Section 10

Electrical Energy Engineering Program (EEE)

Based on Credit Hours System (CHS)

September 2020

1. INTRODUCTION

Industrial development, assimilation of population growth and meeting increasing demand for electrical energy cannot be achieved without population well awareness and expertise in Electrical Power Engineering, Computer and Electronics, and Industrial Applications. Furthermore, Egypt -with its unique geographic location, size of population and available expertise- can play a leading role in modern industries and electrical energy exchange in the Arab world as well as in African countries. In response to this situation, the Faculty of Engineering at Cairo University, the oldest and one of the most prestigious schools of engineering in the Arab world is proposing to establish a modern bachelor program in Electrical Energy Engineering (EEE) based on the credit-hours system (CHS) of education.

2. PROGRAM MISSION

The mission of the Electrical Energy Engineering (EEE) program at Cairo University is to provide the highest standard of excellence in higher education while pursuing continuous quality improvement. The goal of the program is to provide the community with graduates in the area of electrical energy and power capable of effectively using the scientific and technical knowledge developed as undergraduates for the betterment of society. The problem-solving, teamwork, and oral communications skills developed by the graduates of EEE program will also contribute to achieving this goal. The EEE program supports this mission by providing students with appropriate curricula and educational experiences. The curricula would be subjected to continuous assessment by employers, faculty, and students. Students obtain the broad education necessary to understand the impact of electrical energy systems solutions in a global, societal, and cultural context.

The bachelor degree program in Electrical Energy Engineering allows a plan that will necessarily be highly structured during the first four semesters and relatively flexible during the upper six semesters, which constitute the proposed Major semesters. This is achieved by providing the students an assortment of elective courses during the senior years, which will further shape the student's readiness to serve in real life employment tracks. The EEE program provides a laboratory-based curriculum that combines hands-on practice with the appropriate basic electrical and electronic theory. It is application-oriented and is designed to prepare well rounded graduates who can succeed in one or more of the fields related to electrical energy systems technologies.

3. EDUCATIONAL OBJECTIVES

The EEE program pursues the following main educational objectives:

1. To provide students with the understanding of fundamental knowledge prerequisite for the practice of, or for advanced study in, electrical energy systems engineering, including its scientific principles, rigorous analysis, and creative design.

2. To provide students with the broad education, including knowledge of important current issues in electrical energy systems engineering, that is necessary for productive careers in the public or private sectors, or for the pursuit of graduate education.
3. To enable graduates to work not only in local markets but also in regional (particularly, in the Arab and African regions) and international markets.
4. To develop skills for clear communication and responsible teamwork, and to emphasize professional attitudes and ethics, so that graduates are prepared for the complex modern work environment and for lifelong learning.
5. To provide an environment that enables students to pursue their goals in an innovative program that is rigorous and challenging, open and supportive.

4. PROGRAM LEARNING OUTCOMES

The following academic reference standards represent the general expectation about the qualifications attributes and capabilities that the graduates of the Electrical Energy Engineering program should be able to demonstrate.

4.1 Knowledge and Understanding

On successful completion of the program, the graduates must be able to demonstrate knowledge and understanding of:

a1. Concepts, principles and theories relevant to EEE and manufacture
a2. Applied science, mathematics and the technological base relevant to EEE
a3. The constraints within which his engineering judgment will have to be exercised
a4. The specifications, programming and range of application of CAD and CAD/CAM facilities
a5. Relevant contemporary issues in EEE
a6. Basic electrical, control and computer engineering subjects related to the discipline
a7. The role of information technology in providing support for EEE
a8. Engineering design principles and techniques
a9. Characteristics of engineering materials
a10. Management and business techniques and practices appropriate to engineering industry

4.2 Intellectual Skills

On successful completion of the program, the graduates must be able to:

b1. Use creative and innovative thinking in solving problems, and in designing products, systems, components and processes
b2. Apply the principles of mathematics, science and technology in problem solving scenarios in EEE
b3. Analyze and interpret data, and design experiments to obtain primary data;
b4. Design systems, components or processes to meet specific needs
b5. Evaluate and appraise designs, processes and products, and propose improvements
b6. Assess risks, and take appropriate steps to manage those risks

b7. Interpret numerical data and apply analytical methods for design purposes
b8. Use the principles of engineering science in developing solutions to practical EE problems
b9. Solve and propose designs for EEE-related engineering problems
b10. Create new engineering components and processes through the synthesis of ideas from a range of sources
b11. Use computational tools and software packages pertaining to the discipline and develop required computer programs

4.3 Practical and Professional Skills

On successful completion of the program, the graduates must be able to:

c1. Use a wide range of analytical and technical tools, techniques and equipment, including pertinent software
c2. Prepare engineering drawings, computer graphics and specialized technical reports and communicate accordingly
c3. Carry out specialized engineering designs
c4. Employ the traditional and modern CAD and CAD/CAM facilities in design and production processes
c5. Use basic workshop equipment safely
c6. Apply safe systems at work
c7. Analyze experimental results and determine their accuracy and validity
c8 Use laboratory equipment and related computer software
c9. Demonstrate basic organizational and project management skills
c10. Operate and maintain EEE equipment
c11. Use and List relevant literature effectively

4.4 General Transferable Skills

On successful completion of the program, the graduates must be able to:

d1. Communicate effectively, apply IT technologies, and develop skills that are life enriching and have value in other occupations
d2. Present data/results in alternative forms for better understanding and/or greater impression, and utilize appropriate level of delivery
d3. Communicate effectively the information in verbal and writing.
d4. Develop systematic thinking skills to solve general problems and identify critical factors
d5. Evaluate given information and derive practical and new solutions
d6. Function efficiently in multi-member projects
d7. Use common IT tools
d8. Recognize the need for life-long learning and develop aptitude for continuous and independent learning of new concepts and information

5. MARKET NEEDS ASSESSMENT

Educational programs are planned to meet the job market needs and fulfill national (and/or regional) strategic plans. Therefore, it is expected that graduates of the EEE program will be ever in greater demand in order to implement the Egyptian Government

economic development plans. This will drastically enhance the overall employability of EEE graduates .

The EEE program has been preceded by a thorough investigation of exact needs of the particular market it is targeting, zone-wise and skills-wise. The planning details and specifics of the Electrical Energy Engineering program was carried out in view of the following important main contexts:

- Egypt's electrical power engineering job market needs (and graduate attributes).
- National Academic Reference Standards (NARS) for electrical power engineering set by the Supreme Council of Universities (SCU)
- National strategic plans, which emphasize maintaining and/or enhancing Egypt's regional and international leadership

It should be stated here that deep reading of the above mentioned contexts should not only take into consideration current status but expected potential international future developments as well.

In an effort to assess job market needs and graduate attributes a number of experts (from semi-governmental industrial agencies as well as private sector SMEs) were approached to provide some feedback on qualifications and weaknesses of currently available Electrical Power programs in Egypt. It should be stated here that work activities of those who were particularly targeted gave them the opportunity to deal with and/or assess technical attributes of such graduates. Their feedback revealed the following numerous elements of weakness, namely, lack of each of the following: self-motivation, creativity, writing skills, ethical and legal knowledge, marketing skills and management skills. These weaknesses are properly addressed in the proposed EEE curriculum. The same feedback also stressed the need to include in any newly planned Program a considerable dosage of practical training and to orient students on how the various components of this Program are inter-related as well as to real life practices.

Meanwhile, regionally and internationally speaking, fast technological developments in recent decades in addition to new national aspirations driven by global conventional energy reserve situations have highlighted the need to focus on renewable energy issues as well as power engineering components linked to nuclear power generation. This fact is further stressed in view of international and Egyptian Government’s plans to increase percentage of non-conventional power generation over the coming two decades. Moreover, taking into account that Egypt's human resources in general and engineers in particular have always had some share in regional job markets and in view of new job market competitors implicated by globalization efforts, it was necessary to tailor the new Program to international standards as well. For instance, it was stressed in a 2007 US National Science Foundation (NSF) workshop on the "Future Power Engineering Workforce" that there was serious need to incorporate communications in electric energy technologies, solve newly encountered challenges such as those arising in offshore power generation units and cope with new power electronics, energy conversion and new generation and storage technologies.

Specifics of the Electrical Energy Engineering program are tailored to address all of the aforementioned facts, issues and concerns, and – more importantly – with full conformity to NARS. As can be seen from the details of this Program's curriculum different new components were introduced (in the form of new courses) and some old components were revisited (in the form of new course contents). Samples of such components include new renewable energy related courses, modifying courses to highlight its applied and industry-related nature and tailor courses to cope with well observed current graduate weaknesses (such as marketing skills, legalities and communication skills). In brief, the EEE program under consideration has been tailored to be an active tool that addresses and supports national plans and concerns in the next decade.

6. PROGRAM DESCRIPTION

To prepare the student for the above targeted Educational Objectives, a set of program outcomes, that describes what students are expected to know and is able to do by the time of graduation, have been adopted. Those outcomes are based on direct market needs and fall in line with the criteria forged by reputable international accrediting bodies, most notably ABET, USA.

The EEE program offers instructions in numerous topics in the areas of power engineering, power electronics, industrial automation, as well as computer engineering and communications. By the end of the program, the students are expected to gain deep knowledge and skill in the design and study of automated and intelligent energy systems, electrical machine drives, electronic converters, design & performance of power systems, automatic control systems, etc. The students are expected to complete the degree requirements in 10 main semesters. High caliber students may finish in 9 main semesters.

6.1 Curriculum Overview

The curriculum of the EEE program consists of ١٧٥ credits spread over ٦٧ courses covering topics in Humanities and Social Sciences (HSS), Basic Sciences (BS), Engineering Sciences (ES), and Applied Engineering Sciences (AS) as required by the Supreme Council of Universities (SCU).

The curriculum of the EEE program is devoting special attention to issues that are capturing worldwide attention such as:

- Renewable energy: its generation, integration and control.
- The Smart Grid, which is becoming a Program goal of power engineers and governments around the world.
- The adverse environmental impact of developments in the area of electrical energy, or, the price of electrical energy development.

The curriculum includes courses in engineering fundamentals such as: electronics, circuits, communication, automatic control, logic design, and microprocessors. Furthermore, the curriculum covers data structures and algorithms, advanced

mathematics, physics, economics, management and humanities. In the specialized area, advanced and detailed courses are offered. Courses specific to electrical energy include: Control Systems, Power System Operation, Power Electronics, High Voltage Technology, Mechatronics (the combination of mechanical engineering, electronic control and systems), and Electrical Machine Drives.

The curriculum offers to the students the opportunity to select not only the program specialty but also many elective courses within the program. The electives can be grouped into two main groups. The first group serves the student, who is looking forward to working in the areas of electrical energy generation, conversion, integration, transmission and distribution, etc. The second group serves the student who intends to work in the area of industrial applications of electrical power, including computer control, control of electric drives and automation, etc.

6.2 University Requirements

The main purpose of a university education is not only to prepare students for successful careers but also to provide them with the knowledge and skills to develop a rational, well-rounded and successful personal identity. Moreover, Cairo University helps students to gain an appreciative understanding of the natural and cultural environments in which they live and their roles in the society and community services.

The university requirements of the CHS bachelor programs consist of ١٩ credits (10.8% of total 175 credits), which are satisfied by completing twelve (١٠) courses:

1. Nine (٧) compulsory courses equivalent to ١٤ credits (٧.4%), as listed in Table 1a.
2. Three (3) elective courses equivalent to 6 credits (3.4%), as listed in Table 1b.

Table 1a Compulsory Courses of University Requirements (13 credits, 7.4% of total 175 credits)

	Code	Course Title	Credits
1	GENN001	History of Science and Engineering	1
2	GENN004	Computers for Engineers	2
3	GENN005	Technical Writing	2
4	GENN102	Fundamentals of Management	2
5	GENN201	Communication and Presentation Skills	2
6	GENN210	Risk Management and Environment	2
7	GENN224	Concepts of Economics and Accounting	2

Table 1b Elective Courses of University Requirements (6 credits, 3.4% of total 175 credits)

	Code	Course Title	Credits	Group
1	GENN301	Ethics and Legislation	2	E-1(1)
2	GENN303	Critical thinking	2	
3	GENN305	Interdisciplinary Project	٢	
4	GENN310	Advanced Risk Management	2	
5	GENN311	Technical Writing in Arabic	2	
6	GENN321	Foreign Language	2	
7	GENN326	Marketing	2	
8	GENN327	Selections of Life-long Skills	2	
9	GENN328	Scientific Research Methods	2	
10	GENN331	Business Communication	2	
11	GENN332	Service Management	2	
12	GENN333	Creativity, Art & Design	2	Compulsory for AET

Remarks:

(1) Student selects at least three (3) courses equivalent to 6 credits

6.3 College Requirements

College requirements provide students with the knowledge and skills that are essential to develop a successful engineer. A college core that is common to all credit hours programs is implemented. This unified college core contains two categories of courses. The first category of college core courses includes courses of basic knowledge essential to all engineering graduates such as Mathematics, Physics, Mechanics, Graphics and Design, Manufacturing, and Chemistry. The second category includes courses that all students are required to undertake in order to develop certain intended learning outcomes common to all engineering graduates, such as Seminar, Industrial Training, and Graduation Project courses.

The college requirements of the CHS bachelor programs consist of 45 credits (25.7% of total 175 credits), which are satisfied by completing nineteen (19) compulsory courses, as listed in Table 2.

Table 2 Compulsory Courses of College Requirements (45 credits, 25.7% of total 175 credits)

	Code	Course Title	Credits
1	CHEN001	Chemistry	3
2	GENN003	Basic Engineering Design	2
3	MDPN001	Engineering Graphics	3

	Code	Course Title	Credits
4	MDPN002	Fundamentals of Manufacturing Engineering	3
5	MECN001	Mechanics-1	2
6	MECN002	Mechanics-2	2
7	MTHN001	Introduction to Linear Algebra and Analytic Geometry	3
8	MTHN002	Calculus I	3
9	MTHN003	Calculus II	3
10	MTHN102	Multivariable Calculus and Linear Algebra	3
11	MTHN203	Probability and Statistics	3
12	PHYN001	Mechanics, Oscillations, Waves and Thermodynamics	3
13	PHYN002	Electricity and Magnetism	3
14	EEEN280	Engineering Seminar	1
15	EEEN281	Industrial Training-1	1
16	EEEN380	Electrical Energy Engineering Seminar	1
17	EEEN381	Industrial Training-2	2
18	EEEN480	Graduation Project-1	1
19	EEEN481	Graduation Project-2	3

6.4 Discipline Requirements

Students who wish to pursue a bachelor degree in the EEE program have first to finish the discipline-core requirements for Electrical Engineering. The discipline requirements consist of 60 credits (34.3% of total 175 credits), which are satisfied by completing twenty (20) courses, as listed in Table 3. Sixteen (16) of these courses are interdisciplinary courses (coded by CVEN, CMPN, ELCN, INTN, MEPN, MTHN, PHYN), which are equivalent to 48 credits (27.4%). All the discipline core courses are compulsory.

Table 3 Compulsory Courses of Discipline Requirements: Electrical Engineering (60 credits, 34.3% of total 175 credits)

	Code	Course Title	Credits
1	CMPN101	Logic Design-1	3
2	CMPN102	Data Structures and Algorithms	3
3	CMPN103	Programming Techniques	3
4	CMPN201	Microprocessor Systems-1	3
5	CVEN125	Civil Engineering	3
6	ELCN120	Electronics-1: Fundaments of Electronic Components and Logic Gates	3

	Code	Course Title	Credits
7	ELCN104	Circuit Analysis	3
8	ELCN105	Advanced Circuit Analysis	3
9	ELCN202	Electronics-2: Advanced Electronic Circuits	3
10	ELCN203	Signal Analysis	3
11	ELCN306	Communications-1: Analogue Communications	3
12	EPMN100	Basic Laboratory	3
13	EPMN111	Electrostatics and Magnetostatics	3
14	EPMN203	Time Varying Field Applications	3
15	EPMN212	Electrical Measurements	3
16	INTN125	Mechanical Engineering	3
17	MEPN219	Mechanical Power Engineering	3
18	MTHN103	Differential Equations	3
19	MTHN201	Numerical Analysis	3
20	PHYN102	Modern Physics	3

6.5 Major Requirements

The program offers a major specialty in Electrical Energy Engineering which requires the successful completion of at least 51 credits (29.1% of total 175 credits), which are satisfied by completing fourteen (14) courses as follows:

1. Thirteen (13) compulsory courses equivalent to 36 credits (20.5%), as listed in Table 4.
2. Five (5) elective courses equivalent to 15 credits (8.5%), as listed in Table 5. Subject to the academic advisor (AA) approval, the student should select at least one (1) course from set A or set B equivalent to 3 credits and at most four (4) courses from set B or set A equivalent to 12 credits, respectively.
   Possibilities are: one (1) course from set A and four (4) courses from set B or two (2) courses from set A and three (3) courses from set B or three (3) courses from set A and two (2) courses from set B or four (4) courses from set A and one (1) course from set B.

Table 4 Compulsory Courses of Major Requirements: Electrical Energy Engineering (36 credits, 20.5% of total 175 credits)

	Code	Course Title	Credits
1	EPMN201	Microprocessors Electric Energy Applications	3
2	EPMN301	Electrical Machines-1	3
3	EPMN302	Elements of Power Systems	3
4	EPMN313	Control Systems	3
5	EPMN304	Electrical Machines-2	2
6	EPMN305	Power System Protection	2

	Code	Course Title	Credits
7	EPMN306	Power Electronics	3
8	EPMN307	Energy Conversion	2
9	EPMN308	Digital Control Systems	3
10	EPMN309	Power Electronics Systems	3
11	EPMN401	Electrical Machines Drives	3
12	EPMN402	Power System Analysis	3
13	EPMN403	High Voltage Technology	3

Table 5 Elective Courses of Major Requirements: Electrical Energy Engineering (15 credits, 8.5% of total 175 credits)

	Code	Course Title	Credits	Group
A-1	EPMN411	Power Quality	3	E-2(1)
A-2	EPMN412	Electrical Power Distribution	3	
A-3	EPMN413	Energy Conservation	3	
A-4	EPMN414	Smart Power Grid	3	
A-5	EPMN415	Power System Planning	3	
A-6	EPMN416	Power Stations	3	
A-7	EPMN417	Renewable Energy Systems	3	
A-8	EPMN418	Power System Switchgear	3	
A-9	EPMN419	Protection and Digital Relaying	3	
A-10	EPMN423	Electrical Installation	3	
A-11	EPMN428	Power System Operation and Control	3	
A-12	EPMN429	Environmental Impact of Electricity	3	
B-1	EPMN420	Electrical Machines Design	3	
B-2	EPMN421	Special Electrical Machines	3	
B-3	EPMN422	Superconductor Applications	3	
B-4	EPMN424	Mechatronics	3	
B-5	EPMN425	Process Control and Robotics	3	
B-6	EPMN426	Computer Control in Energy Systems	3	
B-7	EPMN427	Intelligent Control	3	
B-8	EPMN430	Operations Research	3	

Remarks:

(1) Student selects at least five (5) courses from group E-2 equivalent to 15 credits subject to the AA approval

6.6 Conformity to SCU Requirements

The classification and categorization of the courses offered by the Electrical Energy Engineering program follow the guidelines provided by the Supreme Council of Universities (SCU), as shown in Table 6. The classification is based upon the "Sample Study Plan and Course Sequence" described in Section 7. The categorization is given for the following five student levels according to the regulations of the credit hours system of education at the Faculty of Engineering, Cairo University:

- **Freshman**: a student who completed less than 36 credits
- **Sophomore**: a student who completed more than 35 credits but less than 72 credits
- **Junior**: a student who completed more than 71 credits but less than 108 credits
- **Senior-1**: a student who completed more than 107 credits but less than 144 credits
- **Senior-2**: a student who completed more than 143 credits

Table 6 Conformity to Supreme Council Criterion

Category	Freshman	Sophomore	Junior	Senior-1	Senior-2	Total Credits	%
Humanities and Social Sciences	3	2	2	4	8	19	10.86
Math and Basic Sciences	25	15	2	1	0	43	24.57
Basic Engineering Sciences	4	9	18	6	2	39	22.29
Computer Application	1	6	4	5	3	19	10.86
Applied Engineering Sciences	2	5	6	16	9	38	21.71
Project and Practice	0	1	4	6	6	17	9.71
Total	35	38	36	38	28	175	100
University Requirements	5	2	2	4	6	١٩	10.86
College Requirements	30	6	2	3	4	45	25.7
Discipline Requirements	0	30	24	6	0	٦٠	34.3
Major Requirements	0	0	8	25	١٨	٥١	29.1
Total	35	38	36	38	28	175	100

The EEE program consists of 67 courses: 59 compulsory courses (154 credits) and 8 elective courses (21 credits). The total 175 credits of the program are distributed between lectures (LEC) and tutorials (TUT), where a tutorial is classified as a problem-solving session (PSS) and/or a practical work/laboratory session (PLS). The one credit of a tutorial corresponds to 2-3 hours to provide sufficient practical training for the students. Thus, the total contact hours of learning are 279 hrs.

7. SAMPLE STUDY PLAN and COURSE SEQUENCE

A sample study plan for the EEE program is presented as one recommended sequence to complete the graduation requirements of the bachelor program over 10 main semesters, the Fall and Spring semesters per academic year. Since the program is based on the credit hours system of education, the student does not have to take the courses during the semester indicated in the study plan as long as the course prerequisites are satisfied.

The EEE curriculum encourages students to interact with the industrial sector and government agencies by offering two industrial training courses in at least two summer sessions. Also, the curriculum gives the student the opportunity to select courses from a number of electives. The students will be trained on teamwork and be exposed to projects about Electrical Energy Engineering during their practical training and graduation projects.

Freshman Year Course Schedule

	Semester-1: Fall		Semester-2: Spring	
	Course Code	CR	Course Code	CR
1.	MECN001	2	MECN002	2(1)
2.	MTHN001	3	CHEN001	3
3.	MTHN002	3	MTHN003	3(2)
4.	PHYN001	3	PHYN002	3
5.	MDPN001 OR MDPN002	3 OR 3	MDPN002 OR MDPN001	3 OR 3
6.	GENN001 OR GENN005	1 OR 2	GENN005 OR GENN001	2 OR 1
7.	GENN004 OR GENN003	2 OR 2	GENN003 OR GENN004	2 OR 2
Semester Credit Hrs		18 or 17		18 or 17

Remarks:

(1) Course MECN002 has a prerequisite course MECN001

(2) Course MTHN003 has a prerequisite course MTHN002

EEE Program Study Plan

	Semester-3: Fall		Semester-4: Spring		Semester-5: Fall		Semester-6: Spring	
	Course Code	CR	Course Code	CR	Course Code	CR	Course Code	CR
1.	MTHN102	3	CMPN102	3	GENN201	2	EPMN307	2
2.	CMPN101	3	ELCN105	3	ELCN120	3	EPMN301	3
3.	MTHN103	3	MTHN203	3	CVEN125	3	EPMN302	3
4.	CMPN103	3	PHYN102	3	EPMN203	3	ELCN203	3
5.	ELCN104	3	EPMN100	3	EMPN212	3	MTHN201	3
6.	INTN125	3	EPMN111	3	CMPN201	3	ELCN202	3
7.					----------	-----	EEEN280	1
8.	----------	------			----------	------	EEEN281(0)	1
Semester Credit Hrs		18		18		17		18+1(0)

	Semester-7: Fall		Semester-8: Spring		Semester-9: Fall		Semester-10: Spring	
	Course Code	CR	Course Code	CR	Course Code	CR	Course Code	CR
1.	EPMN201	3	MEPN219	3	EPMN403	3	GENN3XX(1)	2
2.	EPMN313	3	EPMN308	3	GENN3XX(1)	2	EEEN481	3
3.	EPMN304	2	ELCN306	3	GENN3XX(1)	2	EPMN4XX(2)	3
4.	EPMN305	2	EPMN4XX(2)	3	EEEN480	1	EPMN4XX(2)	3
5.	EPMN306	3	EPMN4XX(2)	3	EPMN402	3	EPMN4XX(2)	3
6.	GENN224	2	EPMN309	3	EPMN401	3		
7.	EEEN380	1	EEEN381(0)	2	GENN210	2	----------	------
8.	GENN102	2					----------	------
Semester Credit Hrs		18		18+2(0)		16		14

Remarks:

(0) Industrial training courses to be completed in the summer sessions

(1) General elective course (group E-1, 2 credits per course): GENN301, GENN310, GENN311, GENN321, GENN326, GENN327, GENN331, GENN332

(2) Major elective course (group E-2, 3 credits per course):
Set A: EPMN411, EPMN412, EPMN413, EPMN414, EPMN415, EPMN416, EPMN417, EPMN418, EPMN419, EPMN423, EPMN428, EPMN429
Set B: EPMN420, EPMN421, EPMN422, EPMN424, EPMN425, EPMN426, EPMN427, EPMN430

8. COURSE CONTENTS

8.1 University-Core Courses

GENN001	**Humanities and Engineering** **Compulsory, Credits: 1 (1+0+0)** **Prerequisite(s): none** History of Technology: Engineering and technology in a cultural, social, and historical context. Development of technology as a key to history of civilization in a comparative perspective - Exploring Humanities: Modes of thought found within humanities and social sciences. Humanities for Engineers: Humanities themes of increased complexity - Different work methodologies - Critical analysis of information & choice of argumentation - Work methodologies and pedagogical interest.
GENN004	**Computers for Engineers** **Compulsory, Credits: 2 (1+0+3)** **Prerequisite(s): none** Developing basic concepts of algorithmic thinking to solve problems of relevance in engineering practice and implementing these algorithms using high-level computer language. Using data types, input/output commands, loops, control structures, functions, arrays, and other programming language constructs in a computer program. Evaluating and interpreting the results of programming work.
GENN005	**Technical Writing** **Compulsory, Credits: 2 (2+0+0)** **Prerequisite(s): GENN002 + 28 credits** Discovering and outlining ideas. Organizing outlines. Ways To begin the three parts of technical writing. Writing abstracts, summaries, and conclusions of long reports. The thesis statement. Forms: letters, memos, reports, scientific articles, job description, CV, references and footnotes. Selection of key words, titles, and subtitles. Editing, revising and proof-reading techniques. Electronic word processing and technical writing, vocabulary building, and basic types and patterns of argument.
GENN102	**Fundamentals of Management** **Compulsory, Credits: 2 (2+0+0)** **Prerequisite(s): 28 credits** Introduction to management, Historical view and evolution of concepts. Basic Managerial Functions: Planning, Strategies, Objectives, MBO; Organizing, Departmentation, Job Description; Elements of Human Resource Management: Staffing, Directing, Controlling. Total Quality Management, Continuous Improvement. Engineering Applications.
GENN201	**Communication and Presentation Skills** **Compulsory, Credits: 2 (1+1+0)** **Prerequisite(s): GENN005** Analyzing the audience. Selecting presentation topics and objectives. Recognizing different types of speeches and presentations. Overcoming nervousness and developing confidence while addressing an audience.

	Researching and generating information for informative presentations. Chucking presentation content. Designing effective visual aids. Using explicit and effective transitions throughout a presentation. Creating benefit statements for persuasive presentations. Using persuasive devices such as pathos and logos in speeches. Planning and delivering informative, persuasive, entertaining and inspiring presentations. Handling question and answer sessions effectively.
GENN224	**Concepts of Economics and Accounting** **Compulsory, Credits: 2(2+0+0)** **Prerequisites (s): 42** The main objective of this course is to provide engineers with the basic concepts of Economics and Accounting where the engineer has to be able of conceiving a business' vision from financial & strategic dimensions alongside to his/her technical skills. The course includes introduction to financial accounting, overview of managerial accounting, and economic concepts. The financial accounting includes the accounting cycle and financial statements. It also includes financial ratios for measuring the organization's performance. The Managerial accounting and behavior of cost includes the cost volume relationships and its further use in Budgeting & Forecasting. Economic concepts are addressed in microeconomics & macroeconomics where microeconomics includes the basic principles of economics, theory, assumptions, and models of economics as a social science, it also includes market forces of supply and demand, and elasticity & its applications. Another important topic addressed in this part is the competitive markets where decisions regarding maximizing profit, shutting down or exiting the market are discussed through computational methods & formulas. Macroeconomics includes measuring the nation's income where it explains the gross domestic product (GDP), its components & types.
GENN210	**Risk Management and Environment** **Compulsory, Credits: 2 (2+0+0)** **Prerequisite(s): GENN102** Risk Management: Introduction. Risk Definition. Basic Axioms Behind Risk Management. Systemic Approach to Handling Risk . Principle of Risk Management: Identification of Risks. Preliminary Risk Analysis (PRA). Risk Assessment. Risk Evaluation. Risk Control. Hierarchies of Control. Monitoring and Reviewing. Documentation. Study of a practical problem in which the student applies Basic Risk Management Environment: Environmental Systems: Local, Regional and Global. Influence of Air Pollutants on the, Environment, Water Pollutants, Industrial Waste, Hazardous Wastes, Management of Pollutant Releases, Pollution Prevention, Recycling of Waste Materials, Waste Treatment Technologies, Ultimate Disposal of Wastes, Water Treatment Technologies. Control of Air Pollution, Contaminated Land and Its Reclamation, Principals and Uses of the Environmental Risk Assessment, Environmental Risk Assessment Methodology, Environmental Impact

	Assessment Environmental Health Risk Assessment. National and International regulations**.**
GENN301	**Ethics and Legislation** **Elective (group E-1), Credits: 2 (1+1+0)** **Prerequisite(s): 80 credits** Engineering profession: Ethical issues in engineering practice. Conflicts between business demands and professional ideals. Social and ethical Responsibilities of Technologists. Codes of professional ethics. Case studies. Value Crisis in contemporary society. Nature of values: Psychological values, Societal values, Aesthetic values, Moral and ethical values. Work ethics and professional ethics. The legal rule: Mandatory and complementary. Sources of Law. Formal sources: Statutory Law, Custom, the Principles of natural Law and rules of justice. Informal sources: Jurisprudence, Doctrine. Application of Law. Holders of right; Natural persons, Juristic persons. Theory of Obligation; definition, forms. Sources of Obligations. Labor Law. Safety and Vocational Laws. The contract; Parties, Formation, Validity, Effect, Interpretation, Responsibilities, Dissolution, and compensation of Damage. Contracts.
GENN303	**Critical Thinking** **New GEN ELECTIVE, 2 (2+0+0)** **Prerequisite(s): GENN003** The aim of the course is to apply critical thinking in the context of problem solving in the engineering field. Critical thinking and abstract thought are invaluable tools, which complement an engineer's technical expertise. Critical Thinking is the intellectually disciplined process of actively and skillfully conceptualizing, applying, analyzing, synthesizing, and/or evaluating information gathered from, or generated by, observation, experience, reflection, reasoning, or communication, as a guide to belief and action. The following terms and applications are also discussed: Analysis, breaking down the problem into parts and finding the relationships between them; Synthesis, thinking about other ways to solve the problem either by incorporating new information or combining the parts in a different way; and finally, Evaluation is making a judgment about the results using the evidence at hand.

GENN305	**Multidisciplinary Project-MP** **Elective (group E-1), Credits: 2 (0+0+0)** **Prerequisite(s): 108 credits** The course aims to give students more space for creativity, out of the box thinking, interdisciplinary /&/or multidisciplinary collaboration and involvement in team work. It's a free specialization course where the subject is to be determined by the student team. The team consists of maximum 6 students and minimum of 4 students. A maximum of two students of the same credit hour program can be members of the same student team. The team shall register the topic of the project with the course coordinator and follow up with him/her at least 3 times during the semester. No mid-term Exam for the course, instead all 60 grades will be allocated on the semester's work and the final Exam jury will be nominated by the course coordinator depending on the project subject, but not necessarily on the student(s) cr. Hr. program. The course is graded as a normal graded course.
GENN310	**Advanced Risk Management** **Elective (group E-1), Credits: 2 (1+1+0)** **Prerequisite(s): GENN210 + MTHN203** Review of the Basic Risk Axioms and Concepts. Evolution of Risk Concepts and Terminology. Financial and Industrial Risk: Comparison and Contrast. Probabilistic Nature of Risk.. System Decomposition. Legal and Regulatory Risks. Tools for Risk Assessment: Probability and Consequences: Event Tree, Fault Tree, FMECA, FEMEA, MOSAR (The French Approach), Simulation, Optimization and Operations Research. HACCP: principles and applications. HAZOP.Qualitative and Quantitative Risk Assessments (QRA). Quantitative Risk Assessment: Qualitative Aspects of System Analysis (Quantification of Basic Events. Confidence Interval. Quantitative Aspects of System Analysis. System Quantification for Dependent Events. Human Reliability. Uncertainty Quantification). Operational Risk. Reporting Risk Operations. Sectoral Risk Management. Specific Risk Topics: Risk Specific to Confined Spaces. The Special Case of BLEVE and Explosive Mixtures. Social and Psychological Risk. Social Risk Management and Social Protection. Disaster Risk Management and Vulnerability Reduction. Can Risk be a Management Style?

GENN311	**Technical Writing in Arabic** **Elective (group E-1), Credits: 2 (1+1+0)** **Prerequisite(s): GENN005 + 80 credits** Review of the Basics of Arabic Grammar and Mechanics. Writing Effective Sentences and Paragraphs Using Arabic Language. Discovering and Outlining Ideas. Writing Abstracts, Summaries, and Conclusions of Long Reports. The thesis Statement. Writing Technical Forms Using Arabic Language: Letters, Memos, Reports, Scientific Articles, Job Description, CV. Writing References and Footnotes. Selection of Key Words, Titles and Subtitles. Editing, Revising and Proofreading Techniques. Electronic Word Processing and Technical Writing. Integrating Graphs, Tables and Charts in Technical Documents. Vocabulary Building. Basic Types and Patterns of Argument: Terminology, Building Sub-Arguments of Fact and Policy. مراجعة أسس القواعد النحوية و ميكانيكيات اللغة العربية - الأخطاء الشائعة فى استخدامات اللغة العربية - كتابة جمل وفقرات صحيحة وفعالة باستخدام اللغة العربية - خلق الأفكار (التفاكر) - كتابة مقدمات، ملخصات و خاتمات التقارير - كتابة الأبحاث - أشكال الكتابة باللغة العربية: الرسائل، المذكرات، التقارير، المقالات العلمية، الوصف الوظيفي، كتابة السيرة الذاتية وتوثيق المراجع - اختيار الكلمات المفتاحية و كذلك العناوين الرئيسية والفرعية - التعرف على تقنيات التحرير و المراجعة و القراءة الاحترافية - إمكانية معالجة النصوص والكتابة الإليكترونية - الرسوم و الجداول و المخططات البيانية في الوثائق الفنية - بناء حصيلة لغوية من الكلمات والمفردات - تعلم الانماط و الأساليب الأساسية والمبدئية للنقاش من حيث المنهجية والبناء.
GENN321	**Foreign Language** **Elective (group E-1), Credits: 2 (1+1+0)** **Prerequisite(s): GENN201** Emphasizing the development of student's communicative skills to speak, listen, read and write in languages other than Arabic and English, such as French, German, Spanish, Italian, Japanese, Chinese, etc, and to study cultural characteristics of such foreign languages from historical, geographical, literature, economic, and social viewpoints. Topics include, but not limited to, the basics of language grammar and mechanics, writing effective sentences and paragraphs, vocabulary building, writing technical engineering documents and writing technical forms: letters, memos, reports, scientific articles, job description, resumes and curriculum vitas.
GENN326	**Marketing** **Elective (group E-1), Credits: 2 (1+1+0)** **Prerequisite(s): GENN102 + 80 credits** Introduction. The Field of Sales; Strategic Sales Force Management. The Personal Selling Process and Sales Force Organization. Profiling and Recruiting Salespeople; Selecting and Hiring Applicants, Developing the Sales Program, Sales Force Motivation, Sales Force Compensation, Expenses and Transportation; Leadership of a Sales Force, Forecasting Sales and Developing Budgets; Sales Territories, Analysis of Sales Volume, Marketing Cost & Profitability Analysis, Performance Evaluation; Ethical and Legal Responsibilities tender writing.

GENN327	**Selections of Life-Long Skills** **Elective (group E-1), Credits: 2 (1+1+0)** **Prerequisite(s): GENN201** Communicating Clearly - Managing Time and Resources - Making Decisions - Delegating Successfully - Motivating People - Managing Teams - Negotiating Successfully - Minimizing Stress - Getting Organized - Managing Changes - Interviewing People - Managing Your Career - Balancing Work and Life - Thinking Creativity and Innovation - Influencing People – Systems Thinking – Interpersonal Management Skills – Entrepreneurial Skills.
GENN328	**Scientific Research Methods** **Elective (group E-1), Credits: 2 (0+0+0)** **Prerequisite(s): 108 credits** Course covers the process of scientific knowledge and practical implementation, underlying research methodology issues. To develop a critical and questioning mindset, critical understanding of issues related to research questions, literature review, methodological design, data collection, analysis and conclusion. Moving you toward fulfillment of the publication and dissertation requirements, perhaps will turn you into a 'Researcher'. All of which to use content to solve technical, practical, and life problems.
GENN331	**Business Communication** **Elective (group E-1), Credits: 2 (1+1+0)** **Prerequisite(s): GENN201** Skills for effective communication in the workplace; constructing and delivering persuasive business presentations; theoretical and experiential knowledge of argumentation and debate for informal and formal presentations; style, layout, and convention of business writing; writing business proposals, progress reports, and feasibility reports; common areas of miscommunication.
GENN332	**Service Management** **Elective (group E-1), Credits: 2 (1+1+0)** **Prerequisite(s): GENN102 + 80 credits** Role of services in the economy, The nature of services, Service quality, Service Strategy, Developing new services, The role of technology in supporting service delivery, Design of services, Capacity planning and managing queues, Quantitative methods for service management.

8.2 College-Core Courses

CHEN001	**Chemistry** **Compulsory, Credits: 3 (2+0+3)** **Prerequisite(s): none** Gases; Applications to gaseous law; Mass balance and heat balance in combustion processes of fuels; Solutions & separation techniques; Applications to electrochemistry; Corrosion; Water treatment; Building

	materials; Environmental Engineering; Selected chemical industries: fertilizers, dyes, polymers, sugar, petro-chemicals, semi-conductors, oil and fats, industrial systems; Chemical Vapor deposition.
GENN003	**Basic Engineering Design** **Compulsory, Credits: 2 (٢+٠+0)** **Prerequisite(s): none** Introduction to Design: Problem description and Introduction to Internet communication - Project Management: Project Management Application, Problem Solving Techniques: Problem Definition, Design Constraints - Creative Thinking and Problem Solving: Introduction to critical and creative thinking, nature of design problems - Brainstorming seminar, list of possible and impossible solutions and generating Ideas - Creative Thinking and Decision making: Product life cycles , Selection of idea (s), Final decision matrix, Justify decision - The Design Matrix: Context, purpose and requirements of engineering design - Analyze selected solution/preliminary design - Automated Design & the Positive Attitudes for Creativity - Systematic generation and evaluation of ideas.
MDPN001	**Engineering Graphics** **Compulsory, Credits: 3 (1+٤+٠)** **Prerequisite(s): none** Techniques and skills of engineering drawing, normal and auxiliary projections. Solid geometry. Intersections between planes and solids. Development, sectioning. Drawing and joining of steel frames. Assembly drawing of some mechanical parts. Drawing of Architectural projections and reading of blueprints.
MDPN002	**Fundamentals of Manufacturing Engineering** **Compulsory, Credits: 3 (2+٠+٣)** **Prerequisite(s): none** Engineering Materials - Elements of Manufacturing Processes, material flow, energy flow and information flow - Forming in the liquid state, Casting and molding processes - Forming in the solid state, metal forming, forming of plastics and powder metallurgy - Material Joining processes, welding, soldering and brazing, riveting, joining by mechanical elements, assembly processes - Material removal processes, metal cutting and finishing processes - Computer applications in manufacturing - Term mini-project.
MECN001	**Mechanics-1 (Statics)** **Compulsory, Credits: 2 (1+٠+٣)** **Prerequisite(s): none** Statics of particles, forces in three-dimensions, vector algebra; equivalent systems of forces, resultant of a group of forces, moments of forces, moment of a couple, reduction of a system of forces, wrench; equilibrium of rigid bodies in two dimensions, reactions at supports and connections for a 2D structure, 2D trusses, equilibrium of rigid bodies in three dimensions, reactions at supports and connections for a three dimensional structure; centroids and centers of gravity, center of gravity of 2D bodies, centroids of areas and lines, first moments of areas and lines, composite plates and wires; moments of inertia, moments of inertia

	of areas, second moment, or moment of inertia of an area, polar moment of inertia, radius of gyration of an area, parallel-axis theorem, moments of inertia of composite areas, product of inertia, principal axes and principal moments of inertia, moments of inertia of masses, moment of inertia of a mass, parallel axis theorem, moments of inertia of thin plates, moments of inertia of composite bodies, mass product of inertia, principal axes and principal moments of inertia.
MECN002	**Mechanics-2 (Dynamics)** **Compulsory, Credits: 2 (1+٠+٣)** **Prerequisite(s): MECN001** Kinematics of particles: rectilinear motion of particles, position, velocity and acceleration, uniform rectilinear motion, uniformly accelerated rectilinear motion, curvilinear motion, derivatives of vector functions, rectangular components of velocity and acceleration, relative motion, tangential and normal components of acceleration, motion of a particle in a circular path, velocity and acceleration of a particle in polar coordinates. Kinetics of particles: Newton's second law, linear momentum of a particle, equations of motion with applications in Cartesian coordinates, tangential and normal directions, polar coordinates, free vibrations of particles, simple harmonic motion; energy & momentum methods, work of a force, kinetic energy of a particle, principle of work and energy, applications, power and efficiency, potential energy, conservation of energy, principle of impulse and momentum, impulsive motion, impact, direct central impact and coefficient of restitution, oblique central impact.
MTHN001	**Introduction to Linear Algebra and Analytic Geometry** **Compulsory, Credits: 3 (2+3+0)** **Prerequisite(s): none** Matrix algebra, determinants, inverse of a matrix, row equivalence, elementary matrices, solutions of linear systems of equations; parabola, ellipse and hyperbola, eccentricity and conic sections; quadratic equations; solid geometry, line, plane, quadratic surfaces.
MTHN002	**Calculus I** **Compulsory, Credits: 3 (2+3+0)** **Prerequisite(s): none** Functions, graphing of functions, combining functions, trigonometric functions; limits and continuity; differentiation; inverse functions; exponential and logarithmic functions; inverse trigonometric functions; hyperbolic and inverse hyperbolic functions; indeterminate forms and L'Hopital's rule; Taylor and Maclaurin expansions.
MTHN003	**Calculus II** **Compulsory, Credits: 3 (2+3+0)** **Prerequisite(s): MTHN002** Anti-derivatives; indefinite integrals; techniques of integration; definite integrals, applications of definite integrals; functions of several variables; partial derivatives, applications for partial derivatives.
MTHN102	**Multivariable Calculus and Linear Algebra**

	Compulsory, Credits: 3 (2+3+0) **Prerequisite(s): MTHN001 + MTHN003** Double integrals, double integrals in polar coordinates; triple integrals, triple integrals in spherical and cylindrical coordinates; applications of double and triple integrals; line and surface integrals; vector analysis, gradient of a scalar function, divergence of a vector, curl of a vector, divergence and Stokes' theorems, vector identities; LU-factorization; vector spaces; inner product spaces; eigenvalues and eigenvectors; diagonalization of matrices; functions of matrices.
MTHN203	**Probability and Statistics** **Compulsory, Credits: 3 (2+3+0)** **Prerequisite(s): MTHN102** Probability axioms; probability laws; conditional probability; random variables; discrete and continuous distributions; joint distribution; computer simulation; sampling; measures of location and variability; parameter estimation, testing of hypothesis.
PHYN001	**Mechanics, Oscillations, Waves and Thermodynamics** **Compulsory, Credits: 3 (2+٠+٣)** **Prerequisite(s): none** Physics and measurements; elastic properties of solids; universal gravitation and motion of planets; fluid mechanics (statics and dynamics); oscillatory motion; wave motion, sound waves; thermo-dynamics, temperature, heat and the first law of thermodynamics, the kinetic theory of gases, heat engines, entropy and the second law of thermodynamics. Laboratory experiments on course topics.
PHYN002	**Electricity and Magnetism** **Compulsory, Credits: 3 (2+٠+٣)** **Prerequisite(s): none** Electric field; Gauss' law; electrostatic potential; capacitance and dielectrics; current and resistance; direct current circuits; magnetic fields, sources of magnetic field; Faraday's law; Maxwell's equations; inductances; magnetic properties of matter. Laboratory experiments on the course topics.
EEEN280	**Engineering Seminar** **Compulsory, Credits: 1 (1+0+0)** **Prerequisite(s): 72 credits + AA Approval** 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.*
EEEN380	**Electrical Energy Engineering Seminar** **Compulsory, Credits: 1 (1+0+0)** **Prerequisite(s): EEEN280 + GENN201** Students will be required to present seminars on a subject assigned to (or chosen by) them about the latest technology relevant to the program.

	The grade depends on organization, quality, and content of both the presentation and the report prepared by the student. *The course is graded as Pass/Fail grade-system.*
EEEN281	**Industrial Training-1** **Compulsory, Credits: 1 (0+0+0)** **Prerequisite(s): 72 credits + AA Approval** Training on industrial establishments relevant to the program. Training lasts for total of 90 hours, during a period about three weeks. The program training advisor schedules at least one follow 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.*
EEEN381	**Industrial Training-2** **Compulsory, Credits: 2 (0+0+0)** **Prerequisite(s): EEEN281 + 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 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.*
EEEN480	**Graduation Project-1** **Compulsory, Credits: 1 (0+0+3)** **Prerequisite(s): 130 credits + AA Approval** Students undertake a major project as part of the program. The aim of the project is to provide the students, who work in groups, with an opportunity to implement appropriate concepts and techniques to a particular design. Students are required to select and research the expected project to be designed and implemented in the following course Graduation Project-2. The student should give an oral presentation to be approved. *The course is graded as Pass/Fail grade-system.*
EEEN481	**Graduation Project-2** **Compulsory, Credits: 3 (1+0+6)** **Prerequisite(s): EEEN480 + AA Approval** All students undertake a major project as part of the program. The aim of the project is to provide the students, who work in groups, with an opportunity to implement the appropriate concepts and techniques to a particular design. A dissertation on the project is submitted on which the

	student is examined orally.

8.3 Discipline Courses

CMPN101	**Logic Design-1** **Compulsory, Credits: 3 (2+1+2)** **Prerequisite(s): PHYN002** Number systems and data representation - Boolean algebra - simplification of Boolean functions - logic gates - combinational and sequential logic circuits – Registers, counters, and adders – Memory
CMPN102	**Data Structures and Algorithms** **Compulsory, Credits: 3 (2+1+2)** **Prerequisite(s): MTHN003 + GENN004 + CMPN103** 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
CMPN103	**Programming Techniques** **Compulsory, Credits: 3 (2+1+2)** **Pre-requisites: MTHN003 + GENN004** 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.
CMPN201	**Microprocessor Systems-1** **Compulsory, Credits: 3 (2+1+2)** **Prerequisite(s): CMPN101** 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
CVEN125	**Civil Engineering** **Compulsory, Credits: 3 (2+2+1)** **Prerequisite(s): MECN001** Buildings: types of buildings, items within a building, types of foundations, building materials with emphasis on concrete and testing, insulation against heat moisture, noise and pollution, Principles of fire protection, tender document. Surveying: Principles & applications of surveying sciences with emphasis on plane surveying, Popular techniques and engineering uses of distance, angles and height difference measurements. Applications of mapping, earthwork computations, setting out engineering structures, Integrated

	digital surveying and mapping using total station, Internet resources. Structures: Types of structures, loads, supports, reactions, internal forces, analysis of beams, frames, trusses. Beams subjected to moving loads.
ELCN120	**Electronics-1: Fundamentals of Electronic Components and Logic Gates** **Compulsory, Credits: 3 (2+3+0)** **Prerequisite(s): ELCN104 + PHYN102** Physical and electrical characteristics of the major semiconductor devices. Various basic circuits in which these devices are used are analyzed. Semiconductors, semiconductor diode. Diode circuits, wave shaping applications, MosFETS, dc analysis of MOS transistor circuit and basic application, MosFETs circuits, analyzes and designs fundamental MOS transistor circuits, including amplifiers, BJTs, dc analysis of bipolar transistor circuits, and discusses basic applications of this transistor, BJT circuits, Frequency response of both MOS and bipolar transistor circuits.
ELCN104	**Circuit Analysis** **Compulsory, Credits: 3 (2+3+0)** **Prerequisite(s): MTHN003** Resistive circuits - Network theorems- Analysis of circuits with AC excitation in the time domain – Analysis of AC circuits in the frequency domain – AC circuit analysis using Phasor Diagram – Analysis of AC circuits using circuit theorems – Maximum power transfer – RLC circuits – Magnetically coupled circuits – Active and Reactive Power definitions – power factor definition - Three phase balanced circuits.
ELCN105	**Advanced Circuit Analysis** **Compulsory, Credits: 3 (2+3+0)** **Prerequisite(s): ELCN104 + MTHN102** Series and parallel resonant circuits, Application on passive filters, two port circuits, Fourier and harmonic analysis, Application of Laplace transforms to circuit analysis, Circuit synthesis, Three phase unbalanced circuits, active filters.
ELCN202	**Electronics-2: Advanced Electronic Circuits** **Compulsory, Credits: 3 (2+2+1)** **Prerequisite(s): ELCN120** Designs and applications of basic electronic circuits, including power amplifiers and various output stages using MOSFETs and BJTs. Operational Amplifiers: feedback, op-amp circuit analysis, application circuits (e.g. followers, amplifiers, integrators, differentiators, summers, differential amplifiers, power amplifiers, instrumentation amplifiers, active rectifiers, comparators, Schmitt triggers, relaxation oscillator, and active filters). Non-ideal effects in op-amps and effects on performance. Multistage amplifier designs. Voltage regulators.
ELCN203	**Signal Analysis** **Compulsory, Credits: 3 (2+3+0)** **Prerequisite(s): ELCN104 + MTHN102**

	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
ELCN306	**Communications-1: Analogue Communications** **Compulsory, Credits: 3 (2+2+1)** **Prerequisite(s): ELCN203 + MTHN203** All Types of AM (DSB-LC, DSB-SC, SSB, VSB, QAM) – AM modulators, and demodulators, advantages and disadvantages-Synchronization circuits - AM applications: Telephone channel multiplexing and superheterodyne receiver -Angle Modulation - Narrow band angle modulated signals - Spectrum of sinusoidal signal (N.B and W.B) - Generation of wide band FM (Indirect and Direct methods)-Demodulation (slope detector, PLL) - De-emphasis and pre-emphasis filtering -compatible stereo - Intersystem comparison – Sampling process – PAM – Quantization (uniform and non-uniform) – PCM – Time division multiplexing – Delta, and adaptive delta modulation – Differential PCM – random process – Stationary and ergodic processes – Mean, correlation, and covariance functions – Power spectral density – Narrow band noise.
EPMN100	**Basic Laboratory** **Compulsory, Credits: 3 (2+0+2)** **Prerequisite(s): ELCN104** Electronic components (resistors, capacitors, inductors, diodes), Use of measuring instruments such as multi-meters and oscilloscopes, Construction and debugging of simple electric circuits, Soldering of components, Basic analog electronic components (LEDs, transistors, MOSFETs, op amps), Basic digital electronic components (inverters, counters, flip flops, shift registers, digital to analog converters), Simple electric/electronic circuit projects
EPMN111	**Electrostatics and Magnetostatics** **Compulsory, Credits: 3 (2+3+0)** **Prerequisite(s): MTHN103 + PHYN002** Review of vectors analysis and vector algebra basics, vector calculus (divergence, gradient, curl, Laplacian), coordinate systems (cartesian, cylindrical and spherical). Electrostatics: Coulomb's law, Gauss's law (integral and differential forms, divergence), electric scalar potential (line integral, gradient), Laplace and Poisson's equations (Laplacian), conduction and

	polarization, boundary conditions on conductors and between dielectrics, method of images, resistance and capacitance. Magnetostatics: Biot-Savart law, Ampere's law (integral and differential forms, curl), magnetic vector potential, Lorentz force, magnetization, boundary conditions between magnetic materials, magnetic energy and inductance.
EPMN201	**Microprocessors Electric Energy Applications** **Compulsory, Credits: 3 (2+2+1)** **Prerequisite(s): ELCN202 + CMPN101** Introduction to computing. Microprocessors and Microcontrollers. Instruction set and Assembly language programming. Programming in C. Minimum system Hardware Configuration. Timer, Serial communication, and Interrupt programming. Display and Keyboard Interfacing. Signal conditioning. A/D and D/A conversion. Sensors and actuators Interfacing. Applications: Demand Side Management, Electric Machine Drives, Electric Vehicles, Renewable Energy applications, Digital protection. Laboratory experiments on the course topics.
EPMN203	**Time Varying Field Applications** **Compulsory, Credits: 3 (2+3+0)** **Prerequisite(s): PHYN102 + EPMN111** Time varying-fields, Faraday's law, Lenz's law, deducing the equivalent circuit of power transformers, Maxwell's equations, power flow and Poynting theorem, skin effect concept, computation of AC impedance, losses in ferromagnetic materials, complex permeability concept, electromagnetic shielding, proximity sensors, levitation and propulsion
EPMN212	**Electrical Measurements** **Compulsory, Credits: 3 (2+2+1)** **Prerequisite(s): EPMN100** Errors in measurements - Electronic measurement, Oscilloscopes - Signal generators - Noise sources and reduction techniques - Troubleshooting with instruments - Analog to digital converter, Electronic digital counters, Digital multi-meter - Temperature transducers, Mechanical Transducers, Optical transducers - Analog and Digital Signal Conditioning - Fiber optic in instrumentation, acoustic detectors – Partial discharge detection – High voltage measurements – High current measurements - Electromagnetic field meters. Laboratory experiments on the course topics.
EPMN301	**Electrical Machines-1** Compulsory, Credits: 3 (2+2+1) Prerequisite(s): ELCN105 + EPMN203 Introduction to Electrical Machines: Definition of motor and generator, Torque development and the concept of torque angle, Electro-magnetically induced emf. DC Machines: Main constructional features, Types of armature winding, Function of the commutator for motoring and generation action, Factors determining induced emf equation, Factors determining the

	electromagnetic torque, types of machines, back emf., Performance and characteristics of different types of DC motors, Conventional Speed control and starting, Applications of DC motors, Losses in a DC machines. Single-Phase Transformers: Introduction, Constructional features of a transformer, Working principle of a transformer, EMF equation, Transformer on no-load and its phasor diagram, transformer on load and its phasor diagram, Equivalent circuit, Losses in a transformer, Open circuit and short circuit test, Calculation for efficiency, condition for maximum efficiency, Auto transformers, Other types of transformers. Three-phase Transformers: Construction of three phase transformers, Types of three phase transformers (i.e., delta-delta, delta-star, star-delta and star-star), Conditions for parallel operation, On load tap changer, ON/OFF load tap changer. Difference between power and distribution transformer, Cooling techniques. Laboratory experiments on the course topics.
EPMN302	**Elements of Power Systems** **Compulsory, Credits: 3 (2+3+0)** **Prerequisite(s): ELCN104** Basic concepts of power systems – power system components – power system element modeling (transmission lines, transformers, etc.) – transmission line parameters – transmission line performance – per-unit system – symmetric components transformation – fault analysis
EPMN313	**Control Systems** **Compulsory, Credits: 3 (2+2+1)** **Prerequisite(s): MTHN103 + ELCN203** This is a fundamental course on modern control systems in continuous time. By completing this course, students should be able to model and analyze linear time-invariant systems in time and frequency domains. Also, students must be able to design compensators and state feedback controllers to achieve both transient and steady state specifications. The course syllabus includes: modeling simple electric and mechanical systems, transfer functions, state space models, block diagram simplification, transient response, error analysis, stability analysis, root locus, bode diagrams, compensator design, controllability, observability, state feedback, control applications using MATLAB. Laboratory experiments on the course topics
INTN125	**Mechanical Engineering** **Compulsory, Credits: 3 (2+1+2)** **Prerequisite(s): none** (Robotics) principles of Robot motion- degrees of freedom- motor control. Introduction to thermodynamics – heat transfer – air conditioning and ventilation systems – air filtering – calculation of thermal loads – fire alarm and fighting equipment – requirements specifications – acceptance criteria
MEPN219	**Mechanical Power Engineering**

	Compulsory, Credits: 3 (2+3+0) **Prerequisite(s): PHYN002** First law of thermodynamics and its applications – Second law of thermodynamics and its applications – Carnot cycle – Internal combustion engines – Steam power stations – Gas turbine plants – Cooling – Heat transfer (conduction, conviction, radiation) – Heat exchangers – Cooling of electrical equipment- Fluid properties and definitions – Statics of fluids – Basic concept of flow – Flow momentum and energy equations – Flow in pipes – Fluid applications: pumps, fans, and turbines.
MTHN103	**Differential Equations** **Compulsory, Credits: 3 (2+3+0)** **Prerequisite(s): MTHN003** 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.
MTHN201	**Numerical Analysis** **Compulsory, Credits: 3 (2+2+1)** **Prerequisite(s): MTHN102 + MTHN103** 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
PHYN102	**Modern Physics** **Compulsory, Credits: 3(2+2+1)** **Prerequisite(s): PHYN001 + PHYN002** Introduction to quantum physics; Quantum mechanics; Atomic Physics; Molecules and solids; energy states and spectra of molecules, bonding in solids, introduction to crystalline properties of semiconductors, free electron theory of metals, band theory of solids, electrical conduction in metals, insulators and semiconductors, superconductivity. Pn junction diode, Zeener diode and tunnel diode

8.4 Major Courses: EEE

EPMN304	**Electrical Machines-2** Compulsory, Credits: 2 (1+2+1) Prerequisite(s): EPMN301 Synchronous Machines: Main constructional features of commutator and brushless excitation system, Generation of three phase emf, Production of rotating magnetic field in a three phase winding, Concept of distribution factor and coil span factor and emf equation, Armature reaction, unity power factor, lag and lead power factor, Operation of single synchronous machine independently, Voltage regulation, Necessary conditions of parallel operation of alternators, Synchronizing an alternator, Operation of synchronous machine as a motor, Effect of change in excitation of a synchronous motor, Applications of synchronous machines (as an alternator, as a synchronous condenser, etc) Three-Phase Induction Motors: Salient constructional features of squirrel cage and slip ring 3-phase induction motors, Principle of operation, slip and its significance, Locking of rotor and stator fields, Rotor resistance, inductance, emf and current, Relationship between copper loss and the motor slip, Power flow diagram of an induction motor, Factors determining the torque, Torque-slip curve, stable and unstable zones, Effect of rotor resistance upon the torque slip relationship, Double cage rotor motor and its applications, Starting of 3-phase induction motors, DOL, star-delta, auto transformer, Causes of low power factor of induction motors, Testing of 3-phase motor on no load rotor test and find efficiency. Single-Phase Induction Motors: Construction, Theory of Operation, Effect of Main and Auxiliary windings characteristics on starting, Applications Laboratory experiments on the course topics
EPMN305	**Power System Protection** **Compulsory, Credits: 2 (1+2+1)** **Prerequisite(s): EPMN302** Introduction to protective relaying - Power system bus configurations - Elements of a protection system - International practices- Relay operating principles – Fault detection - Relay designs - Electro-mechanical relays - Faults in Networks and Machines (Short-circuits , Other types of faults) - Protection Functions: over-current protection , Earth fault protection, Directional over-current protection, Directional earth fault protection , Differential protection, Negative phase unbalance protection, Positive sequence under-voltage and phase rotation direction protection, Under or over-frequency protection.
EPMN306	**Power Electronics**

	Compulsory, Credits: 3 (2+2+1) **Prerequisite(s): ELCN202** POWER SEMICONDUCTOR DEVICES: Principle of operation - Characteristics and modeling of power diodes, SCR, power BJT, and power MOSFET. PHASE CONTROLLED CONVERTERS: Uncontrolled, semi-controlled, and fully-controlled rectifiers - Converters design and control - Inverter operation - Input power factor - Effect of source inductance - Firing circuits. DC TO DC CHOPPERS: Buck, Boost, and Cuk Converter circuit Analysis, energy Analysis, circuit simulation, continuous and discontinuous modes of operation. Laboratory experiments on the course topics.
EPMN307	**Energy Conversion** **Compulsory, Credits: 2 (1+3+0)** **Prerequisite(s): PHYN002** Energy sources (Depleted and Renewable Sources)– energy and sustainable development - energy utilization and growth rates -energy reserve – economics of energy systems -fuels – energy conversion devices for production of various types of energy (Thermal, Mechanical, Electrical) - energy storage – environmental impact of various generating stations.
EPMN308	**Digital Control Systems** **Compulsory, Credits: 3 (2+2+1)** **Prerequisite(s): EMPN313** 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.
EPMN309	**Power Electronics Systems** **Compulsory, Credits: 3 (2+2+1)** **Prerequisite(s): EPMN306** Single-phase voltage source inverters - Three-phase voltage source inverters- Current source inverters - Closed-loop operation of inverters - Power quality - Reactive power and harmonic compensation - Shunt active power filters - Series active power filters. Laboratory experiments on the course topics.
EPMN401	**Electrical Machines Drives** **Compulsory, Credits: 3 (2+2+1)** **Prerequisite(s): EPMN309 + EPMN304** Drive Requirements and Specifications, Drive Classifications and

	Characteristics, Load Profiles and Characteristics, Variable-Speed Drive Topologies, PWM VSI Drive, PWM Techniques, Impact of PWM Waveform. Laboratory experiments on the course topics. DC Motor Drives, Induction Motor Drives, Synchronous Motor Drives. Special Motors Drives: Permanent Magnet ac Synchronous Motor Drives, Permanent-Magnet Brushless dc Motor Drives, Servo Drives, Stepper Motor Drives, Switched-Reluctance Motor Drives, and Synchronous Reluctance Motor Drive.
EPMN402	**Power System Analysis** **Compulsory, Credits: 3 (2+3+0)** **Prerequisite(s): EPMN302** Power system modeling – load flow studies – short circuit studies – automatic generation and voltage control - power system stability - power system security.
EPMN403	**High Voltage Technology** **Compulsory, Credits: 3 (2+3+0)** **Prerequisite(s): MEPN219** Generation of dc, ac and impulse high voltage – Impulse voltage recording – Breakdown in gases and Corona – Theories of conduction and breakdown in liquids and solids – High voltage testing – Destructive & nondestructive tests – Insulation classes – Insulation coordination.– Gas insulated systems – Measurements of natural properties of insulation.
EPMN411	**Power Quality** **Elective (group E-2, set A), Credits: 3 (2+3+0)** **Prerequisite(s): EPMN302 + AA approval** Relevance of Power Quality and the cost of poor power quality - Disturbances on AC mains: Sags, Dips, and Swells - Transient Over-voltages – Low, medium and high frequency transients - Voltage and current harmonics -.Voltage flicker - Voltage regulation - Frequency variations – Power quality monitoring for high reliability systems including Web-based power quality monitoring – power quality mitigation devices - On-site surveys of power quality - A system approach to grounding - Measurement and mitigation techniques - IEEE, IEC Standards - Utility power quality standards.
EPMN412	**Electrical Power Distribution** **Elective (group E-2, set A), Credits: 3 (2+3+0)** **Prerequisite(s): EPMN305 + AA approval** Components of distribution systems -Overhead lines versus underground cables - load characteristics - design of sub-distribution lines and distribution substations - design of primary and secondary distribution - voltage drop and power loss calculations - voltage regulation concepts - application of capacitors in power distribution systems.
EPMN413	**Energy Conservation** **Elective (group E-2, set A), Credits: 3 (2+3+0)**

	Prerequisite(s): EPMN302 + EPMN313 + AA approval Load management - Economic dispatch – System voltage control – Electricity Tariff - Power factor improvement - Distribution economics - Load characteristics- Demand side management alternatives - power factor correction- high efficient motors and lighting - unit commitment- power pools - power system security- state estimation in power systems.
EPMN414	**Smart Power Grid** **Elective (group E-2, set A), Credits: 3 (2+3+0)** **Prerequisite(s): ELCN306 + EPMN302 + AA approval** Benefits and definitions relating to Smart Grids – Electric power regulation and tariffs – Load management – Peak power curtailment (leveling) - Power network interconnection – Remote area generation and smart grid's role in renewable energy generation – Automation and monitoring of bulk power transmission – Power line communications (PLC) and Broad-band over power lines communications (BPL) – Smart energy meters – Load control switches - Interoperability between power grids - The international perspective [Europe's Super Smart Grid].
EPMN415	**Power System Planning** **Elective (group E-2, set A), Credits: 3 (2+3+0)** **Prerequisite(s): EPMN302 + EPMN313 + AA approval** Load characteristics - load estimation - load forecasting - economic assessment - modeling and techniques for generation planning- modeling and techniques for network planning - outages studies – FACTS schemes.
EPMN416	**Power Stations** **Elective (group E-2, set A), Credits: 3 (2+3+0)** **Prerequisite(s): MEPN219 + EPMN307 + AA approval** Electric Energy Demand- Electric Energy Sources- Power Plant Economics- Selection of Plant Location and Size- Gas Turbine, Thermal, Hydro-Electric and Nuclear Power Stations- Economic Operation of Steam Plants- Hydro-Thermal Coordination- Major Electrical Equipment in Power Plants.
EPMN417	**Renewable Energy Systems** **Elective (group E-2, set A), Credits: 3 (2+3+0)** **Prerequisite(s): MEPN219 + EPMN307 + AA approval** Sources of renewable energy - Fundamentals of : wind energy, tidal wave energy , solar-thermal energy, geothermal energy - photovoltaic sources - hydro and other common electrical renewable generation schemes - Selection and sizing of systems components - Detailed design of a typical photovoltaic inverter battery system - Renewable energy integration with existing grid connected power.
EPMN418	**Power System Switchgear** **Elective (group E-2, set A), Credits: 3 (2+3+0)** **Prerequisite(s): EPMN403 + AA approval** Substation components - Dimensioning of switchgear installations – Low Voltage, Medium Voltage, and High Voltage apparatus – Conductor

	materials – Accessories for switchgear installations – Types of circuit breakers – Circuit breakers ratings - Arc extinction methods – Surge arresters- Compact Switchgear – Mixed Technology Switchgear (MTS)- switching transients – fast transients in GIS – Controlled switching.
EPMN419	**Protection and Digital Relaying** **Elective (group E-2, set A), Credits: 3 (2+3+0)** **Prerequisite(s): EPMN305 + AA approval** Bus-bar protection - Transformer protection - Motor protection - Generator protection- Distance protection - Monitoring the performance of power systems (Oscillographic analysis, Synchronized sampling, Fault location, Alarms, etc) - Solid-state relays , Computer relays - Digital systems (Signal Processing, Filtering Overview, Discrete Domain , Digital Filtering, Performance Measurements, Bandwidth, Aliasing) - The Cosine Filter - Relay Ladder Logic.
EPMN428	**Power System Operation and Control** **Elective (group E-2, set A), Credits: 3 (2+3+0)** **Prerequisite(s): EPMN402 + AA approval** Economic operation – unit commitment – power pools – deregulation of power industry – active power control – reactive power control – load frequency control
EPMN429	**Environmental Impact of Electricity** **Elective (group E-2, set A), Credits: 3 (2+3+0)** **Prerequisite(s): AA approval** Air impacts: [Climate change, Acid rain, Ozone (smog) and fine particulates, Air toxics (mercury)], Water impacts: [Consumption of water resources, Pollution of water bodies], Land impacts: [On-site land impacts, Off-site land impacts], Generation of wastes: [Solid waste, Radio-active waste from nuclear power stations], Effects on wild life, Electric and magnetic fields, Environmental assessment requirements for electric power projects.
EPMN420	**Electrical Machines Design** **Elective (group E-2, set B), Credits: 3 (2+3+0)** **Prerequisite(s): EPMN304 + AA approval** Magnetic, electric and thermal properties of materials used in the construction of electrical machines. Single- and Three-Phase Transformers design: relation between dimensions and rating as well as performance, estimating design details to meet particular requirements. Three-Phase Induction Motor design: relation between dimensions and rating as well as performance, estimating design details to meet particular requirements. Single-Phase Induction Motor design: similarity and differences with three-phase induction motors, design details of auxiliary winding corresponding to a particular starting strategy. The course relies on a mix of analytical and computational tools. Numerical modeling techniques are also utilized including finite elements methods as

	implemented in software packages available for students.
EPMN421	**Special Electrical Machines** **Elective (group E-2, set B), Credits: 3 (2+3+0)** **Prerequisite(s): EPMN304 + AA approval** Introduction to the unified theory of machines, permanent-magnet AC synchronous motors, permanent-magnet brushless DC motors, servo motors, stepper motors, switched-reluctance motors, synchronous reluctance motors, hysteresis motors, linear motors, micro motors.
EPMN422	**Superconductor Applications** **Elective (group E-2, set B), Credits: 3 (2+3+0)** **Prerequisite(s): EPMN203 + AA approval** Historical note on the discovery of superconductivity, difference between a perfect conductor and a superconductor, Type-I and Type-II superconductors, Meissner effect, diamagnetism, conduction theory of superconductivity, superconductor applications in power engineering; superconducting transformers, superconducting motors and generators, superconducting network current limiters, superconducting cables, other applications (superconducting magnetic levitation vehicles, super-conducting bearings), superconducting magnetic energy storage system for power quality mitigation - future trends in superconductor usage.
EPMN423	**Electrical Installation** **Elective (group E-2, set A), Credits: 3 (2+3+0)** **Prerequisite(s): EPMN301 + AA approval** Load characteristics - Load Assessment - Electric Supply Regulations- Conductors and cables - Installation methods - Design of electrical systems for residential, commercial, and industrial installations - Protection equipment and coordination of protective devices - Voltage drop and short circuit calculations - Electrical safety and Grounding - Electrical drawing.
EPMN424	**Mechatronics** **Elective (group E-2, set B), Credits: 3 (2+3+0)** **Prerequisite(s): EPMN201 + EPMN313 + AA approval** The objective of this course is to allow the students to understand the synergy between mechanical design, computer control and electronic components in arriving at a mechatronics system. Students will be provided with the needed knowledge and understanding of issues related to integrating mechanical, electronic and software components towards building mechatronic devices. Subjects such as actuators, sensors as well as electronics and hardware components for mechatronics will be discussed. The syllabus includes the following topics: Introduction to mechatronics system design, Mechanisms for motion transmission systems, Actuators and Sensors with mixed disciplines, Interfacing, Microcontroller-based control systems, Microcontroller-based instrumentation systems, Systems with mixed disciplines, Analogue active filters.
EPMN425	**Process Control and Robotics**

	Elective (group E-2, set B), Credits: 3 (2+3+0) **Prerequisite(s): EPMN308 + AA approval** This is an industrially oriented course. It demonstrates to students what they are likely to see in real life if they work in the instrumentation and control field. By the end of this course, students should be able to read P&I diagrams, identify control loops, and tune industrial controllers including robot arms. The course syllabus includes: Piping and instrumentation diagrams, cascade controllers, feed forward controllers, control design of time-delay processes, internal model control, two-degree of freedom controllers, hybrid controllers, introduction to model predictive control, Smith predictor, implementation of industrial controllers, introduction to nonlinear controllers, robots kinematics, robots inverse kinematics, path planning, joint control of robotic arms.
EPMN426	**Computer Control in Energy Systems** **Elective (group E-2, set B), Credits: 3 (2+3+0)** **Prerequisite(s): EPMN201 + EPMN313 + AA approval** This course provides a comprehensive theoretical, yet practical, look at all aspects of distributed control systems and their associated devices and systems. It includes new subjects related to advanced PLC topics, such as I/O bus networks, the IEC 1131-3 programming standard, process control, and PID algorithms. The course syllabus includes: Evolution of distributed control systems (DCS) – local control units architectures – programmable logic controllers – programming techniques- discrete input output modules – analog input-output modules – serial communication interfacing – data measurements and transducers - function blocks – local control units languages – communication requirements – network topologies – input/output bus networks - operator interface – SCADA systems – process controllers and loop tuning.
EPMN427	**Intelligent Control** **Elective (group E-2, set B), Credits: 3 (2+3+0)** **Prerequisite(s): EPMN313 + AA approval** 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 counteract 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 networks 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.
EPMN430	**Operations Research** **Elective (group E-2, set B), Credits: 3 (2+3+0)**

	Prerequisite(s): AA approval This course presents the foundations of the subject of Operations Research. Various topics considered in the course are: Operations research historical background, Overview of Mathematical programming models, Linear programming problem formulation, Fundamentals of algebraic solution of Simplex method, the Transportation Model, the Assignment Model, Integer Programming Techniques, and Introduction to Multiobjective Mathematical Programming, fundamentals of network for a project management, Critical Path Method, Inventory Control, and Decision Making under Uncertainties.