable stresses – Design variants and inversions. The various design calculations. Interpretation and usage of component data sheets. Design of detachable joints: (threaded joints, keys and splines) – Design of permanent joints: (welding, interference fitting, riveting, riveting, riveting, adhesion) – Design of some machine elements: springs, power screws. Applications to small-scale mechanical systems. Course project. | | | | | | | | | |
| References | Richard Budynas, Keith Nisbett, Shigley's Mechanical Engineering Design, 10th Edition, McGraw Hill, 2014. | | | | | | | | | |
| MDPS355 | Dynamics of Machine Components | 3 | 2 | 0 | 3 | | | | | 5 |
| | Pre-requisites: MDPS251 | | | | | | | | | |
| | Dynamics fundamentals and basic concepts, Plane Kinetics of Rigid bodies: force-mass-acceleration, work and energy, virtual work, balancing of machinery: rotating elements, 4-bar linkage, reciprocating elements, Engine dynamics, balancing of single cylinder engine, Flywheel design and turning moment diagram, multi-cylinder engines: Line engines, V-engines, W-engines, Simulation using Computer Graphics and MATLAB Software and case studies, Course project | | | | | | | | | |
| References | R.L. Norton, Design of Machinery, 6th ed. McGraw Hill, 2019. | | | | | | | | | |
| MDPS371 | Mechanical Vibrations | 3 | 2 | 2 | | | | | | 4 |
| | Pre-requisites: MDPS355 | | | | | | | | | |
| | Introduction and basic concepts, sources and causes of vibrations, free and forced vibrations of SDOF systems, vibration transmissibility, vibration control, free and forced vibrations of 2DOF systems, vibration absorber, MDOF systems: (natural frequencies and normal modes, forced vibrations), vibration measurement methods, computer-aided simulation and case studies, course project | | | | | | | | | |
| References | S. S. Rao, Mechanical Vibrations, 6th ed., Pearson, 2017. | | | | | | | | | |

| Code | Name/Content | Credit Hours | Contact Hours | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Lec | Tut (2) | App. Tut | Lab | Stud | Off. Tut | Off. Hrs | Total |
| MDPS372 | Control Systems Dynamics | 3 | 2 | 0 | 2 | 1 | | | | 5 |
| | Pre-requisites: MDPS355 | | | | | | | | | |
| | Introduction to system dynamics; Mathematical modeling of dynamic systems (mechanical, electrical, electronic, hydraulic, pneumatic, and thermal); Transfer-function approach; State-space approach; Time-domain analysis – Block diagrams - Transient response – Stability analysis – Root locus; Frequency-domain analysis– Bode diagrams – Nyquist plots. Computer simulation and case studies. Course project. | | | | | | | | | |
| References | K. Ogata, Modern Control Engineering, 5th ed., Pearson, 2010 | | | | | | | | | |
| MDPS473 | Automatic Control I | 3 | 2 | 2 | 0 | 0 | | | | 4 |
| | Pre-requisites: MDPS372 | | | | | | | | | |
| | Introduction to feedback control systems; Control system characteristics; Control Design by the Root locus method; Control Design by the Frequency-response method; PID Controllers and Tuning. Computer simulation and case studies. Course project. | | | | | | | | | |
| References | K. Ogata, Modern Control Engineering, 5th ed., Pearson, 2010 | | | | | | | | | |

**Program Courses (Compulsory)**

| Code | Name/Content | Credit Hours | Contact Hours | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Lec | Tut (2) | App. Tut | Lab | Stud | Off. Tut | Off. Hrs | Total |
| CMPS102 | Programming Techniques | 3 | 2 | 0 | | 3 | | | | 5 |
| | Pre-requisites: INTS005 | | | | | | | | | |
| | Introduction to software design - evolution and comparison of programming languages - types and characteristics of translators - structured programming - function versus object-oriented programming- introduction to parallel programming- program maintenance & testing - documentation - numerical and non-numerical examples-programming project | | | | | | | | | |
| References | | | | | | | | | | |
| CMPS118 | Introduction to Logic Design | 3 | 2 | 2 | | | | | | 4 |
| | Pre-requisites: INTS005 | | | | | | | | | |
| | Number systems and data representation - Boolean algebra - simplification of Boolean functions - logic gates - combinational and sequential logic circuits – Registers, counters, and adders – Memory | | | | | | | | | |
| References | | | | | | | | | | |

| Code | Name/Content | Credit Hours | Contact Hours | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Lec | Tut (2) | App. Tut | Lab | Stud | Off. Tut | Off. Hrs | Total |
| CMPS201 | Microprocessor Systems | 3 | 2 | 0 | 1 | 2 | | | | 5 |
| | Pre-requisites: CMPS118 for MEE, CMPS101 for CCE | | | | | | | | | |
| | Computer architecture - CPU architecture - fetch-decode-execute cycle - addressing modes - instruction set - memories (RAM-ROM-Cache-Flash) - memory interfacing - timing diagrams - assembly language - instruction formats - data representation - arithmetic operations | | | | | | | | | |
| References | | | | | | | | | | |
| EPES451 | Industrial Communication and Network | 3 | 2 | 2 | | | | | | 4 |
| | Pre-requisites: EPES305 | | | | | | | | | |
| | Fundamentals of wired and wireless data networks. Principles of industrial communications systems and protocols. How to secure, diagnose, and optimize communication networks. | | | | | | | | | |
| References | | | | | | | | | | |
| MDPS374 | Design of Mechatronic Systems | 3 | 2 | 4 | 0 | 0 | | | | 6 |
| | Pre-requisites: MDPS352 +MDPS355 | | | | | | | | | |
| | This course introduces mechanical engineering students to the interdisciplinary field of Mechatronics. The course includes the design and analysis of Mechatronic systems through hands-on laboratory experiments that involve component selection and interfacing, matching, and performance evaluation. | | | | | | | | | |
| References | | | | | | | | | | |
| MDPS423 | Robotics Engineering | 3 | 2 | 2 | 0 | 0 | | | | 4 |
| | Pre-requisites: MDPS251 | | | | | | | | | |
| | Introduction to Robotics Technology, Robot structures and components, Kinematics and dynamics of planar robots, Kinematics of 3-D robots and homogeneous transformation, Trajectory planning and robot control methods, computer simulation and practical training. Course project | | | | | | | | | |
| References | J. Craig, Introduction to Robotics: Mechanics and Control, 4th ed. Pearson, 2017. | | | | | | | | | |

| Code | Name/Content | Credit Hours | Contact Hours | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Lec | Tut (2) | App. Tut | Lab | Stud | Off. Tut | Off. Hrs | Total |
| MDPS470 | Mechatronics Lab | 2 | 1 | 0 | | 3 | | | | 4 |
| | Pre-requisites: 108 CREDITS | | | | | | | | | |
| | Practical laboratory using prototyping equipment for Mechatronics applications; Implementation of Mechatronics system design principles; Experimental evaluation of Mechatronics systems; Hands-on laboratory projects using electric, mechanical, electronic component. The evaluation of students will be upon reports submitted by students, a written exam in Mid-Term and an Oral Exam by a panel of beer examiners. | | | | | | | | | |
| References | | | | | | | | | | |
| MDPS479 | Embedded systems for Mechatronic Applications | 2 | 1 | 2 | | | | | | 3 |
| | Pre-requisites: CMPS201 | | | | | | | | | |
| | Introduction to embedded systems – Embedded system tools – Computer Architecture – Microcontroller Interfacing AVR and ARM – real-time operating system – ISTQB – Automotive Bus Technology. The evaluation of students will be upon reports and Final project | | | | | | | | | |
| References | | | | | | | | | | |

## Program Courses (Electives)

| Code | Name/Content | Credit Hours | Contact Hours | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Lec | Tut (2) | App. Tut | Lab | Stud | Off. Tut | Off. Hrs | Total |
| CMPS103 | Data Structures and Algorithms | 3 | 2 | 0 | | 3 | | | | 5 |
| | Pre-requisites: INTS005 + CMPS102 | | | | | | | | | |
| | Data types and representation – file structures- data structures representation in storage media and memory allocation- linear lists -stacks - queues - memory allocation - trees - graphs - Hashing -searching, sorting algorithms and their analysis-programming project | | | | | | | | | |
| References | | | | | | | | | | |
| CMPS202 | Introduction to Database Management Systems | 3 | 2 | 0 | | 3 | | | | 5 |
| | Pre-requisites: CMPS102 | | | | | | | | | |
| | Basic database concepts - data structures and operations - data modeling - database system architecture - data definition and data manipulation languages - query languages including Algebra and SQL - software package training | | | | | | | | | |
| References | | | | | | | | | | |
| CMPS302 | Algorithms Design & Analysis | 3 | 2 | | 1 | 2 | | | | 5 |
| | Pre-requisites: CMPS103 | | | | | | | | | |
| | Algorithms Design and analysis- examples - Techniques for designing efficient algorithms - analysis of complexity - complexity bounds of fundamental problems, graph problems and combinatorial problems – Balanced binary search trees – Dynamic programming - Divide-and-conquer - Search - Branch-and-bound - Fundamentals of parallel algorithms - Applications (approximate string matching, data compression, computational geometry) - NP-completeness - NP-hardness | | | | | | | | | |
| References | | | | | | | | | | |
| CMPS402 | Machine Intelligence | 3 | 2 | | | 3 | | | | 5 |
| | Prerequisite(s): CMPS202 | | | | | | | | | |
| | (Artificial Intelligence) Introduction to artificial intelligence concepts and definitions -state-space and search - knowledge representation - logic-production systems - semantic networks - frames - knowledge issues - inference - inheritance - nonmonotonic reasoning-uncertainty - fuzziness- game playing - AI-programming languages - Introduction to expert systems and knowledge engineering.- application fields that need intelligence (natural languages- learning-planning-robotics- decision support systems- intelligent agents – Semantic web) | | | | | | | | | |
| References | | | | | | | | | | |

| Code | Name/Content | Credit Hours | Contact Hours | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Lec | Tut (2) | App. Tut | Lab | Stud | Off. Tut | Off. Hrs | Total |
| CMPS446 | Image Processing and Computer Vision | 3 | 2 | 0 | | 3 | | | | 5 |
| | Pre-requisites: MTHS204 | | | | | | | | | |
| | Image representation - methods of image processing - enhancement - data compression - reconstruction from projection - features extraction - image analysis - pattern recognition - computer vision | | | | | | | | | |
| EECS303 | Signal Analysis for Mechatronic Systems | 3 | 2 | 2 | | 0 | | | | 4 |
| | Pre-requisites: EPES201 + MTHS102 | | | | | | | | | |
| | Continuous time and discrete time signals and systems - basic system properties - Linear Time Invariant Systems – The C.T and D.T. convolution - Properties of LTI systems - Fourier Series Representation of C.T. and D.T. Periodic Signals - Parseval's relation - The C.T. Fourier Transform for periodic and aperiodic signals - Properties of continuous time F.T. – The D.T. Fourier Transform – Properties of D.T. Fourier Transform - Complex exponential and sinusoidal Amplitude Modulation-Demodulation for Sinusoidal AM - Frequency Division Multiplexing - Representation of continuous time signal by its samples - The sampling Theorem - The effect of under-sampling or aliasing - sampling with zero order hold - The Z Transform | | | | | | | | | |
| References | Alan Oppenheim , Alan Willsky, with Hamid, Signals and Systems, 2nd Edition, Pearson, 2006. | | | | | | | | | |
| EPES452 | Digital Control of Mechatronic Systems | 3 | 2 | 2 | | 0 | | | | 4 |
| | Pre-requisites: EECS303 + MDPS473 | | | | | | | | | |
| | By completing this course, students should be able to convert linear time invariant systems from continuous-time to discrete-time. Identification of unknown systems is also considered. Students should be able to design digital controllers and filters. The course syllabus includes sampling continuous-time systems, time-delay systems, transfer functions in z-domain, block diagram simplification, stability analysis, transformation techniques, compensator designs, PID controllers, digital filters, state space models, controllability, observability, state feedback, output feedback, and introduction to system identification. Laboratory experiments on the course topics. | | | | | | | | | |
| References | K. Ogata, Discrete-Time Control Systems, 2nd ed, Pearson, 2015. | | | | | | | | | |

| Code | Name/Content | Credit Hours | Contact Hours | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Lec | Tut (2) | App. Tut | Lab | Stud | Off. Tut | Off. Hrs | Total |
| EPES453 | Intelligent Control of Mechatronic Systems | 3 | 2 | 2 | | 0 | | | | 4 |
| | Pre-requisites: EECS303+ MDPS473 | | | | | | | | | |
| | This course introduces the basics of intelligent control. Many commercial products use intelligent control. For example: washing machines use it to determine the amount of detergent and cameras use it to ccunteract vibrations. This course helps students to understand and design simple intelligent controllers. The syllabus includes the following: Artificial intelligence basics, fuzzy set theory, fuzzy logic, Fuzzy reasoning, Fuzzy controllers, Fuzzy PID control, Neural network's introduction, perception model, classification problem, multilayer networks, Feed forward networks, back propagation learning algorithms, recurrent networks, radial basis networks, neural network control. Neuro-fuzzy systems, introduction to optimization methods such as swarm optimizations and ants colony, application examples. | | | | | | | | | |
| References | Laxmidhar Behera, Intelligent Systems and Control Principles and Applications, Oxford University Press, 2010. | | | | | | | | | |
| MDPS323 | Modern Manufacturing Processes | 3 | 2 | 2 | | 0 | | | | 4 |
| | Pre-requisites: MDPS241 + MDPS242 | | | | | | | | | |
| | Gear and thread manufacturing; non-conventional metal cutting; Electro-chemical machining; Electro discharge machining; Laser beam machining; Electron beam machining; Water jet machining; Rapid Prototyping; micro system product; micro fabrication processes; Property enhancing of metals; cleaning and surface treatment; Coating and deposition processes; Thermal and mechanical coating; Processing of integrated circuit. | | | | | | | | | |
| References | Mikell P. Groover, Fundamentals of Modern Manufacturing: Materials, Processes, and Systems, 7th Edition, Wiley, 2019 | | | | | | | | | |

| Code | Name/Content | Credit Hours | Contact Hours | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Lec | Tut (2) | App. Tut | Lab | Stud | Off. Tut | Off. Hrs | Total |
| MDPS332 | Computer Aided Design and Manufacturing CAD/CAM | 3 | 2 | 2 | 0 | | | | | 4 |
| | Pre-requisites: MDPS241 | | | | | | | | | |
| | Product Cycle and CAD/CAM, Automation and CAD/CAM, Programming for lathe, drilling and milling machines, canned cycles, subroutines, Do Loops, Computer assisted part programming, DNC, CNC, Adaptive control. Industrial robotics: Robot physical configurations, robot motions, accuracy, repeatability, end effecter, sensors, robot programming, robot languages. Group Technology: part families, part classifications and coding systems, group technology machine, cell, concepts of composite part, benefits and limitations. Computer aided process planning: Retrieval type process planning systems, generative process planning systems, machinability data systems, computer generated time standard. Computer Integrated Manufacturing: Types of manufacturing systems, types of CIMS, special manufacturing systems, Flexible Manufacturing Systems FMS, Manufacturing Cells, Course project. | | | | | | | | | |
| References | Zhuming Bi, Xiaoqin Wang, Computer Aided Design and Manufacturing, 1st Edition, Wiley-ASME Press Series, 2020. , | | | | | | | | | |
| MDPS353 | Mechanism Design | 3 | 2 | 2 | | 0 | | | | 4 |
| | Pre-requisites: MDPS355 | | | | | | | | | |
| | Introduction and basic concepts, Mechanisms and structures, Number synthesis, Paradoxes, Isomers, Linkage transformation, Intermittent motion, Inversion, Function path and motion generation Graphical synthesis of planar mechanisms: Two-position synthesis, Three-position synthesis, Quick-return mechanisms, Coupler curves, Analytical synthesis of planar mechanisms, Optimal planar mechanism synthesis, Analytical synthesis of simple toggles, Introduction to spatial mechanism synthesis, simulation using Computer Graphics and MATLAB Software and case studies. Course project | | | | | | | | | |
| References | R.L. Norton, Design of Machinery, 6th ed. McGraw Hill, 2019. | | | | | | | | | |

| Code | Name/Content | Credit Hours | Contact Hours | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Lec | Tut (2) | App. Tut | Lab | Stud | Off. Tut | Off. Hrs | Total |
| MDPS363 | Finite Element Analysis | 3 | 2 | 2 | 0 | | | | | 4 |
| | Pre-requisites: MDPS261 | | | | | | | | | |
| | Basic principles of continuum mechan cs and finite element methods, modern application to solution of practical problems in solid, structural, and fluid mechanics, heat and mass transfer, and other field problems. Kinematics of deformation, strain and stress measures, constitutive relations, conservation laws, virtual work, and variational principles. Discretization of governing equations using finite element methods. Solution of central problems using an existing general-purpose finite element analysis program, Course project. | | | | | | | | | |
| References | Nam-Ho Kim, Bhavani V. Sankar, Ashok V. Kumar, Introduction to Finite Element Analysis and Design, 2nd Edition, Wiley, 2018. | | | | | | | | | |
| MDPS381 | Fundamentals of Industrial Engineering | 3 | 2 | 0 | 3 | 0 | | | | 5 |
| | Pre-requisites: None | | | | | | | | | |
| | The course provides an introduction tc the principles and techniques of industrial engineering, including operations research, process design and analysis, supply chain management, and human factors engineering. Students learn how to optimize systems and processes in industrial settings using tools such as mathematical modeling and statistical analysis. | | | | | | | | | |
| References | Farrokh Sassani, Industrial Engineering Foundations: Bridging the Gap between Engineering and Management, Mercury Learning and Information, 2016 | | | | | | | | | |
| MDPS390 | Project Management | 3 | 2 | 2 | 0 | 0 | | | | 4 |
| | Pre-requisites: MDPS381 | | | | | | | | | |
| | Introduction to Project planning and scheduling, Project charter, Scope statement, Work Breakdown Structure, Responsibility Chart. Network diagram, Schedule analysis and possibilities using the Critical Path Method (CPM) and the Program Evaluation and Review Technique (PERT). Resource leveling and allocation, Time-cost trade off (Crashing a schedule), Gantt Chart, Time overlaps, Time and cost control, Risk monitoring and control, Computer applications with case studies. | | | | | | | | | |
| References | J. Heagney, Fundamentals of Project Management, AMACOM; Fifth edition, 2016 | | | | | | | | | |

| Code | Name/Content | Credit Hours | Contact Hours | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Lec | Tut (2) | App. Tut | Lab | Stud | Off. Tut | Off. Hrs | Total |
| MDPS432 | Pressure Vessels and Piping | 3 | 2 | 2 | 0 | | | | | 4 |
| | Pre-requisites: 85 Credits+ AA Approval | | | | | | | | | |
| | Introduction to ASME Boiler, Pressure Vessels, and Piping Codes. Section VIII Divs. 1 and 2. B31 code series. Material selection. Basic principles in design. Types of loads. Failure theories. Design for internal and external pressure. Design of end closures with various geometries. Design of openings and nozzles. Fabrication requirements. Non-destructive examination and testing. Piping stress and flexibility analyses, design and selection of piping supports. Computer implementation of general-purpose software packages. course project | | | | | | | | | |
| References | Baldev Raj, B.K. Choudhary, K. Velusamy, Pressure Vessels and Piping, Volume I: Codes, Standards, Design and Analysis, Alpha Science International, 2009. | | | | | | | | | |
| MDPS444 | Sheet Metal Processing | 3 | 2 | 0 | 2 | 1 | | | | 5 |
| | Pre-requisites: MDPS242 | | | | | | | | | |
| | Review of Sheet metal industry applications, Sheet Metal Properties, Deformation of sheet metals, Simple Stamping Analysis, Deep Drawing Die design, Sheet metal shearing and bending, Non-Conventional Sheet metal processes. Die design: Standard parts, progressive and compound dies, Mechanical and Hydraulic Presses selection-CNC punch presses. Course project | | | | | | | | | |
| References | Sheet Metal Forming Fundamentals, Taylan Altan & Erman Takkaya, 2012, ASM International. | | | | | | | | | |
| MDPS457 | Fluid Power Systems | 3 | 2 | 2 | 0 | | | | | 4 |
| | Pre-requisites: MCNS202 + MDPS372 | | | | | | | | | |
| | Fluid power transmission; actuation and control – Properties of hydraulic fluids – Positive displacement pumps and motors; types, static characteristics of constant and variable geometric volume units, flow rate, torque and power – Cylinders – Pressure, flow, and directional control valves; direct and pilot operated, static flow forces acting on poppets and spools, static characteristics of valves – Accumulators – Accessories – Throttling and non-throttling systems –Basics of design of fluid power systems and examples from industrial and mobile applications – Course project. | | | | | | | | | |
| References | M. G. Rabie, Fluid Power Engineering McGraw Hill, 2009. | | | | | | | | | |

| Code | Name/Content | Credit Hours | Contact Hours | | | | | | | |
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| | | | Lec | Tut (2) | App. Tut | Lab | Stud | Off. Tut | Off. Hrs | Total |
| MDPS458 | Hydraulic Servo Control | 3 | 2 | 2 | 0 | 0 | | | | 4 |
| | Pre-requisites: MDPS457 + MDPS473 | | | | | | | | | |
| | Fields of applications of hydraulic servo systems –Hydraulic servo systems versus proportional systems and electric servo systems – Hydraulic servo valves; types, static characteristics, valves coefficients, lapping conditions – Transient and steady state flow forces acting on spools and flappers – Pilot operated servo valves and types of feedback – Dynamic characteristics of servo valves and fluid lines – Hydro mechanical and electro-hydraulic servo systems; loop gain, stability, dynamics – Course project. | | | | | | | | | |
| References | M. G. Rabie, Fluid Power Engineering McGraw Hill, 2009. | | | | | | | | | |
| MDPS474 | Automatic Control II | 3 | 2 | 2 | 0 | | | | | 4 |
| | Pre-requisites: MDPS473 | | | | | | | | | |
| | Linear control systems analysis in State Space – State-Transition Matrix - Controllability – Observability; Linear control systems design in State Space – Pole placement – State Observers – Linear quadratic regulators. Computer simulation and case studies. Course project. | | | | | | | | | |
| References | K. Ogata, Modern Control Engineering, 5th ed., Pearson, 2010. | | | | | | | | | |
| MDPS476 | Mobile Robots and Autonomous Systems | 3 | 2 | 2 | 0 | | | | | 4 |
| | Pre-requisites: MDPS423 | | | | | | | | | |
| | Introduction to Mobile Robots Locomotion; Kinematics of Mobile Robots: Maneuverability – Workspace; Mobile Robots Perception: Sensors – Computer Vision – Image Processing – Place Recognition; Mobile Robot Localization; Planning and Navigation: Path Planning – Obstacle Avoidance. Computer Simulations and Course Project. | | | | | | | | | |
| References | Eugene Kagan, Nir Shvalb, Irad Ben-Gal, Autonomous Mobile Robots and Multi-Robot Systems: Motion-Planning, Communication, and Swarming, 1st Edition, Wiley, 2019. | | | | | | | | | |
| MDPS477 | Micro and Nano-Electromechanical Systems | 3 | 2 | 2 | 0 | 0 | | | | 4 |
| | Pre-requisites: MDPS372 | | | | | | | | | |
| | Introduction to Micro and Nano-Electromechanical Systems (MEMS/NEMS); Design of MEMS/NEMS; Fabrication of MEMS/NEMS; Principles of sensing and actuation in MEMS/NEMS: Electrostatic – Piezoresistive - Magnetic; Applications of MEMS/NEMS; Computer Simulations and Course Project. | | | | | | | | | |
| References | Sergey Edward Lyshevski, Nano- and Micro-Electromechanical Systems: Fundamentals of Nano- and Microengineering, Second Edition, CRC Press, 2005 | | | | | | | | | |

| Code | Name/Content | Credit Hours | Contact Hours | | | | | | | |
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| | | | Lec | Tut (2) | App. Tut | Lab | Stud | Off. Tut | Off. Hrs | Total |
| MDPS478 | Vehicle System Dynamics and Control | 3 | 2 | 2 | 0 | 0 | | | | 4 |
| | Pre-requisites: MDPS372 | | | | | | | | | |
| | Introduction – vehicle body motion – Tires – Suspension systems – Equations of motion of passenger cars – vehicle stability - Simulation of motion of passenger cars - Fundamentals of Hybrid Electric Vehicles and Electric Vehicles, Course Project. | | | | | | | | | |
| References | Dean Karnopp, Vehicle Dynamics, Stability, and Control, 2nd Edition, CRC Press, 2013. | | | | | | | | | |
| MDPS482 | Quality Management | 3 | 2 | 2 | 0 | 0 | | | | 4 |
| | Pre-requisites: MTHS204 | | | | | | | | | |
| | Introduction to quality systems. Cost of quality. Total quality management. Quality systems and standards: six sigma and ISO. Reengineering. Statistical quality control: control charts for variables and attributes, process capability analysis, acceptance-sampling plans. Quality function deployment. Quality circles. Quality loss functions. | | | | | | | | | |
| MDPS490 | Design For Manufacturing | 3 | 2 | 2 | 0 | 0 | | | | 4 |
| | Pre-requisites: MDPS381 + MDPS242 | | | | | | | | | |
| | This course covers the principles and practices of designing products for efficient and cost-effective manufacturing. Topics include design guidelines for various manufacturing processes, such as casting, forming, machining, and assembly, as well as considerations for material selection, geometric tolerancing, and design for sustainability. The course also covers the use of computer-aided design (CAD) and computer-aided manufacturing (CAM) tools to optimize the design and production process. | | | | | | | | | |
| References | S. El Wakil, Processes and Design for Manufacturing, 3rd Edition, CRC Press, 2019. | | | | | | | | | |
| MDPS492 | Computer Integrated Manufacturing CIM | 3 | 2 | 2 | 0 | 0 | | | | 4 |
| | Pre-requisites: MDPS381 + MDPS242 | | | | | | | | | |
| | The Computer Integrated Manufacturing (CIM) course provides an overview of the principles and practices of computer-based manufacturing systems. The course covers the key activities involved in CIM, such as computer-aided design (CAD), computer-aided manufacturing (CAM), computer numerical control (CNC), and robotics. It also covers emerging topics in CIM, such as additive manufacturing, virtual manufacturing, and smart manufacturing. The course emphasizes the integration of computer-based technologies with traditional manufacturing processes, such as casting, machining, and assembly. | | | | | | | | | |
| References | James A. Rehg, Henry W. Kraebber, Computer Integrated Manufacturing, 3rd Edition, Pearson, 2004. | | | | | | | | | |

| Code | Name/Content | Credit Hours | Contact Hours | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Lec | Tut (2) | App. Tut | Lab | Stud | Off. Tut | Off. Hrs | Total |
| MEPS415 | Power Generation | 3 | 2 | 2 | 0 | 0 | | | | 4 |
| | Pre-requisites: 85 Credits+ AA Approval | | | | | | | | | |
| | The course covers several topics associated with power generation from first and second law perspectives. Steam power generation (Rankin cycles with reheat and regeneration). Gas power generation (Gas turbines without and with regeneration). Course project. | | | | | | | | | |
| References | Allen J. Wood, Bruce F. Wollenberg, Gerald B. SheblÃ, Power Generation, Operation, and Control, 3rd Edition, Wiley, 2013. | | | | | | | | | |
| MEPS425 | Renewable Energy | 3 | 2 | 2 | 0 | 0 | | | | 4 |
| | Pre-requisites: 85 Credits+ AA Approval | | | | | | | | | |
| | General review of thermodynamics; solar power systems for heat and electric power; electric power generation from solar energy; hydroelectric power generation; geothermal and ocean thermal energy recovery systems; tidal and wave power; economics and system integrations. Course project. | | | | | | | | | |
| References | Mehmet Kanoglu, Yunus Cengel, John Cimbala, Fundamentals and Applications of Renewable Energy, 1st Edition, McGraw Hill; 2019. | | | | | | | | | |