Program Specifications
University: Ain Shams Faculty: Engineering

A- Basic Information

1.	Programme title:	**B. SC. in Mechanical Engineering (Production)**
2.	Programme type:	Single ■ Double ☐ Multiple ☐
3.	Faculty:	Faculty of Engineering – Ain Shams University
4.	Department(s) offering the Program:	**Design and Production Engineering**
5.	Coordinator:	**Prof. Adel Moneeb Elsabbagh**
6.	External evaluator(s):	**Prof. Ahmed Kohail**
7.	Internal Evaluator:	**Prof. Mostafa Chaaban**
8.	Date of program bylaw approval:	**2003**
9.	Date of program specifications approval:	**September 2018**

B- Professional Information

1. Program Mission:

The mission of the Design and Production Engineering program is to provide quality learning that is driven by a professional and technology-oriented focus and highly committed to innovation and industrialization. The department is devoted to educating and inspiring future generations of production engineers who are both technically skilled and ethically professional. The program is therefore based on the following intentions:

PM1. Prepare students for a professional career with a broad knowledge of basic and practical mechanical engineering with high emphases on the different aspects of production engineering; material technology, mechanical design, manufacturing processes and industrial aspects.

PM2. Conduct engineering research and to pursue graduate degrees in the above fields

PM3. Achieve leadership positions in scientific and technological enterprises in Egypt and the Middle East

PM4. Compete internationally l in the fields of manufacturing Engineering.

PM5. Behave ethically based on the professional principles.

2. Program Aims

The main aims of the "Design and Production Engineering" program at the "Faculty of Engineering" in "Ain Shams University" are to equip the student with the proper scientific knowledge and develop his/her skills to:

PA1. Apply knowledge of mathematics, science and engineering concepts to the solution of engineering problems.

PA2. Design a system; component and process to meet the required needs within realistic constraints.

PA3. Design and conduct experiments as well as analyse and interpret data.

PA4. Identify, formulate and solve fundamental engineering problems.

PA5. Use the techniques, skills, and appropriate engineering tools, necessary for engineering practice and project management.

PA6. Work effectively within multi-disciplinary teams.

PA7. Communicate effectively.

PA8. Consider the impacts of engineering solutions on society & environment.

PA9. Demonstrate knowledge of contemporary engineering issues.

PA10. Display professional and ethical responsibilities; and contextual understanding

PA11. Engage in self- and life- long learning.

PA12. Work with mechanical design and manufacturing systems.

PA13. Use of mathematics and physical and engineering sciences and systems analysis tools in products, components and machines design, and/or the manufacturing of such products, components and machines.

PA14. Use different instruments, devices and tools appropriately and carry-out wide range of experiments, automatic data acquisition, data analysis and interpretation, and data presentation, both orally and in the written form.

PA15. Use the computer software for design, communication and visualization.

PA16. Use and/or develop computer software, necessary for the design, manufacturing and management of industrial systems and projects.

PA17. Analyze multi-disciplinary mechanical, electrical, electronic, thermal and hydraulic systems.

PA18. Lead and supervise groups of designers, technicians and other work force.

3. Intended learning outcomes (ILOs)

a- Knowledge and understanding:

The graduates of the program should be able to demonstrate the knowledge and understanding of:

A1- Concepts & theories of mathematics and sciences, appropriate to the discipline.

A2- Basics of information and communication technology (ICT)

A3- Characteristics of engineering materials related to the discipline.

A4- Principles of design including elements design, process and/or a system related to specific disciplines.

A5- Methodologies of solving engineering problems, data collection and interpretation

A6- Quality assurance systems, codes of practice and standards, health and safety requirements and environmental issues.

A7- Business and management principles relevant to engineering.

A8- Current engineering technologies as related to disciplines.

A9- Topics related to humanitarian interests and moral issues.

A10- Technical language and report writing

A11- Professional ethics and impacts of engineering solutions on society and environment

A12- Contemporary engineering topics.

A13- Concepts, principles and theories relevant to Mechanical Engineering and manufacture;

A14- The constraints within which his/her engineering judgment will have to be exercised;

A15- The specifications, programming and range of application of CAD and CAD/CAM facilities

A16- Relevant contemporary issues in mechanical engineering.

A17- Basic electrical, control and computer engineering subjects related to the discipline

A18- The role of information technology in providing support for mechanical engineers

A19- Engineering design principles and techniques

A20- Management and business techniques and practices appropriate to engineering industry.

b- Intellectual skills:

The graduates of the program should be able to

B1- Select appropriate mathematical and computer-based methods for modelling and analysing problems.

B2- Select appropriate solutions for engineering problems based on analytical thinking.

B3- Think in a creative and innovative way in problem solving and design.

B4- Combine, exchange, and assess different ideas, views, and knowledge from a range of sources.

B5- Assess and evaluate the characteristics and performance of components, systems and processes.

B6- Investigate the failure of components, systems, and processes.

B7- Solve engineering problems, often on the basis of limited and possibly contradicting information.

B8- Select and appraise appropriate ICT tools to a variety of engineering problems.

B9- Judge engineering decisions considering balanced costs, benefits, safety, quality, reliability, and environmental impact.

B10- Incorporate economic, societal, environmental dimensions and risk management in design.

B11- Analyse results of numerical models and assess their limitations.

B12- Create systematic and methodical approaches when dealing with new and advancing technology.

B13- Apply the principles of mathematics, science and technology in problem solving scenarios in mechanical engineering

B14- Analyze and interpret data, and design experiments to obtain primary data؛

B15- Evaluate and appraise designs, processes and products, and propose improvements؛

B16- Interpret numerical data and apply analytical methods for engineering design purposes

B17- Use the principles of engineering science in developing solutions to practical mechanical engineering problems.

B18- Select appropriate manufacturing method considering design requirements.

c- Professional and practical skills:

The graduates of the program should be able to:

C1- Apply knowledge of mathematics, science, information technology, design, business context and engineering practice integrally to solve engineering problems.

C2- Professionally merge the engineering knowledge, understanding, and feedback to improve design, products and/or services.

C3- Create and/or re-design a process, component or system, and carry out specialized engineering designs.

C4- Practice the neatness and aesthetics in design and approach.

C5- Use computational facilities and techniques, measuring instruments, workshops and laboratory equipment to design experiments, collect, analyse and interpret results.

C6- Use a wide range of analytical tools, techniques, equipment, and software packages pertaining to the discipline and develop required computer programs.

C7- Apply numerical modelling methods to engineering problems.

C8- Apply safe systems at work and observe the appropriate steps to manage risks.

C9- Demonstrate basic organizational and project management skills.

C10- Apply quality assurance procedures and follow codes and standards.

C11- Exchange knowledge and skills with engineering community and industry.

C12- Prepare and present technical reports.

C13- Utilize practical systems approach to design and performance evaluation;

C14- Prepare engineering drawings, computer graphics and specialized technical reports and communicate accordingly.

C15- Employ the traditional and modern CAD and CAD/CAM facilities in design and production processes

C16- Use basic workshop equipment safely؛

C17- Analyze experimental results and determine their accuracy and validity؛

C18- Use laboratory equipment and related computer software؛

C19- Operate and maintain mechanical equipment.

C20- Prepare the process plan for manufacturing

d- General and transferable skills:

The graduates of the program should be able to:

D1- Manage working in a team.

D2- Share ideas and communicate with others in oral or written formats.

D3- Deal with others according to the rules of professional ethics.

4. Academic standards

The "Design and Production Engineering" program ADOPTS the **N**ational **A**cademic **R**eference Standards (NARS) for "MECHANICAL DESIGN AND PRODUCTION ENGINEERING" prepared by the National Authority for Quality Assurance and Accreditation of Education-Egypt., 2nd Ed., August 2009. And this adoption has been approved by the Academic Department Council at June 2010.

- See Table [1] for a relationship matrix of **"Program ILOs Vs the NARS's ILOs**".
- See Table [2] for a relationship matrix of **"Program Aims Vs NARS's Graduate's Attributes"**.
- See Table [3] for a relationship matrix of **"Institute's Mission Vs Program's Mission**".
- See Table [4] for a relationship matrix of **"Program's Mission Vs Program's Aims**".
- See Table [5] for a relationship matrix of **"Program's Aims Vs Program's ILOs**".
- See Table [6] for a relationship matrix of "**Program's ILOs Vs Program's Courses"**.

5. Curriculum structure and contents

a- Programme duration:

Five Years, - 300 contact hours

b- Programme structure

Lectures	158h	Practical	142h	Total	300h
Compulsory	288h	Elective	12h	Optional/Selective	40h

	Subject Area	NARS%	Program%
A	Humanities and Social Sciences (Univ. Req.)	(9-12 %)	9.0
B	Mathematics and Basic Sciences	(20-26 %)	22.7
C	Basic Engineering Sciences (Faculty/Spec. Req.)	(20-23 %)	20.0
D	Applied Engineering and Design	(20-22 %)	21.7
E	Computer Applications and ICT*	(9-11 %)	11.0
F	Projects* and Practice	(8-10 %)	9.3
G	Discretionary (Institution character-identifying) subjects	(6-8 %)	6.3
	Total	84	100

See appendix - Table [7] for courses classification according to subject area.

c- Programme courses

LEVEL 1					
Code No.	Course Title	No.	No. of hours / week	prerequisites	prerequisites

			of units	Lect.	Tut./ Lab.	Exer.		
PHM	011	Mathematics (1)	NA	4	0	2	Compulsory	1st
PHM	021	Physics (1)	NA	4	1	1		
PHM	031	Mechanics (1)	NA	2	1	1		
MDP	021	Engineering Drawing & Projection	NA	1	0	4		
CSE	011	Computer Technology	NA	2	0	1		
PHM	041	Chemistry	NA	4	1	1		
PHM	011	Mathematics (1)	NA	4	0	2	Compulsory	2nd
PHM	021	Physics (1)	NA	4	1	1		
PHM	031	Mechanics (1)	NA	2	1	1		
MDP	021	Engineering Drawing & Projection	NA	1	0	4		
HUM	x11	Technical English Language	NA	2	0	0		
MDP	022	Production Technology & Engineering History	NA	4	2	1		
Total				34	7	19		
				60				

LEVEL 2

Code No.		Course Title	No. of units	No. of hours / week			Compulsory	Semester
				Lect.	Lab.	Exer.		
PHM	112	Mathematics (2)	NA	4	0	2	Compulsory	1st
MDP	161	Machine Drawing	NA	0	0	4		
PHM	122	Physics (2)	NA	2	1	1		
PHM	132	Mechanics (2)	NA	2	1	1		
CES	112	Theory of Structures	NA	2	0	2		
MDP	131	Materials Engineering & Testing	NA	4	2	2		
PHM	112	Mathematics (2)	NA	4	0	2	Compulsory	2nd
MDP	161	Machine Drawing	NA	0	0	4		
EPM	112	Electrical & Electronic Engineering	NA	4	1	1		
MDP	111	Manufacturing Technology (1)	NA	4	2	1		
MEP	111	Thermodynamics (1)	NA	2	1	1		
HUM	x12	Technical Report Writing	NA	2	0	1		
Total				30	8	22		
				60				

LEVEL 3

Code No.		Course Title	No. of units	No. of hours / week			Compulsory	Semester
				Lect.	Tut./ Lab.	Exer.		
MDP	251	Mechanics of Machines (1)	NA	2	1	1	Compulsory	1st
MDP	252	Machine Construction	NA	2	0	2		
EPM	212	Electrical Engineering	NA	2	1	1		
MDP	221	Stress Analysis	NA	2	0	2		
MEP	212	Thermodynamics (2)	NA	4	2	2		

MEP	231	Fluid Dynamics	NA	4	1	1		
MDP	251	Mechanics of Machines (1)	NA	2	1	1	Compulsory	2nd
MDP	252	Machine Construction	NA	2	0	2		
MDP	211	Manufacturing Technology (2)	NA	4	2	1		
MEP	221	Heat & Mass Transfer	NA	4	1	2		
MEP	281	Measurements	NA	3	1	1		
HUM	X31	Engineering Economy	NA	2	0	1		
Total				33	10	17		
				60				

LEVEL 4

Code No.		Course Title	No. of units	No. of hours / week			Compulsory	Semester
				Lect.	Tut./ Lab.	Exer.		
MDP	361	Machine Design	NA	2	0	2	Compulsory	1st.
MDP	341	Measuring Instruments	NA	4	2	2		
MDP	352	Mechanics of Machines (2)	NA	4	0	2		
MDP	353	Automatic Control	NA	2	0	2		
MDP	371	Theory of Metal Cutting	NA	2	0	2		
MDP	381	Theory of Metal Forming	NA	2	0	2		
MDP	361	Machine Design	NA	2	0	2	Compulsory	2nd
MDP	321	Manufacturing Technology (3)	NA	4	2	1		
MDP	322	Work Study	NA	2	0	2		
MDP	372	Machines of Metal Cutting & Forming	NA	4	2	2		
HUM	X21	Management & Marketing	NA	2	0	1		
MDP		Elective (1)	NA	2	0	2		
Total				32	6	22		
				60				

		Elective Course (1)					Elective	2nd
MDP	323	Quality Systems	NA	2	0	2		
MDP	324	Reliability Engineering	NA	2	0	2		
MDP	325	Quality of Service Industries	NA	2	0	2		

LEVEL 5

Code No.	Course Title	No.	No. of hours / week	m pu lc	m est

			of units	Lect.	Tut./ Lab.	Exer.		
MDP	499	Project	NA	0	2	2	Compulsory	1st.
MDP	422	Quality Control	NA	2	2	0		
MDP	451	Tool Design		3	1	2		
MDP	471	Numerical Control Machines	NA	3	1	1		
HUM	X41	Legislation & Contracts	NA	2	0	1		
MDP		Elective (2)	NA	2	0	2		
MDP		Elective (3)	NA	2	0	2		
MDP	423	Facilities Planning	NA	4	0	2	Compulsory	2nd
MDP	424	Operations Management	NA	3	0	2		
MDP	441	Measurement		4	3	1		
HUM	X32	Project Management		2	0	2		
HUM	X42	Environmental Impact of Projects	NA	2	0	1		
MDP	499	Project	NA	0	2	2		
Total				29	11	20		
				60				

		Elective Course (2)					Elective	1st
MDP	427	Computer Applications in industry	NA	2	0	2		
MDP	428	Ergonomics	NA	2	0	2		
MDP	431	Materials & Process Selection	NA	2	0	2		
		Elective Course (3)						
CEP	452	Environmental Engineering	NA	2	0	2		
CSE	461	Information Systems	NA	2	0	2		
MDP	443	Systems Modeling		2	0	2		
MDP	455	Operations Research						

6. Program admission requirements

Having Egyptian Secondary education or equivalent certificate with major in Mathematics.

7. Regulations for progression and program completion

a- The student is considered successful if he passes the examinations in all courses of his class.

b- The student is promoted to the next higher level if he fails in not more than two subjects of his class or from lower classes,

c- In addition to the two subjects mentioned in the previous item, the student who fails in two subjects in humanities and social sciences, whether from his class or from lower classes, is admitted to the transfer to the consecutive higher level. Passing successfully in all courses before obtaining the B.Sc. degree is a prerequisite.

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

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

   a. Distinction: from 85% of the total mark and upwards.
   b. Very good: from 75% to less than 85% of the total mark.
   c. Good from: 65% to less than 75% of the total mark
   d. Pass: from: 50% to less than 65% of the total mark

f- The grades of a failing student in a course is estimated in one of' the following grades:

   a. Weak: from 30% to less than 50% of the total mark
   b. Very Weak: less than 30% of the total mark.

g- 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.

h- The student is awarded an honour degree if his cumulative sum is distinction or very good provided that he gets a grade not less than very good in any class of study other than the preparatory year. Moreover, he should have not failed in any examination he has sat in any class other than the preparatory year.

8. Program ILOs Assessment Methods

The following table illustrates the assessment methods and what they assess in most cases. For further details refer to the courses' specifications.

	Program ILOs			
	K&U	Intellectual	Professional	General
Written Exams	■	■	■	
Practical Exams	■		■	■
Oral Exams	■	■		■
Projects	■	■	■	■
Researches	■		■	■

9. Evaluation of program intended learning outcomes

Evaluator	Tool	Sample
1-Senior students	Evaluation sheet	50%
2-Alumni	Evaluation sheet & interview	10%
3-Stakeholders **(**Employers)	Evaluation sheet & interview	25%
4-External and internal Evaluators	Evaluation report	1 for each
5- Other: Faculty Members	Evaluation sheet	50%

Appendix

Table [1] The relationship matrix of **"Program ILOs Vs the NARS**'s **ILOs**".

Program ILO

NARS ILO	a- Knowledge and understanding																				b- Intellectual skills																	
	Engineer should generally know												should also know								Engineer should generally be able to												also be able to					
	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13	A14	A15	A16	A17	A18	A19	A20	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15	B16	B17	B18
A1	■																																					
A2		■																																				
A3			■																																			
A4				■																																		
A5					■																																	
A6						■																																
A7							■																															
A8								■																														
A9									■																													
A10										■																												
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A18																		■																				
A19																			■																			
A20																				■																		
B1																					■																	
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B13																																	■					
B14																																		■				
B15																																			■			
B16																																				■		
B17																																					■	
B18																																						■

Table [1] The relationship matrix of **"Program ILOs Vs the NARS**'s **ILOs**".

Program ILO

NARS ILO	c- Professional and practical skills																			d- General and Transferable		
	Engineer should generally be able to													Production Engineer should also be able to								
	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19	C20	D1	D2	D3
C1																							
C2																							
C3																							
C4																							
C5																							
C6																							
C7																							
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C13																							
C14																							
C15																							
C16																							
C17																							
C18																							
C19																							
C20																							
D1																							
D2																							
D3																							

Table [2] The relationship matrix of **"Program Aims Vs NARS's Graduate's Attributes"**.

NARS's Graduate's Attributes (GA)

		Engineer General Attributes											Specialized Engineer Specialized Attributes						
		a	b	c	d	e	f	g	h	i	j	k	a	b	c	d	e	f	g
Program Aims (PA)	PA 1	■																	
	PA 2		■																
	PA 3			■															
	PA 4				■														
	PA 5					■													
	PA 6						■												
	PA 7							■											
	PA 8								■										
	PA 9									■									
	PA 10										■								
	PA 11											■							
	PA 12												■						
	PA 13													■					
	PA 14														■				
	PA 15															■			
	PA 16																■		
	PA 17																	■	
	PA 18																		■

Institute Mission

IM1. Preparation distinguished graduate capable of keep pace with global technological in various disciplines that meet the needs of local and regional markets, and

IM2. can conduct scientific research and applied through the creation of appropriate conditions for faculty members and their assistants and students, and

IM3. to provide educational programs in advanced undergraduate and graduate studies and continuing education, and

IM4. the establishment of advisory centers and research labs, including sophisticated contribute to community service and to meet its needs.

Program Mission

PM1. Prepare students for a professional career with a broad knowledge of basic and practical mechanical engineering with high emphases on the different aspects of production engineering; material technology, mechanical design, manufacturing processes and industrial aspects.

PM2. Conduct engineering research and to pursue graduate degrees in the above fields

PM3. Achieve leadership positions in scientific and technological enterprises in Egypt and the Middle East

PM4. Compete internationally in the fields of manufacturing Engineering.

PM5. Behave ethically based on the professional principles.

Table [3] The relationship matrix of **"Institute's Mission Vs Program's Mission**".

		Program's Mission (PM)				
		PM 1	PM 2	PM 3	PM 4	PM 5
Institute's Mission (IM)	IM 1					
	IM 2					
	IM 3					
	IM 4					

Table [4] The relationship matrix of "**Program's Mission Vs Program's Aims**".

		Program's Mission (PM)				
		PM 1	PM 2	PM 3	PM 4	PM 5
Program Aims (PA)	PA 1	■				
	PA 2		■			
	PA 3		■			
	PA 4	■				
	PA 5			■		
	PA 6			■		■
	PA 7					■
	PA 8				■	■
	PA 9	■			■	
	PA 10					■
	PA 11		■			
	PA 12	■				
	PA 13	■				
	PA 14	■	■			
	PA 15	■				
	PA 16	■				
	PA 17	■			■	
	PA 18			■		

Table [5] The relationship matrix of **" Program's Aims Vs Program's ILOs "**.

		Program Aims (PA)																	
		PA1	PA2	PA3	PA4	PA5	PA6	PA7	PA8	PA9	PA10	PA11	PA12	PA13	PA14	PA15	PA16	PA17	PA18
Program ILO's	A1	■			■					■			■						
	A2					■									■	■			
	A3	■												■					
	A4		■	■									■	■					
	A5			■											■				
	A6					■			■										■
	A7					■	■										■		■
	A8				■							■						■	
	A9										■								■
	A10							■								■			
	A11								■								■		
	A12											■						■	
	A13												■						
	A14		■											■					
	A15															■			
	A16												■					■	
	A17														■			■	
	A18																■		
	A19												■			■			
	A20																■		■
	B1	■												■					
	B2		■			■													
	B3				■					■									
	B4	■	■											■	■				
	B5	■	■			■												■	
	B6	■																■	
	B7	■	■		■														
	B8					■		■											
	B9								■	■									
	B10								■	■	■								
	B11																	■	
	B12											■							
	B13												■	■					
	B14														■				
	B15												■	■			■		
	B16															■		■	
	B17												■	■					
	B18												■	■			■		

Table [5] The relationship matrix of **" Program's Aims Vs Program's ILOs "**.

		Program Aims (PA)																	
		PA1	PA2	PA3	PA4	PA5	PA6	PA7	PA8	PA9	PA10	PA11	PA12	PA13	PA14	PA15	PA16	PA17	PA18
Program ILO	C1	■	■	■	■		■											■	
	C2	■	■	■	■								■						
	C3	■	■	■	■								■						
	C4						■	■	■										
	C5	■												■	■				
	C6			■		■										■			
	C7					■						■				■			
	C8					■	■		■		■								■
	C9					■	■		■		■								■
	C10									■							■		
	C11							■								■			
	C12							■								■			
	C13		■	■															
	C14							■								■			
	C15							■								■			
	C16												■		■				
	C17														■			■	
	C18														■			■	
	C19												■		■				
	C20													■		■			
	D1						■												■
	D2						■			■	■								■
	D3						■			■	■								■

Table [6] for a relationship matrix of "**Program's ILOs Vs Program's Courses**

Course Title	Code	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13	A14	A15	A16	A17	A18	A19	A20
Mathematics (1	PHM011	■												■							
Physics (1)	PHM021	■												■							
Mechanics (1)	PHM031	■												■							
Eng. Drawing & Proj.	MDP021		■													■				■	
Computer technology	CSE011		■																		
Chemistry	PHM041			■																	
Mathematics (1	PHM011	■												■							
Physics (1)	PHM021	■												■							
Mechanics (1)	PHM031	■												■							
Eng. Drawing & Proj.	MDP021		■							■						■				■	
Technical English	HYMX11									■	■										
Prod. Tech & History	MDP022			■						■		■									
Mathematics (2	PHM112	■												■							
Machine Drawing	MDP161		■													■			■	■	
Physics (2)	PHM122	■												■							
Mechanics (2)	PHM132	■												■							
Theory of Structures	CES112			■	■																
Materials Eng. & Test.	MDP131			■																	
Mathematics (2	PHM112	■												■							
Machine Drawing	MDP161		■													■			■		
Electrical & Electronic	EPM112																	■			
Manuf. technology (1)	MDP111			■										■							
Thermodynamics (1)	MEP111		■											■							
Report Writing	HUMx12									■	■	■									
Mech of Machines (1)	MDP251	■												■	■					■	
Machine Construction	MDP252		■													■				■	
Electrical Engineering	EPM212																	■			
Stress Analysis	MDP221		■																	■	
Thermodynamics (2)	MEP212	■												■							
Fluid Dynamics	MEP231	■												■							
Mech of Machines (1)	MDP251	■												■	■					■	
Machine Construction	MDP252		■													■				■	
Manuf. Tech. (2)	MDP211			■										■			■				
Heat & Mass Transfer	MEP221	■												■							
Measurements	MEP281					■	■														
Engineering Economy	HUMx31						■	■					■								■
Machine Design	MDP361		■	■	■				■							■				■	
Measuring Instrum.	MDP341					■	■														
Mech of Machines (2)	MDP352	■												■						■	
Automatic Control	MDP353				■				■									■			
Theory of M. Cutting	MDP371	■												■							
Theory of M. Forming	MDP381	■			■									■							
Machine Design	MDP361		■	■	■				■							■				■	
Manuf Technology (3)	MDP321			■										■			■				
Work Study	MDP322						■	■					■			■					■
Machines of metal C&F	MDP372	■												■							
Manage. & Market.	HUMx21						■	■					■								■
Quality Systems	MDP323						■	■					■								■
Reliability Engineering	MDP324						■	■					■								■
Quality of Service Ind	MDP325						■	■					■								■

Project	MDP499				■	■					■			■						■	
Quality Control	MDP422						■	■					■								■
Tool Design	MDP451	■		■										■							
NC Machines	MDP471												■	■		■					
Legislation & Cont.	HUMx41						■	■		■		■									
Computer Appl. in ind	MDP427		■													■					
Ergonomics	MDP428									■		■			■						
Process Selection	MDP431			■										■							
Env. Engineering	CEP452											■									
Information Systems	CSE461		■																■		
Systems Modeling	MDP443													■						■	
Operations Research	MDP455							■					■								
Facilities Planning	MDP423																				
Oper. Management	MDP424							■					■								
Measurement	MDP441						■									■					
Project Management	HUMx32							■													■
Env. Impact of Proj.	HUMx42											■									
Project	MDP499				■	■					■			■						■	

Table [6] for a relationship matrix of "**Program's ILOs Vs Program's Courses**

Course Title	Code	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15	B16	B17	B18
Mathematics (1	PHM011	■												■					
Physics (1)	PHM021	■												■					
Mechanics (1)	PHM031	■												■					
Eng. Drawing & Proj.	MDP021			■	■	■			■							■		■	
Computer technology	CSE011								■										
Chemistry	PHM041													■					
Mathematics (1	PHM011	■												■					
Physics (1)	PHM021	■												■					
Mechanics (1)	PHM031	■												■					
Eng. Drawing & Proj.	MDP021			■	■	■			■									■	
Technical English	HYMX11																		
Prod. Tech & History	MDP022						■			■						■			■
Mathematics (2	PHM112	■												■					
Machine Drawing	MDP161			■	■	■			■									■	
Physics (2)	PHM122	■												■					
Mechanics (2)	PHM132	■					■							■					
Theory of Structures	CES112	■												■					
Materials Eng. & Test.	MDP131						■												
Mathematics (2	PHM112	■												■					
Machine Drawing	MDP161			■	■	■			■									■	
Electrical & Electronic	EPM112													■					
Manuf. technology (1)	MDP111						■			■						■			■
Thermodynamics (1)	MEP111								■			■					■		
Report Writing	HUMx12																		
Mech of Machines (1)	MDP251	■					■							■					
Machine Construction	MDP252			■	■	■		■	■									■	
Electrical Engineering	EPM212													■					
Stress Analysis	MDP221								■			■					■		
Thermodynamics (2)	MEP212	■							■			■					■		
Fluid Dynamics	MEP231	■							■								■		
Mech of Machines (1)	MDP251	■					■							■					
Machine Construction	MDP252																		
Manuf. Tech. (2)	MDP211						■			■						■			■
Heat & Mass Transfer	MEP221	■							■			■							
Measurements	MEP281														■				
Engineering Economy	HUMx31									■	■								
Machine Design	MDP361			■	■	■		■	■									■	
Measuring Instrum.	MDP341														■				
Mech of Machines (2)	MDP352	■					■		■					■					
Automatic Control	MDP353													■					
Theory of M. Cutting	MDP371	■																	
Theory of M. Forming	MDP381	■																	
Machine Design	MDP361			■	■	■		■	■									■	
Manuf Technology (3)	MDP321						■			■						■			■
Work Study	MDP322									■	■								
Machines of metal C&F	MDP372	■												■					■
Manage. & Market.	HUMx21									■	■								
Quality Systems	MDP323									■	■								
Reliability Engineering	MDP324									■									■
Quality of Service Ind	MDP325									■	■								
Project	MDP499			■	■	■		■	■	■	■								
Quality Control	MDP422										■								

Tool Design	MDP451	■																■
NC Machines	MDP471			■														
Legislation & Cont.	HUMx41				■			■		■								
Computer Appl. in ind	MDP427								■									
Ergonomics	MDP428				■			■		■								
Process Selection	MDP431						■					■				■		■
Env. Engineering	CEP452									■								
Information Systems	CSE461								■			■			■			
Systems Modeling	MDP443							■							■			
Operations Research	MDP455		■		■			■						■				
Facilities Planning	MDP423		■					■										
Oper. Management	MDP424		■		■								■	■				
Measurement	MDP441												■		■			
Project Management	HUMx32		■		■			■		■								
Env. Impact of Proj.	HUMx42									■	■							
Project	MDP499			■	■	■		■	■	■	■							

Table [6] for a relationship matrix of "**Program's ILOs Vs Program's Courses**

Course Title	Code	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19	C20	D1	D2	D3
Mathematics (1	PHM011	■																						
Physics (1)	PHM021	■																						
Mechanics (1)	PHM031	■																						
Eng. Drawing & Proj.	MDP021				■										■									
Computer technology	CSE011						■								■									
Chemistry	PHM041	■																						
Mathematics (1	PHM011	■																						
Physics (1)	PHM021	■																						
Mechanics (1)	PHM031	■																						
Eng. Drawing & Proj.	MDP021				■										■									
Technical English	Humx11				■							■	■										■	
Prod. Tech & History	MDP022																■			■	■			
Mathematics (2	PHM112	■																						
Machine Drawing	MDP161				■										■									
Physics (2)	PHM122	■																						
Mechanics (2)	PHM132	■																						
Theory of Structures	CES112	■		■			■																	
Material Eng. & Test.	MDP131			■																				
Mathematics (2	PHM112	■																						
Machine Drawing	MDP161				■										■	■								
Electrical & Electron	EPM112						■										■			■	■	■		
Manuf. tech (1)	MDP111																							
Thermodynamics (1)	MEP111							■																
Report Writing	HUMx12											■	■										■	
Mech of Machines (1)	MDP251	■						■						■										
Machine Construction	MDP252	■	■		■										■	■						■		
Electrical Engineering	EPM212	■																						
Stress Analysis	MDP221	■		■			■																	
Thermodynamics (2)	MEP212	■						■																
Fluid Dynamics	MEP231	■						■																
Mech of Machines (1)	MDP251	■		■				■																
Machine Construction	MDP252	■	■	■	■										■	■						■		
Manuf. Tech. (2)	MDP211																■			■	■		■	
Heat & Mass Transfer	MEP221	■												■										
Measurements	MEP281																	■	■					
Engineering Economy	HUMx31								■	■	■													■
Machine Design	MDP361	■	■		■										■	■						■		
Measuring Instrum.	MDP341																	■	■					
Mech of Machines (2)	MDP352	■						■						■										
Automatic Control	MDP353						■																	
Theory of M. Cutting	MDP371	■															■				■			
Theory of M. Forming	MDP381	■															■				■			
Machine Design	MDP361	■	■		■										■	■						■		
Manuf Technology (3)	MDP321																■			■	■			
Work Study	MDP322								■	■	■													
Machines of metal C&F	MDP372	■															■				■			
Manage. & Market.	HUMx21								■	■	■													
Quality Systems	MDP323								■	■	■													
Reliability Engineering	MDP324		■	■																				
Quality of Service Ind	MDP325								■	■	■													
Project	MDP499		■		■								■	■	■	■						■	■	■
Quality Control	MDP422								■	■	■													
Tool Design	MDP451	■															■				■			

NC Machines	MDP471																							
Legislation & Cont.	HUMx41																							
Computer Appl. in ind	MDP427																							
Ergonomics	MDP428																							
Process Selection	MDP431																							
Env. Engineering	CEP452																							
Information Systems	CSE461																							
Systems Modeling	MDP443																							
Operations Research	MDP455																							
Facilities Planning	MDP423																							
Oper. Management	MDP424																							
Measurement	MDP441																							
Project Management	HUMx32																							
Env. Impact of Proj.	HUMx42																							
Project	MDP499																							

Table [7] Program courses classification according to subject areas

Course Code		Course Name	Cr.H. / Contact H. @ Bylaw	A	B	C	D	E	F	G
				Humanities and Social Sciences (Univ. Req.)	Mathematics and Basic Sciences	Basic Engineering Sciences (Faculty/Spec. Req.)	Applied Engineering and Design	Computer Applications and ICT*	Projects* and Practice	Discretionary (Institution character-identifying) subjects
	NARS Range			9-12 %	20-26 %	20-23%	20-22 %	9-11 %	8-10%	6-8 %
		Program Subject area %	300	8.0	21.0	21.7	21.7	11.3	10.0	6.3
		Sum								
PHM	11	Mathematics (1	6		6					
PHM	21	Physics (1)	6		6					
PHM	31	Mechanics (1)	4		4					
MDP	21	Engineering Drawing & Projection	5			5				
CSE	11	Computer Technology	3					3		
PHM	41	Chemistry	6		6					
PHM	11	Mathematics (1	6		6					
PHM	21	Physics (1)	6		6					
PHM	31	Mechanics (1)	4		4					
MDP	21	Engineering Drawing & Projection	5			2		3		
HUM	x11	Technical English Language	2	2						
MDP	22	Production Technology &	7			4				3
PHM	112	Mathematics (2	6		6					
MDP	161	Machine Drawing	4			4				
PHM	122	Physics (2)	4		4					
PHM	132	Mechanics (2)	4		4					
CES	112	Theory of Structures	4						2	2
MDP	131	Materials Engineering & Testing	8		4	4				
PHM	112	Mathematics (2	6		6					
MDP	161	Machine Drawing	4			4				
EPM	112	Electrical & Electronic Engineering	6			6				
MDP	111	Manufacturing Technology (1)	7				4			3
MEP	111	Thermodynamics (1)	4			4				
HUM	x12	Technical Report Writing	3	3						
MDP	251	Mechanics of Machines (1)	4			4				
MDP	252	Machine Construction	4			2			2	
EPM	212	Electrical Engineering	4			4				

Table [7] Program courses classification according to subject areas

Course Code		Course Name	Cr.H. / Contact H. @ Bylaw	A	B	C	D	E	F	G
				Humanities and Social Sciences (Univ. Req.)	Mathematics and Basic Sciences	Basic Engineering Sciences (Faculty/Spec. Req.)	Applied Engineering and Design	Computer Applications and ICT*	Projects* and Practice	Discretionary (Institution character-identifying) subjects
MDP	221	Stress Analysis	4			2			2	
MEP	212	Thermodynamics (2)	8			6			2	
MEP	231	Fluid Dynamics	6		2	2			2	
MDP	251	Mechanics of Machines (1)	4			2		2		
MDP	252	Machine Construction	4			2			2	
MDP	211	Manufacturing Technology (2)	7			4				3
MEP	221	Heat & Mass Transfer	7			3		2		2
MEP	281	Measurements	5			1		2		2
HUM	X31	Engineering Economy	3	3						
MDP	361	Machine Design	4				2	2		
MDP	341	Measuring Instruments	8				4	2	2	
MDP	352	Mechanics of Machines (2)	6				2	2	2	
MDP	353	Automatic Control	4				2	2		
MDP	371	Theory of Metal Cutting	4				4			
MDP	381	Theory of Metal Forming	4				4			
MDP	361	Machine Design	4				2		2	
MDP	321	Manufacturing Technology (3)	7				3		4	
MDP	322	Work Study	4	2			2			
MDP	372	Machines of Metal Cutting & Forming	8				4	4		
HUM	X21	Management & Marketing	3	3						
MDP		Elective (1	4					4		
MDP	499	Project	4						4	
MDP	422	Quality Control	4				4			
MDP	451	Tool Design	6				6			
MDP	471	Numerical Control Machines	5				3	2		
HUM	X41	Legislation & Contracts	3	3						
MDP		Elective (2	4					2		2
MDP		Elective (3	4					2		2
MDP	423	Facilities Planning	6				6			
MDP	424	Operations Management	5				5			
MDP	441	Measurement	8				8			
HUM	X32	Project Management	4	4						
HUM	X42	Environmental Impact of Projects	3	3						
MDP	499	Project	4						4	