مرفقات المعيار الخامس

تصميم البرنامج

مرفق 2-2/1/5

توصيف برنامج هندسة القوى الميكانيكية

برنامج هندسة القوي الميكانيكية

لائحة 2003

University: Benha University
Faculty: Faculty of engineering at Shoubra
Department: Mechanical Engineering Department
Specification of Mechanical Power Engineering (B.Sc. Program) 2022-2023

A- Basic Information

1- Program title: Mechanical Power Engineering Program
2- Program type: Single
3- Department: Mechanical Engineering
4- Coordinator: Prof. Dr. Mohamed Moawad
5- External evaluator: Prof. Dr. Mohamed Watani Mohamed El-Sayed, Faculty of engineering, Mataria, Helwan University
6- Last date of program specifications approval: 2003

B- Professional Information

1. Faculty Mission:

"The faculty of Engineering at Shoubra is committed to prepare a graduate with competencies and problem-solving skills that qualify each engineer to compete in local and regional labor markets, the graduate will be able to innovate and become an entrepreneur. The faculty also committed to the development of engineering sciences and producing internationally distinguished scientific research, with the framework of human values and social responsibility".

2. Program Mission:

The mechanical power engineering program is committed to graduating engineers who are able to understand the continuous development in scientific technologies and competition at the local and regional levels, equipped with basic and applied science foundations, able to produce innovative solutions to the needs of all sectors of society in the fields of mechanical power engineering, and are aware of the ethical and professional values and requirements of environmental protection. In addition to developing research and scientific studies and upgrading their quality in line with the needs of society.

To judge the compatibility between the program mission and faculty mission, both are divided to keywords and the matrix given in **Appendix A** is used.

3. Program Educational Objectives:

The mechanical power engineering program objectives are:

3.1. Apply and integrate knowledge and understanding of mathematics, physics, engineering sciences and skills to solve engineering problems in various topics and computer programs available to solve

real problems in industries, heating, ventilation and air conditioning systems, and power plants to meet the required needs within realistic constraints.

3.2. Identify, formulate, and solve basic engineering problems and use appropriate engineering techniques, skills and tools necessary for engineering practice and project management.

3.3. Evaluating the sustainability and environmental issues related to mechanical energy systems and considering the impact of engineering solutions on society and the environment.

3.4. Use energy efficiently, demonstrate knowledge of contemporary engineering issues, and engage in self-learning and lifelong learning.

3.5. Apply industrial security, display professional and ethical responsibilities, understand context, and communicate effectively.

3.6. Work effectively within multi-disciplinary engineering teams and lead or supervise a group of engineers, technicians, and workforce.

3.7. Design, operation and maintenance of fluid and energy transmission systems, heating, ventilation and air conditioning systems, internal combustion engines and steam engines, verifying their performance and solving their basic operational problems.

To judge the compatibility of program mission with its Educational Objectives, the matrix given in **Appendix B** is used.

4. Graduate Attributes

According to the National Academic Reference Standard (NARS2018), the graduates of any engineering program must satisfy the following attributes:

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 in 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.

Besides the above-mentioned general attributes of all engineering graduates, the mechanical power engineering graduates must satisfy the following attributes:

11) Evaluate the sustainability and environmental issues related to mechanical power systems.
12) Use energy efficiently.
13) Apply industrial safety.
14) Apply and integrate knowledge, understanding and skills of different subjects and available computer software to solve real problems in industries and HVAC systems and power stations.
15) Lead or supervise a group of engineers, technicians, and work force.
16) Carry out preliminary designs of fluid transmission and power systems, investigate their performance and solve their essential operational problems.
17) Design, operate and maintain HVAC systems, internal combustion engines and steam engines.

To judge the compatibility of program mission as well as its Educational Objectives with the graduate attributes, the two matrices given in **Appendix C** are used.

5. Academic Standards of Program

5.1. Program Competencies

According to the National Academic Reference Standard, the program in Mechanical Power Engineering must satisfy the following Competencies:

5.1. General Engineering NARS Competencies in 2018		
Level A (NARS)	A.1	Identify, formulate, and solve complex engineering problems by applying engineering fundamentals, basic science and mathematics.
	A.2	Develop and conduct appropriate experimentation and/or simulation, analyze and interpret data, assess and evaluate findings, and use statistical analyses and objective engineering judgment to draw conclusions.
	A.3	Apply engineering design processes to produce cost-effective solutions that meet specified needs with consideration for global, cultural, social, economic, environmental, ethical and other aspects as appropriate to the discipline and within the principles and contexts of sustainable design and development.
	A.4	Utilize contemporary technologies, codes of practice and standards, quality guidelines, health and safety requirements, environmental issues and risk management principles.
	A.5	Practice research techniques and methods of investigation as an inherent part of learning.
	A.6	Plan, supervise and monitor implementation of engineering projects, taking into consideration other trades requirements.

5.1. General Engineering NARS Competencies in 2018		
	A.7	Function efficiently as an individual and as a member of multi-disciplinary and multi- cultural teams.
	A.8	Communicate effectively – graphically, verbally and in writing – with a range of audiences using contemporary tools.
	A.9	Use creative, innovative and flexible thinking and acquire entrepreneurial and leadership skills to anticipate and respond to new situations.
	A.10	Acquire and apply new knowledge; and practice self, lifelong and other learning strategies.

5.2. Mechanical Engineering NARS		
Level B (NARS)	B.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.
	B.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.
	B.3	Select conventional mechanical equipment according to the required performance.
	B.4	Adopt suitable national and international standards and codes, integrate legal, economic, and financial aspects to design, build, operate, inspect and maintain mechanical equipment and systems.

5.3. Mechanical Power ARS		
Level C (ARS)	C.1	Prepare, supervise the implementation of engineering drawings, computer graphics and write, present technical reports.
	C.2	Plan, schedule and use workshop equipment according to the appropriate codes and standards.

	C.3	Prepare, supervise and carry out plans for operation and maintenance of power mechanical systems (fluid transmission networks, internal combustion engines, Refrigeration, HVAC, power plant equipment,,,,,,).
	C.4	Design, evaluate mechanical power and energy for engineering systems, process performance and propose, conduct improvements.

6. National Academic References Standards (NARS)

The department adopted exactly **NARS** as reference academic standards for levels A and B and **ARS** for level C of this program (*National Academic Reference Standards (NARS) for Engineering 2nd edition, issued in 2018*).

7. Curriculum Structure and Content

7. 1. Program Duration: 10 semesters (5-years)

The academic year 2020-2021 depends on a plan for hybrid education in order to reduce the time of students' attendance inside architecture department due to COVID 19 pandemic. All theoretical lectures in all courses will be taken using e-learning platforms, and the exercises will be taken in the department.

Students of the same year were divided into groups (studios), and they were distributed throughout Mechanical Engineering Department halls, no more than half of capacity in each hall. The department's working hours were extended until 7 PM, and the weekend was reduced from two days to only one day, which is Friday. The staff were distributed over a specific group of students in each hall, to reduce the human connection as much as possible.

7. 2. Program Structure: Contact hours system

- **No. of Contact hours:** 298 159 Lectures 139 Tutorial/Exercises
- **No. of Contact hours:** 298 286 Compulsory 12 Elective
- **No. of Contact hours of basic science:** 63 hours = 21.14%
- **No. of Contact hours of social science and humanities:** 27 hours = 9.06%
- **No. of Contact hours of specialized courses:** 208 hours = 69.80%

7. 3. Indicative Curricula Content by Subject Area

	Subject Area	Contact Hours	%	NARS Tolerance
A	Humanities and Social Sciences (Univ. Req.)	27	9.06 %	9–12 %
B	Mathematics and Basic Sciences	63	21.14 %	20–26 %
C	Basic Engineering Sciences (Faculty/Spec. Req.)	68	22.82%	20–23 %
D	Applied Engineering and Design	62	20.81%	20–22 %
E	Computer Applications and ICT	30	10.07 %	9–11 %
F	Projects and Practice	27	9.06 %	8–10 %
	Subtotal	277	92.95 %	92–94 %
G	Discretionary (Program character-identifying) subjects	21	7.05 %	6–8 %
	Total	**298**	**100 %**	**100%**

7. 4. Program Levels (Years):

Preparatory Year: It is required to pass 60 hours distributed as follows:
60 compulsory 0 Elective

First Year Mechanical Power It is required to pass 60 hours distributed as follows:
60 compulsory 0 Elective

Second Year Mechanical Power: It is required to pass 60 hours distributed as follows:
60 compulsory 0 Elective

Third Year Mechanical Power: It is required to pass 60 hours distributed as follows:
56 compulsory 4 Elective

Fourth Year Mechanical Power: It is required to pass 58 hours distributed as follows:
50 compulsory 8 Elective

Year	Hours		
	Compulsory	Elective	Total
Preparatory	60	0	60
First	60	0	60
Second	60	0	60
Third	56	4	60
Fourth	50	8	58
Total Hours			298

7. 5. Program Levels and Courses

Year of Program 1 - Preparatory Year (Semester 1) - Compulsory

Code	Course Title	No. of hours / week				Intended Learning Outcomes (ILO's)
		Lect.	Tut.	Lab.	Total	
EMP001	Mathematics (A)	4	2	-	6	As Attached Matrix
EMP012	Mechanics (A)	2	2	-	4	
EMP013	Physics (A)	4	1	2	7	
EMP014	Chemistry	4	-	2	6	
MDP001	Engineering Drawing and Isometric	1	4	-	5	
GEN001	Technical Language	-	2	-	2	

Year of Program 1 - Preparatory Year (Semester 2) - Compulsory

Code	Course Title	No. of hours / week				Intended Learning Outcomes (ILO's)
		Lect.	Tut.	Lab.	Total	
EMP021	Mathematics (B)	4	2	-	6	As Attached Matrix
EMP012	Mechanics (B)	2	2	-	4	
EMP023	Physics (B)	4	-	2	6	
MDP001	Engineering Drawing and Isometric	-	4	-	4	
ELC001	Introduction to Computers	2	-	1	3	
MET002	Engineering Production	2	-	3	5	
GEN002	History of Engineering Science	2	-	-	2	

Year of Program 2 - First Year Mechanical Power (Semester 1) - Compulsory

Code	Course Title	No. of hours / week				Intended Learning Outcomes (ILO's)
		Lect.	Tut.	Lab.	Total	
MDP131	Machine Drawing	1	4	-	5	As Attached Matrix
MDP132	Engineering Materials and Metallurgy	2	2	-	4	
MDP133	Production Engineering (1)	2	-	2	4	
MDP134	Engineering Mechanics & Theory of Machines	3	2	-	5	
EMP131	Physics (2)	4	2	-	6	
EMP132	Mathematics (2)(A)	4	2	-	6	

Year of Program 2 - First Year Mechanical Power (Semester 2) - Compulsory

Code	Course Title	No. of hours / week				Intended Learning Outcomes (ILO's)
		Lect.	Tut.	Lab	Total	
MPE121	Engineering Thermodynamics (1)	4	2	-	6	As Attached Matrix
MDP131	Machine Drawing	1	4	-	5	
MDP135	Strength of Materials and Testing	2	2	-	4	
MDP136	Stress Analysis	3	2	-	5	
CVE/SRE131	Civil & Survey Engineering	2	2	-	4	
EMP133	Mathematics (2)(B)	4	2	-	6	

Year of Program 3 - Second Year Mechanical Power (Semester 1) - Compulsory

Code	Course Title	No. of hours / week				Intended Learning Outcomes (ILO's)
		Lect.	Tut.	Lab.	Total	
MPE211	Thermodynamics (2)	4	2	-	6	As Attached Matrix
MPE212	Fluid Mechanics (A)	4	2	-	6	
MDP231	Structures Mechanics	2	2	-	4	
MDP232	Design of Machine Elements (1)(A)	2	4	-	6	
MDP233	Production Engineering (2)	2	2	-	4	
EMP231	Engineering Mathematics (A)	2	2	-	4	

Year of Program 3 - Second Year Mechanical Power (Semester 2) - Compulsory

Code	Course Title	No. of hours / week				Intended Learning Outcomes (ILO's)
		Lect.	Tut.	Lab.	Total	
MPE221	Heat Transfer (1)	2	2	-	4	As Attached Matrix
MPE222	Fluid Mechanics (B)	3	2	-	5	
MDP232	Design of Machine Elements (1)(B)	2	2	-	4	
MDP234	Theory of Machines	4	2	-	6	
ELC230	Electronic Engineering	2	2	-	4	
EMP232	Engineering Mathematics (B)	2	2	-	4	
GEN230	Industrial Engineering and Management	2	1	-	3	

Year of Program 4 - Third Year Mechanical Power (Semester 1) - Compulsory

Code	Course Title	No. of hours / week				Intended Learning Outcomes (ILO's)
		Lect.	Tut.	Lab	Total	
MPE311	Heat Engine and Combustion (A)	2	2	-	4	As Attached Matrix
MPE312	Fluid Mechanics (2)	4	2	-	6	
MPE313	Heat and Mass Transfer (A)	3	2	-	5	
MPE314	Numerical Methods in Energy Science	2	3	-	5	
MPE315	Measurements and Measuring Instruments	2	4	-	6	
MPE34x	Elective Group (not in Major)	2	2	-	4	

Elective Group I (Selected by students)

Code	Course Title	No. of hours / week				Intended Learning Outcomes (ILO's)
		Lect.	Tut.	Lab	Total	
MDP321	Machine Design (1)	2	2	-	4	As Attached Matrix
MDP322	Production Engineering (3)	2	2	-	4	
MDP323	Industrial Processes Research	2	2	-	4	
MDP324	Quality Management	2	2	-	4	
MDP325	Lubrication	2	2	-	4	
MDP326	Operations Design and Factories	2	2	-	4	
ELC327	Computer Engineering & Programming	2	2	-	4	

Year of Program 4 - Third Year Mechanical Power (Semester 2) - Compulsory

Code	Course Title	No. of hours / week				Intended Learning Outcomes (ILO's)
		Lect.	Tut.	Lab	Total	
MPE321	Heat Engine and Combustion (B)	2	2	-	4	As Attached Matrix
MPE322	Fluid Machines	4	2	-	6	
MPE323	Heat and Mass Transfer (B)	2	2	-	4	
MPE324	Hydraulic Systems and Equipment	3	2	-	5	
EPM331	Power and Electrical Machines	3	2	-	5	
GEN331	Engineering Economy and Vocational Legislations	4	2	-	6	

Year of Program 5 - (Fourth Year Mechanical (Power)) (Semester 1) - Compulsory

Code	Course Title	No. of hours / week				Intended Learning Outcomes (ILO's)
		Lect.	Tut.	Lab	Total	
MPE411	Refrigeration and Air conditioning	4	2	-	6	As Attached Matrix
MPE412	Internal Combustion Engines	3	3	-	6	
MPE413	Turbo-Machines (A)	3	3	-	6	
MPE414	Project (A)	-	4	-	4	
MPE44x	Elective Group (in Major)	3	1	-	4	
MDP431	Mechanical Vibrations	2	2	-	4	

Year of Program 5 - Fourth Year Mechanical Power (Semester 2) - Compulsory

Code	Course Title	No. of hours / week				Intended Learning Outcomes (ILO's)
		Lect.	Tut.	Lab	Total	
MPE421	Traditional Power Stations	4	2	-	6	As Attached Matrix
MPE422	Renewable Energies	4	2	-	6	
MPE423	Turbo-Machines (B)	2	2	-	4	
MPE424	Automatic Control	2	2	-	4	
MPE414	Project (B)	-	4	-	4	
MPE44x	Elective Group (in Major)	3	1	-	4	See Elective Group II

Elective Group II (Selected by students)

Code	Course Title	No. of hours / week				Intended Learning Outcomes (ILO's)
		Lect.	Tut.	Lab	Total	
MPE441	Nuclear Engineering	3	1	-	4	As Attached Matrix
MPE442	Advanced Environmental Pollution	3	1	-	4	
MPE445	Hydraulic Power Plants	3	1	-	4	
MPE447	Design Of Pipes Networks	3	1	-	4	
MPE448	Water Desalination	3	1	-	4	

Elective Group II (Selected by students)

Code	Course Title	No. of hours / week				Intended Learning Outcomes (ILO's)
		Lect.	Tut.	Lab	Total	
MPE443	Advanced Air Conditioning	3	1	-	4	As Attached Matrix
MPE444	Fires and Explosions	3	1	-	4	
MPE446	Cooling and Low Temperature Engineering	3	1	-	4	
MPE449	Using Computers in Control	3	1	-	4	
MPE450	Biphasic Flow	3	1	-	4	
MPE451	Advanced Combustion	3	1	-	4	
MPE452	Advanced Internal Combustion Engines	3	1	-	4	

8. Program Admission Requirements

Having Egyptian Secondary education or equivalent certificate with major in Mathematics, then after passing the preparatory year and fulfilling the admission requirements the students will be able to attend the department.

9. Regulations for progression and program completion First Year/Level/Semester

a) The student is considered successful if he/she passes the examinations in all courses of his class. The student is promoted to the next higher level if he/she fails in not more than two subjects of his class or from lower classes,

b) The referred student has to sit the examination in the courses in which he/she has failed together with the students studying the same courses. The student gets a pass grade when he/she passes the examination successfully. In case the student was considered absent with acceptable excuse in a course, he/she gets the actual grade,

c) The grades of the successful student in a course and in the general grade are evaluated as follows

- **Distinction:** from 85% of the total mark and upwards.
- **Very good:** from 75% to less than 85% of the total mark.

- **Good:** from 65% to less than 75% of the total mark
- **Pass:** from 50% to less than 65% of the total mark
- The grades of a failing student in a course are estimated in one of the following grades:
  - Weak: from 30% to less than 50% of the total mark
  - Very weak: less than 30% of the total mark.

Grade	percentage	
	from	Up to
Distinction	85%	100%
Very good	75%	85%
Good	65%	75%
Pass	50%	65%
The grades of a failing student in a course are estimated in one of' the following grades:		
Weak	30%	50%
Very weak		less than 30%

- The B.Sc. general grade for students is based on the cumulative marks obtained during all the years of study. The students are then arranged serially according their cumulative sum.
- The student is awarded an honor degree if his cumulative sum is distinction or very good provided that he/she gets a grade not less than very good in any class of study other than the preparatory year. Moreover, he/she should have not failed in any examination he/she has sat in any class other than the preparatory year.

10. Teaching and Learning Methods

Considering that the program competences illustrate a wholistic status that would be achieved through a journey involves many different courses within different levels, and the final competence achievement can only be assessed at the end of its journey, each single competence is broken-down into measurable Learning Outcomes LOs that should be achieved in different courses. Thus, the program graduate competence may be considered as the final goal, while the courses LOs may be considered as the procedural aims/objectives. Hence, different teaching and learning methods are applied in program courses to cover the three domains given by the following table. For more details, please refer to the course specifications.

▪ Teaching and Learning Methods

- Face-to-face Lecture
- Online Education
- Tutorial / Exercise
- Group Discussions
- Laboratory

- Site Visit
- Presentation
- Collaborate Learning (Team Project)
- Research and Reporting
- Class Activity
- Case Study
- Assignments/homework
- Brain Storming

Teaching & Learning Methods	Learning Outcomes Domains (Courses LOs)		
	Cognitive	Psychomotor	Affective
Face-to-face Lecture	√	√	√
Online Education	√		√
Tutorial / Exercise		√	√
Group Discussions	√		
Laboratory	√	√	
Site Visit			√
Presentation	√		√
Collaborate Learning (Team Project)	√		√
Research and Reporting		√	√
Class Activity	√	√	
Case Study	√	√	
Assignments/homework		√	√
Brain Storming	√	√	

11. Assessment Methods of Program Intended Learning Outcomes:

Different assessment methods are applied in the program courses to assess these Learning Outcomes. The following table illustrates the assessment methods and what they assess in most cases. For further detail, refer to the courses' specifications

- Written Exams
- Online Exams
- Oral Exam
- Quizzes
- Lab Exam
- Take-Home Exam
- Research Assignments
- Reporting Assignments
- Project Assignments
- In-class Questions
- Class activities

Formative assessment	Learning Outcomes Domains (Courses LOs)		
	Cognitive	Psychomotor	Affective
Quizzes	√	√	√
Research Assignments	√		√
In-class Questions	√	√	√
Class activities	√	√	√

Summative assessments	Learning Outcomes Domains (Courses LOs)		
	Cognitive	Psychomotor	Affective
Written Exams	√	√	√
Online Exams	√	√	
Oral Exam	√	√	√
Lab Exam	√	√	
Take-Home Exam	√	√	√
Reporting Assignments	√		√
Project Assignments	√	√	√

12. Evaluation of Program Intended Learning Outcomes200

No.	Evaluator	Tool	Sample
1.	Senior students	Evaluation sheet	50%
2.	Alumni	Evaluation sheet & interview	5%
3.	Stakeholders (Employers)	Evaluation sheet & interview	5%
4.	External Evaluator(s) (External Examiner(s))	Report	2%
5.	Other	None	-

Coordinator of
Program Quality assurance committee

Assoc. Prof. Dr. Mohamed Reda Salem

Head of
Mechanical Engineering Department

Prof Dr. Sameh Shawky Habib

Appendix #A

To judge the compatibility between the program mission and faculty mission, the following matrix is used.

Key Words of Program Mission \ Key Words of Faculty Mission	prepare a graduate with competencies and problem-solving skills	compete in local and regional labor markets	innovate and become an entrepreneur	development of engineering sciences	producing internationally distinguished scientific research	human values and social responsibility
Development of scientific technologies	√			√		
Competition at the local and regional levels		√				
Basic and applied science foundations					√	
Produce innovative solutions			√			
Ethical and professional values and requirements of environmental protection						√
Developing research and scientific studies		√		√		

Appendix #B

To judge the compatibility of program mission with its objectives, the following matrix is used:

Key Words of Program Mission / Program Objectives	Development of scientific technologies	Competition at the local and regional levels	Basic and applied science foundations	Produce innovative solutions	Ethical and professional values and requirements of environmental	Developing research and scientific studies
Objective #1	√		√	√		√
Objective #2	√		√	√		√
Objective #3	√	√	√		√	
Objective #4	√			√		
Objective #5	√				√	
Objective #6		√		√	√	
Objective #7	√	√	√	√		√

Appendix # C

To judge the compatibility of graduate attributes with program objectives, the following matrix is used:

Program Objectives / Graduate Attributes	Objective #1	Objective #2	Objective #3	Objective #4	Objective #5	Objective #6	Objective #7
Attribute #1	√						
Attribute #2		√					
Attribute #3						√	
Attribute #4					√		
Attribute #5	√		√				
Attribute #6			√				
Attribute #7		√					
Attribute #8				√			
Attribute #9					√	√	
Attribute #10					√	√	
Attribute #11			√				
Attribute #12				√			
Attribute #13					√		
Attribute #14	√						
Attribute #15		√			√	√	
Attribute #16							√
Attribute #17							√

Appendix # D

To judge the compatibility of program objectives with its competencies, the following matrix is used:

Program Objectives	Program Competencies																	
	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	B1	B2	B3	B4	C1	C2	C3	C4
Objective #1	√	√		√						√	√				√		√	
Objective #2	√		√		√				√		√	√					√	√
Objective #3		√	√	√						√		√	√		√			√
Objective #4				√			√							√		√		
Objective #5						√	√		√							√		
Objective #6			√													√		
Objective #7		√	√								√	√					√	√

Appendix # E

To judge the compatibility of program's graduate attributes with its competencies, the following matrix is used:

Program Objectives	Program Competencies																	
	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	B1	B2	B3	B4	C1	C2	C3	C4
Attribute #1	√																	
Attribute #2	√								√									
Attribute #3	√		√	√														
Attribute #4						√	√											
Attribute #5			√	√		√			√									
Attribute #6			√	√														
Attribute #7		√																
Attribute #8					√					√								
Attribute #9								√										
Attribute #10									√									
Attribute #11			√															
Attribute #12	√	√		√							√		√					
Attribute #13				√								√				√		
Attribute #14											√	√		√			√	
Attribute #15							√								√			
Attribute #16														√				√
Attribute #17														√				√

Appendix # F

Course Matrix with program Competences

The following matrix is used to judge the compatibility between the program competences and program courses

Course Code	Course Name	Engineering Competencies (2018)										"Department" Mechanical Engineering Competencies (NARS)				"Discipline" Mechanical Power Engineering Competencies (ARS)			
		A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	B1	B2	B3	B4	C1	C2	C3	C4
First Year (Preparatory Year / Zero Level of Program): First Semester																			
EMP001	Mathematics (A)	√							√										
EMP012	Mechanics (A)	√							√										
EMP013	Physics (A)	√							√										
EMP014	Chemistry	√							√										
MDP001	Engineering Drawing and Isometric			√							√		√						
GEN001	Technical Language							√	√										
First Year (Preparatory Year / Zero Level of Program): Second Semester																			
EMP021	Mathematics (B)	√							√										
EMP012	Mechanics (B)	√							√										
EMP023	Physics (B)	√							√										
MDP001	Engineering Drawing and Isometric			√							√		√						
ELC001	Introduction to Computers	√		√															

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		A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	B1	B2	B3	B4	C1	C2	C3	C4
MET002	Engineering Production		√	√			√												
GEN002	History of Engineering Science	√		√					√	√									
Second Year (First Level of Program): First Semester																			
MDP131	Machine Drawing		√								√	√							
MDP132	Engineering Materials and Metallurgy		√			√			√			√							
MDP133	Production Engineering (1)					√							√						
MDP134	Engineering Mechanics & Theory of Machines	√		√								√							
EMP131	Physics (2)	√							√										
EMP132	Mathematics (2)(A)	√							√										
Second Year (First Level of Program): Second Semester																			
MPE121	Engineering Thermodynamics (1)	√						√											
MDP131	Machine Drawing			√								√	√						
MDP135	Strength of Materials and Testing		√						√			√							
MDP136	Stress Analysis				√				√			√							
CVE/SRE131	Civil & Survey Engineering				√	√	√												
EMP133	Mathematics (2)(B)	√							√										
Third Year (Second Level of Program): First Semester																			
MPE211	Thermodynamics (2)								√			√	√						

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		A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	B1	B2	B3	B4	C1	C2	C3	C4
MPE212	Fluid Mechanics (A)	√							√			√							
MDP231	Structures Mechanics	√							√			√							
MDP232	Design of Machine Elements (1)(A)	√										√	√						
MDP233	Production Engineering (2)					√			√			√							
EMP231	Engineering Mathematics (A)	√							√										
Third Year (Second Level of Program): Second Semester																			
MPE221	Heat Transfer (1)	√	√						√			√							
MPE222	Fluid Mechanics (B)	√	√						√			√							
MDP232	Design of Machine Elements (1)(B)	√			√							√	√						
MDP234	Theory of Machines			√								√	√						
ELC230	Electronic Engineering	√				√					√								
EMP232	Engineering Mathematics (B)	√							√										
GEN230	Industrial Engineering and Management					√		√		√	√								
Fourth Year (Third Level of Program): First Semester																			
MPE311	Heat Engine and Combustion (A)	√	√									√			√			√	√
MPE312	Fluid Mechanics (2)	√	√									√							√
MPE313	Heat and Mass Transfer (A)	√	√									√			√				√
MPE314	Numerical Methods in Energy Science	√	√			√					√		√			√			

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		A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	B1	B2	B3	B4	C1	C2	C3	C4
MPE315	Measurements and Measuring Instruments	√	√		√	√						√		√			√		
Fourth Year (Third Level of Program): Second Semester																			
MPE321	Heat Engine and Combustion (B)										√	√			√			√	√
MPE322	Fluid Machines										√	√		√					√
MPE323	Heat and Mass Transfer (B)										√	√			√				√
MPE324	Hydraulic Systems and Equipment	√										√		√					√
EPM331	Power and Electrical Machines	√	√		√														
GEN331	Engineering Economy and Vocational Legislations	√					√								√				
Fifth Year (Fourth Level of Program): First Semester																			
MPE411	Refrigeration and Air conditioning			√	√							√		√	√			√	√
MPE412	Internal Combustion Engines			√	√								√			√		√	√
MPE413	Turbo-Machines (A)			√		√							√	√				√	√
MPE414	Project (A)	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
MDP431	Mechanical Vibrations	√		√								√							
Fifth Year (Fourth Level of Program): Second Semester																			
MPE421	Traditional Power Stations		√								√	√		√				√	√
MPE422	Renewable Energies											√	√	√		√		√	√
MPE423	Turbo-Machines (B)			√		√							√	√				√	√
MPE424	Automatic Control	√			√							√							√

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		A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	B1	B2	B3	B4	C1	C2	C3	C4
MPE414	Project (B)	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
Electives of Fourth Year (Third Level of Program): First Semester																			
MDP321	Machine Design (1)		√									√	√						
MDP322	Production Engineering (3)					√			√			√							
MDP323	Industrial Processes Research					√		√			√				√				
MDP324	Quality Management						√					√							
MDP325	Lubrication											√			√				
MDP326	Operations Design and Factories		√		√			√	√	√				√	√				
ELC327	Computer Engineering & Programming	√	√		√				√										
Electives of Fifth Year (Fourth Level of Program): First Semester																			
MPE441	Nuclear Engineering											√		√	√			√	√
MPE442	Advanced Environmental Pollution				√									√	√		√		
MPE445	Hydraulic Power Plants														√	√		√	√
MPE447	Design Of Pipes Networks											√			√	√	√	√	√
MPE448	Water Desalination											√	√	√	√		√	√	√
Electives of Fifth Year (Fourth Level of Program): Second Semester																			
MPE443	Advanced Air Conditioning											√	√		√	√	√	√	√
MPE444	Fires and Explosions												√	√	√	√	√	√	√
MPE446	Cooling and Low Temperature Engineering											√		√	√		√	√	√

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		A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	B1	B2	B3	B4	C1	C2	C3	C4
MPE449	Using Computers in Control											√	√		√	√	√		
MPE450	Biphasic Flow											√	√		√	√		√	
MPE451	Advanced Combustion												√		√			√	√
MPE452	Advanced Internal Combustion Engines													√	√			√	√