**COURSES DESCRIPTION FOR**

**Electrical Power & Machines Engineering Department**

**College of Engineering**

**University of Diyala**

**Diyala, Iraq**

***Prepared by Department Academic Staff***

***Reviewed, revised and Introduced by:***

***The Scientific Committee of The Department***

1. **Introduction**

**1.1 Overview of Dep. of Elec. Power & Machines Engineering**

The electrical power & machines engineering department was established in 1998 with Electronics engineering department as the first two academic departments for establishment of the College of Engineering at the University of Diyala. It was necessary to establish a department for meeting the emerging need for skilled electrical power engineers and to keep abreast of the scientific and technical progress in the world.

Since its inauguration, electrical power engineering department adopted a well academic program equal to the electrical power engineering departments worldwide by focusing on both theoretical and practical integrated aspects of the electrical power system and machines engineering fields of study.

The undergraduate study at the department is four years in length; from the moment of receiving the freshman year students whose average grades qualify them to join it up till to the graduation of the senior year students where they get their Bachelor of Science degree in electrical power engineering.

In preparing this , we have rely on the Anbar University/ Electrical Eng. Department and utilize the common points that was observed and directed by the Staff of Ohio University (USA).

**1.2 Program Educational Objective**

The curriculum requirements specify subject areas appropriate to Electrical Power and Machines Engineering (EP). The professional component must include:

* + - 1. A combination of mathematics and basic sciences general education component (some with experimental experience) appropriate to the discipline.
      2. Electrical Power Engineering topics, consisting of electrical engineering sciences and engineering design appropriate to the electrical power utilization study.
      3. A general education component that complements the technical content of the curriculum and is consistent with the program and institution objectives.

**1.3 Program Curriculum**

The Bachelor of Science (B.Sc.) in Electrical Power And Machines Engineering approved by the Department includes just one branch, electrical power and machines Engineering, and the student can choose it by the competition in the average of primary school. Throughout the first and second years all student take a general subject with the electrical and electronics engineering, and specialties starting from the third year of study by adding a pure specialties subjects.

* 1. **Program Outcomes**

The graduate of the B.Sc. in Electrical Power & Machines Engineering program will:

1. Engage in Electrical Power and Machines Engineering profession in public and private sectors including, but not limited to, relevant governmental sectors, consulting firms, contracting companies, marketing and real estate investments.
2. Engage in ongoing professional development activities by pursuing graduate studies and / or other learning opportunities to respond to the arising challenges.
3. Advance in responsibility and leadership in their careers.
   1. **Program Outcomes (ABET):**
4. An ability to apply knowledge of mathematics, science, and engineering
5. An ability to design and conduct experiments, as well as to analyze and interpret data.
6. An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.
7. An ability to function on multidisciplinary teams.
8. An ability to identify, formulate, and solve engineering problems.
9. An understanding of professional and ethical responsibility.
10. An ability to communicate effectively.
11. The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context.
12. A recognition of the need for, and an ability to engage in life-long learning.
13. A knowledge of contemporary issues.
14. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.
15. **Course Description**

Courses are coded as follows:

1. Course code (started by capital letters followed by number of 3-digits

2. Course Name

3. Parenthesized numerals, e.g., (4-3-1-3), indicate, in order, the credit hours, the classroom hours (1 hour = 1 credit hour), tutorial hours (credit hour = 0), and the laboratory hours (3 hour = 1 credit hour). Prerequisites, if any, are indicated at the course description. These have been established to assure an adequate and uniform background for students in advanced classes. Occasionally, students may feel they already have the appropriate background for an advanced course because of previous training, transfer credits, or credit by examination.

Course Numbering System Course code is presented according to three requirement:

1. University requirement started by 🡺 the letter **U**
2. Engineering College requirement is started by 🡺 the letter **E**
3. Department Requirement started by 🡺 the letters **EP**

**(E**lectrical **P**ower & Machines Engineering).

The number consists from 3 digits as following:-

100- First year

200- Second year

300- Third year

400- Fourth year

Levels 🡺 01 To 99 Represents serial number of the subject in the assigned stage

Represents University Requirements 🡺 Example: U101

Represents College Requirements 🡺 Example: E101

Represents Department Requirements 🡺 Example: EP204

1. **Electrical Power & Machines Engineering Program**

|  |  |  |  |
| --- | --- | --- | --- |
| **Program Outcome** | Program Educational Objective | | |
| **1** | **2** | **3** |
| **a** | √ |  |  |
| **b** | √ |  |  |
| **c** | √ | √ |  |
| **d** |  | √ |  |
| **e** | √ |  |  |
| **f** | √ |  |  |
| **g** | √ | √ |  |
| **h** | √ |  |  |
| **i** | √ |  |  |
| **j** | √ |  | √ |
| **k** | √ |  | √ |

1. ***Graduation Requirements***

|  |  |
| --- | --- |
| ***Requirements*** | ***Credit hours*** |
| ***University Requirements*** | ***6*** |
| ***College Requirements*** | ***26*** |
| ***Department Requirements*** | ***112*** |
| ***Department Elective Classes*** | ***10*** |
| ***Total*** | ***154*** |

1. ***University Requirements: 6 Credit Hours***

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| ***Course Code*** | ***Course Title*** | ***Cr. Hours*** | ***Weekly hours*** | | |
| ***Lec.*** | ***Tut.*** | ***Lab.*** |
| ***U101*** | ***Human Rights& Democracy*** | ***1*** | ***1*** | ***-*** | ***-*** |
| ***U102*** | ***Computer Science*** | ***2*** | ***1*** | ***-*** | ***2*** |
| ***U103*** | ***English Language*** | ***2*** | ***2*** | ***-*** | ***-*** |
| ***U104*** | ***Arabic Language*** | ***1*** | ***1*** | ***-*** | ***-*** |
| ***Total*** | | ***6*** | ***5*** | ***-*** | ***2*** |
| ***7*** | | |

1. **College Requirements: 26 Credit Hours**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| ***No.*** | ***Course Code*** | ***Course Title*** | ***Cr. Hours*** | ***Weekly hours*** | | |
| ***Lec.*** | ***Tut.*** | ***Lab.*** |
| ***1*** | ***E101*** | ***Mathematics I*** | ***3*** | ***3*** | ***1*** | ***-*** |
| ***2*** | ***E102*** | ***Mathematics II*** | ***3*** | ***3*** | ***1*** | ***-*** |
| ***3*** | ***E103*** | ***Physics*** | ***2*** | ***2*** | ***-*** | ***-*** |
| ***4*** | ***E104*** | ***Engineering Drawing I*** | ***1*** |  | ***-*** | ***3*** |
| ***5*** | ***E105*** | ***Engineering Drawing II*** | ***1*** |  | ***-*** | ***3*** |
| ***6*** | ***E106*** | ***Workshop Skills I*** | ***1*** |  | ***-*** | ***3*** |
| ***7*** | ***E107*** | ***Workshop Skills II*** | ***1*** |  | ***-*** | ***3*** |
| ***8*** | ***E108*** | ***Programming*** | ***2*** | ***1*** | ***-*** | ***2*** |
|  |  | ***TOTAL for 1st Year*** | ***14*** | ***9*** | ***2*** | ***14*** |
| ***9*** | ***E201*** | ***Applied Mathematics I*** | ***3*** | ***3*** | ***1*** | ***-*** |
| ***10*** | ***E202*** | ***Applied Mathematics II*** | ***3*** | ***3*** | ***1*** | ***-*** |
|  |  | ***TOTAL for 2nd Year*** | ***6*** | ***6*** | ***2*** | ***-*** |
|  |  | ***TOTAL for 3rd Year*** | ***0*** | ***0*** | ***-*** | ***-*** |
| ***11*** | ***E401*** | ***Engineering Profession Ethics*** | ***2*** | ***2*** | ***-*** | ***-*** |
| ***12*** | ***E402*** | ***Eng. Graduation Project I*** | ***1*** | - | ***-*** | ***2*** |
| ***13*** | ***E403*** | ***Eng. Graduation Project II*** | ***1*** | - | ***-*** | ***2*** |
| ***14*** | ***E404*** | ***Engineering Economy*** | ***2*** | ***2*** | ***-*** | ***-*** |
|  |  | ***TOTAL for 4th Year*** | ***6*** | ***4*** | ***-*** | ***4*** |
|  | ***Total*** | | ***26*** | ***21*** | ***4*** | ***18*** |
| ***43*** | | |

1. **Department Requirements: 112 Credit Hours**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| ***Course No.*** | ***Course Title*** | ***Cr. Hours*** | ***Weekly hours*** | | |
| ***Lec.*** | ***Tut.*** | ***Lab.*** |
| ***EP101*** | ***Digital Techniques I*** | ***3*** | ***2*** | **-** | ***2*** |
| ***EP102*** | ***Digital Techniques II*** | ***3*** | ***2*** | **-** | ***2*** |
| ***EP103*** | ***Electrical Engineering Fundamentals I*** | ***4*** | ***3*** | ***1*** | ***3*** |
| ***EP104*** | ***Electrical Engineering Fundamentals II*** | ***4*** | ***3*** | ***1*** | ***3*** |
| ***EP105*** | ***Engineering Mechanics I***  ***(Statics)*** | ***2*** | ***2*** | ***-*** | ***-*** |
| ***EP106*** | ***Engineering Mechanics II***  ***(Dynamics)*** | ***2*** | ***2*** | ***-*** | ***-*** |
| ***EP107*** | ***Physical Electronics*** | ***2*** | ***2*** | ***-*** | ***-*** |
| ***EP108*** | ***Entertainment & Culture Activity*** | ***0*** | ***-*** | ***-*** | ***1*** |
|  | ***TOTAL for 1st Year*** | ***20*** | ***16*** | ***2*** | ***11*** |
| ***EP201*** | ***Electronics I*** | ***3*** | ***2*** | **-** | ***2*** |
| ***EP202*** | ***Electronics II*** | ***3*** | ***2*** | **-** | ***2*** |
| ***EP203*** | ***Electric Circuits Analysis I*** | ***2*** | ***2*** | ***1*** | ***-*** |
| ***EP204*** | ***Electric Circuits Analysis II*** | ***2*** | ***2*** | ***1*** | ***-*** |
| ***EP205*** | ***Advanced Programming*** | ***2*** | ***1*** | ***-*** | ***2*** |
| ***EP206*** | ***Machines I (DC)*** | ***3*** | ***2*** | ***-*** | ***2*** |
| ***EP207*** | ***Machines (Transformer) II*** | ***3*** | ***2*** | ***-*** | ***2*** |
| ***EP208*** | ***Electro-Magnetics I*** | ***2*** | ***2*** | ***1*** | ***-*** |
| ***EP209*** | ***Electro-Magnetics II*** | ***2*** | ***2*** | ***1*** | ***-*** |
| ***EP210*** | ***Thermodynamics*** | ***2*** | ***2*** | ***-*** | ***-*** |
| ***EP211*** | ***Power Plants*** | ***2*** | ***2*** | ***-*** | ***-*** |
| ***EP212*** | ***Software Eng. Application*** | ***2*** | ***1*** | ***-*** | ***2*** |
| ***EP213*** | ***Entertainment & Culture Activity*** | ***0*** | ***-*** | ***-*** | ***1*** |
|  | ***TOTAL for 2nd Year*** | ***28*** | ***22*** | ***4*** | ***13*** |
| ***EP301*** | ***Electric Power Engineering I*** | ***3*** | ***2*** | ***1*** | ***2*** |
| ***EP302*** | ***Electric Power Engineering II*** | ***3*** | ***2*** | ***1*** | ***2*** |
| ***EP303*** | ***Measurement & Instruments*** | ***2*** | ***2*** | ***-*** | ***-*** |
| ***EP304*** | ***Electronic Systems and Signals*** | ***2*** | ***2*** | ***1*** | ***-*** |
| ***EP305*** | ***Communication Systems*** | ***2*** | ***2*** | ***-*** | ***-*** |
| ***EP306*** | ***High Voltage Engineering*** | ***3*** | ***2*** | ***-*** | ***2*** |
| ***EP307*** | ***AC-Machines I (Synchronous)*** | ***3*** | ***2*** | ***1*** | ***2*** |
| ***EP308*** | ***AC-Machines II (Induction)*** | ***3*** | ***2*** | ***1*** | ***2*** |
| ***EP309*** | ***Power Electronics I*** | ***3*** | ***2*** | **-** | ***2*** |
| ***EP310*** | ***Power Electronics II*** | ***3*** | ***2*** | **-** | ***2*** |
| ***EP311*** | ***Control Theory I*** | ***3*** | ***2*** | ***-*** | ***2*** |
| ***EP312*** | ***Control Theory II*** | ***3*** | ***2*** | ***-*** | ***2*** |
| ***EP313*** | ***Electric Power Generation*** | ***2*** | ***2*** | ***-*** | ***-*** |
| ***EP314*** | ***Microcontroller*** | ***2*** | ***2*** | ***-*** | ***-*** |
| ***EP315*** | ***Engineering Analysis*** | ***3*** | ***3*** | **-** | - |
| ***EP316*** | ***Engineering Numerical Methods*** | ***3*** | ***3*** | **-** | - |
| ***EP317*** | ***Entertainment & Culture Activity*** | ***0*** | ***-*** | ***-*** | ***1*** |
|  | ***TOTAL for 3rd Year*** | ***43*** | ***34*** | ***5*** | ***19*** |
| ***EP401*** | ***Power System Analysis 1*** | ***3*** | ***2*** | ***-*** | ***2*** |
| ***EP402*** | ***Power System Analysis II*** | ***3*** | ***2*** | ***-*** | ***2*** |
| ***EP403*** | ***Power System Protection*** | ***3*** | ***2*** | ***-*** | ***2*** |
| ***EP404*** | ***Electric Power Distribution*** | ***2*** | ***2*** |  | ***-*** |
| ***EP405*** | ***Electrical Design & sustainability*** | ***2*** | ***2*** | ***-*** | ***-*** |
| ***EP406*** | ***Special Machines*** | ***3*** | ***2*** | ***-*** | ***2*** |
| ***EP407*** | ***Electrical Drives*** | ***3*** | ***2*** | ***-*** | ***2*** |
| ***EP408*** | ***Administration &Leadership skills*** | ***2*** | ***2*** | ***-*** | ***-*** |
|  | ***TOTAL for 4th Year*** | ***21*** | ***16*** | ***0*** | ***10*** |
| ***TOTAL*** | | ***112*** | ***88*** | ***11*** | ***53*** |
| **151** | | |

1. **Electives: 10 Credit Hours only**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| ***Course No.*** | ***Course Title*** | ***Cr. Hours*** | ***Weekly hours*** | | |
| ***Lec.*** | ***Tut.*** | ***Lab.*** |
| ***4th Year*** | ***4th Year*** | ***4th Year*** | ***4th Year*** | ***4th Year*** | ***4th Year*** |
| ***EP409*** | ***Renewable Energy Utilization*** | ***2*** | ***2*** | ***-*** | ***-*** |
| ***EP410*** | ***Smart Grid*** | ***2*** | ***2*** | ***-*** | ***-*** |
| ***EP411*** | ***Digital Signal Processing (DSP)*** | ***2*** | ***2*** | ***-*** | ***-*** |
| ***EP412*** | ***Electric Heating*** | ***2*** | ***2*** | ***-*** | ***-*** |
| ***EP413*** | ***Industrial Application of AC Motors*** | ***2*** | ***2*** | ***-*** | ***-*** |
| ***EP414*** | ***Distribution System Automation*** | ***2*** | ***2*** | ***-*** | ***-*** |
| ***EP415*** | ***Information Theory*** | ***2*** | ***2*** | ***-*** | ***-*** |
| ***EP416*** | ***Lighting Engineering*** | ***2*** | ***2*** | ***-*** | ***-*** |
| ***EP417*** | ***Grounding*** | ***2*** | ***2*** | ***-*** | ***-*** |
| ***EP418*** | ***Power System Operation & Control*** | ***2*** | ***2*** | ***-*** | ***-*** |
| ***EP419*** | ***Artificial Intelligence*** | ***2*** | ***2*** | ***-*** | ***-*** |
| ***EP420*** | ***Servomechanism*** | ***2*** | ***2*** | ***-*** | ***-*** |
| ***Total*** | | ***24*** | ***24*** | ***-*** | ***-*** |
| **24** | | |

1. **EP Program: Curriculum**

Typical degree program is shown in the following Tables for Electrical Power Engineering, where recommended EP course plan by semester is presented

**First Year**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ***First Semester*** | | | | | ***Second Semester*** | | | | |
| ***Course Title*** | ***Credit***  ***Hours*** | ***Weekly hours*** | | | ***Course Title*** | ***Credit Hours*** | ***Weekly hours*** | | |
| ***Lec.*** | ***Tut.*** | ***Lab.*** | ***Lec.*** | ***Tut.*** | ***Lab.*** |
| ***Mathematics -I*** | ***3*** | ***3*** | ***1*** | ***-*** | ***Mathematics- II*** | ***3*** | ***3*** | ***1*** | **-** |
| ***Physics I*** | ***2*** | ***2*** | ***-*** | ***-*** | ***Physical Electronics*** | ***2*** | ***2*** | ***-*** | ***-*** |
| ***Workshop Skills- I*** | 1 | ***-*** | ***-*** | ***3*** | ***Workshop Skills II*** | 1 | ***-*** | ***-*** | ***3*** |
| ***Digital Technique I*** | ***3*** | ***2*** | ***-*** | ***2*** | ***Digital Technique II*** | ***3*** | ***2*** | ***-*** | ***2*** |
| ***Fundamentals of EE- I*** | ***4*** | ***3*** | ***1*** | ***2*** | ***Fundamentals of***  ***EE - II*** | ***4*** | ***3*** | ***1*** | ***2*** |
| ***English Language*** | ***2*** | ***2*** | ***-*** | ***-*** | ***Arabic Language*** | ***1*** | ***1*** | ***-*** | ***-*** |
| ***Entertainment & Culture Activity I*** | ***-*** | ***-*** | ***-*** | ***1*** | ***Human Rights*** | ***1*** | ***1*** | ***-*** | ***-*** |
| ***Engineering Drawing I***  ***(Basic)*** | ***1*** |  | ***-*** | ***3*** | ***Engineering Drawing-II (AutoCAD)*** | ***1*** |  |  | ***3*** |
| ***Computer Science*** | ***2*** | ***1*** | ***-*** | ***2*** | ***Programming*** | ***2*** | ***1*** | ***-*** | ***3*** |
| ***Engineering Mechanics-I***  ***(Statics)*** | ***2*** | ***2*** | ***-*** | ***-*** | ***Engineering Mechanics-II***  ***(Dynamics)*** | ***2*** | ***2*** | ***-*** | ***-*** |
| ***Total*** | ***20*** | ***15*** | ***2*** | ***13*** | ***Total*** | ***20*** | ***15*** | ***2*** | ***13*** |
| ***30*** | | | ***32*** | | |

**Second Year**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ***First Semester*** | | | | | ***Second Semester*** | | | | |
| ***Course Title*** | ***Credit***  ***Hours*** | ***Weekly hours*** | | | ***Course Title*** | ***Credit Hours*** | ***Weekly hours*** | | |
| ***Lec.*** | ***Tut.*** | ***Lab.*** | ***Lec.*** | ***Tut.*** | ***Lab.*** |
| ***Applied Mathematics -I*** | ***3*** | ***3*** | ***1*** | ***-*** | ***Applied***  ***Mathematics- II*** | ***3*** | ***3*** | ***1*** | **-** |
| ***Electronics I*** | ***3*** | ***2*** | ***-*** | ***2*** | ***Electronics II*** | ***3*** | ***2*** | ***-*** | ***2*** |
| ***Electric Circuits I*** | ***2*** | ***2*** | ***1*** | ***-*** | ***Electric Circuits II*** | ***2*** | ***2*** | ***1*** | ***-*** |
| ***Advanced Programming*** | ***2*** | ***1*** | ***-*** | ***2*** | ***Software Eng. Application*** | ***2*** | ***1*** | ***-*** | ***2*** |
| ***Electro-Magnetics I*** | ***2*** | ***2*** | ***-*** | ***-*** | ***Electro-Magnetics II*** | ***2*** | ***2*** | ***-*** | ***-*** |
| ***Machines I (DC)*** | ***3*** | ***2*** | ***1*** | ***2*** | ***Machines II (Transformer)*** | ***3*** | ***2*** | ***1*** | ***2*** |
| ***Thermodynamics*** | ***2*** | ***2*** | ***-*** | ***-*** | ***Power Plants*** | ***2*** | ***2*** | ***-*** | ***-*** |
|  |  |  |  |  | ***Entertainment & Culture Activity*** | ***-*** | ***-*** | ***-*** | ***1*** |
| ***Total*** | ***17*** | ***14*** | ***3*** | ***6*** | ***Total*** | ***17*** | ***14*** | ***3*** | ***7*** |
| ***23*** | | | ***24*** | | |

**Third Year**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ***First Semester*** | | | | | | ***Second Semester*** | | | | |
| ***Course Title*** | ***Credit***  ***Hours*** | | ***Weekly hours*** | | | ***Course Title*** | ***Credit Hours*** | ***Weekly hours*** | | |
| ***Lec.*** | ***Tut.*** | ***Lab.*** | ***Lec.*** | ***Tut.*** | ***Lab.*** |
| ***Electric Power I*** | ***3*** | | ***2*** | ***-*** | ***2*** | ***Electric Power II*** | ***3*** | ***2*** | ***-*** | ***2*** |
| ***Electric Power Generation*** | ***2*** | | ***2*** | ***-*** | ***-*** | ***High Voltage Engineering*** | ***3*** | ***2*** | ***-*** | ***2*** |
| ***Engineering Analysis*** | ***3*** | | ***3*** | **-** |  | ***Engineering Numerical Methods*** | ***3*** | ***3*** | **-** |  |
| ***Signals and Systems*** | ***2*** | | ***2*** | ***1*** | ***-*** | ***Communication Systems*** | ***2*** | ***2*** | ***-*** | ***-*** |
| ***AC-Machines I (Synchronous)*** | ***3*** | | ***2*** | ***1*** | ***2*** | ***AC-Machines II (Induction)*** | ***3*** | ***2*** | ***1*** | ***2*** |
| ***Power Electronics I*** | | ***3*** | ***2*** | **-** | ***2*** | ***Power Electronics II*** | ***3*** | ***2*** | **-** | ***2*** |
| ***Control Theory I*** | ***3*** | | ***2*** | ***-*** | ***2*** | ***Control Theory II*** | ***3*** | ***2*** | ***-*** | ***2*** |
| ***Measurement & Instruments*** | ***2*** | | ***2*** | ***-*** | ***-*** | ***Micro controller*** | ***2*** | ***2*** | ***-*** | ***-*** |
|  |  | |  |  |  | ***Entertainment & Culture Activity I*** | ***-*** | ***-*** | ***-*** | ***1*** |
| ***Total*** | ***21*** | | ***15*** | ***2*** | ***8*** | ***Total*** | ***22*** | ***17*** | ***1*** | ***11*** |
| ***25*** | | | ***29*** | | |

**Forth Year**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ***First Semester*** | | | | | ***Second Semester*** | | | | |
| ***Course Title*** | ***Credit***  ***Hours*** | ***Weekly hours*** | | | ***Course Title*** | ***Credit Hours*** | ***Weekly hours*** | | |
| ***Lec.*** | ***Tut.*** | ***Lab.*** | ***Lec.*** | ***Tut.*** | ***Lab.*** |
| ***Power System Analysis I*** | ***3*** | ***2*** | ***-*** | ***2*** | ***Power System Analysis II*** | ***3*** | ***2*** | ***-*** | ***2*** |
| ***Power System Protection*** | ***3*** | ***2*** | ***-*** | ***2*** | ***Engineering Profession Ethics*** | ***2*** | ***2*** | ***-*** | ***-*** |
| ***Electric Power Distribution*** | ***2*** | ***2*** |  | ***-*** | ***Electrical Design & sustainability*** | ***2*** | ***2*** | ***-*** | ***-*** |
| ***Special Machines*** | ***3*** | ***2*** | ***-*** | ***2*** | ***Electrical Drives*** | ***3*** | ***2*** | ***-*** | ***2*** |
| ***Eng. Graduation Project I*** | ***1*** | **-** | ***-*** | ***2*** | ***Eng. Graduation Project II*** | ***1*** | **-** | ***-*** | ***2*** |
| ***Administration and Leadership skills*** | ***2*** | ***2*** | **-** | **-** | ***Engineering Economy*** | ***2*** | ***2*** | ***-*** | ***-*** |
| ***Elective*** | ***2*** | ***2*** | ***-*** | ***-*** | ***Elective*** | ***2*** | ***2*** | ***-*** | ***-*** |
| ***Elective*** | ***2*** | ***2*** | ***-*** | ***-*** | ***Elective*** | ***2*** | ***2*** | ***-*** | ***-*** |
| ***Elective*** | ***2*** | ***2*** | ***-*** | ***-*** |  |  |  |  |  |
| ***Total*** | ***20*** | ***16*** | ***-*** | ***8*** | ***Total*** | ***17*** | ***14*** | ***-*** | ***6*** |
| ***24*** | | | ***20*** | | |

**Summer Training**

The **Electrical Power Engineering** curriculum requires students to complete one month of summer training at private industries or governmental firms. This training is a compulsory component of graduation requirements. It is supervised by the Summer Training Committee of the department.

1. **EP Curriculum \ Credit Requirements**

* 4 - Years Program (Full - Time Study)
* 154 subject credit hours for the **Electrical Power Engineering**
* Curriculum Component
* Mathematics and basic Science: 24credit hrs.
* Engineering Topics: 102 credit hrs.
* General Education: 28 credit hrs.

**Credit Hours Distribution**

The following subsections describe the program areas: (1) Mathematics, (2) General Education includes Technical engineering component (non-electrical) and non technical component including social and humanity component. (3) Topics of Core engineering. Figure 1. illustrates the general relative distribution of curriculum categories

Figure 1. General Relative Distributions of Curriculum Categories **Electrical Power Engineering**

1. **How the Curriculum Aligns with the Program Educational Objectives**

The faculty has complete authority to define, revise, implement, and achieve program educational objectives. Input is required from the students, alumni, and the employers of our alumni in the implementation of program objectives. The major role of the faculty is to create, revise, and evaluate subjects for the program as well as define and revise program educational objectives and ensure achievement of student outcomes. Therefore, the above process ensures alignment of the curriculum with Program Educational Objectives as shown in various tables. The **Electrical Power & Machines Engineering** department insures that the students receive all the engineering analysis within the context of engineering program. At our faculty meetings, the discussion is possible subjects to be introduced in the different subjects and brainstorm on ways to bring engineering program and open-ended problems into our subjects.

Program Outcomes: For the purpose of achieving its objectives, the electrical engineering department has developed eleven Program Outcomes (POs) as an initial set of POs. These outcomes are, in effect, what the students expected to know and achieve post graduation. The following Table shows these program outcomes

|  |  |
| --- | --- |
| **OUTCOMES** | Code |
| PO1: an ability to apply knowledge of mathematics, science, and engineering fundamentals. | a |
| PO2: an ability to outline and conduct experiments as well as analyze and interpret data. | b |
| PO3: an ability to design an integrated system and its various components and processes, within realistic economic, environment, social, political, ethical, health and safety, manufacturability, and sustainability constraints. | c |
| PO4 : an ability to function on multi-disciplinary teams to analyze and solve problems. | d |
| PO5 : an ability to identify, evaluate and solve engineering problems. | e |
| PO6 : an understanding of the responsibility of engineers to practice in professional and ethical manner at all times. | f |
| PO7 : an ability to communicate effectively using oral, written, and graphic forms. | g |
| PO8 : the broad education necessary to understand the potential impact of engineering solutions on society and the environment. | h |
| PO9 : an understanding of the need for up-to-date engineering tools and other knowledge acquired through life-long learning. | i |
| PO10 : knowledge of contemporary issues related to engineering. | j |
| PO11 : an ability to use modern engineering tools, skills and design techniques necessary for the practice of engineering. | k |

University Requirement

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| ***No.*** | ***Course Code*** | ***Course Title*** | ***Cr. Hours*** | ***Weekly hours*** | | |
| ***Lec.*** | ***Tut.*** | ***Lab.*** |
| ***1*** | ***U101*** | ***Human Rights& Democracy*** | ***1*** | ***1*** | ***-*** | ***-*** |
| ***2*** | ***U102*** | ***Computer Science*** | ***2*** | ***1*** | ***-*** | ***2*** |
| ***3*** | ***U103*** | ***English Language*** | ***2*** | ***2*** | ***-*** | ***-*** |
| ***4*** | ***U104*** | ***Arabic Language*** | ***1*** | ***1*** | ***-*** | ***-*** |
|  | ***Total*** | | ***6*** | ***5*** | ***-*** | ***2*** |
| ***7*** | | |

**Course Number: U101**

**Course Name: Human Rights& Democracy**

**Credit hours: (1-1-0-0)**

**Pre-requisite: None**

**Course Contents:** Introduces students to the philosophic and political background of the concept of human rights. Discusses important documents as part of the history of the development of human rights theories. Examines important issues in current political and ethical debates about human rights. Reviews core legal documents and the work of the most important governmental and nongovernmental institutions currently involved in human rights protection and promotion. Examines at least one current problem area in human rights protection.

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**Course Number: U102**

**Course Name: Computer Science**

**Credit hours: (2-1-0-2)**

**Pre-requisite: None**

**Course Contents:** Introduction: MSDOS Operating System,Windows Operating System, creating new folder, selecting folders, finding folders or files copying and moving files and folders. How to start any program shut Down formatting floppy disk, scandisk, arranging icon, run, help, etc; Win Word, Excel and Power point: All facilities, Description of its features and use, the function of toolbars and menu items (File, Edit, View, Format, Tools. Computer Aided Programs/AutoCAD, Electronic Multi-simulator:

Description of the facilities provided by Auto CAD, drawing various,. Geometrical patterns. The use of various tools provided and various menu items. Internet.

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**Course Number: U103**

**Course Name: English**

**Credit hours: (2-2-0-0)**

**Pre-requisite: None**

**Course Contents: *(New English course recommended by the Ministry council )*** or

This course is designed to enable the students to achieve academic oral and written communication to the standard required at university level. The course integrates all the language skills with emphasis on writing, and it stimulates students’ imagination, and promotes personal expression. Students, in this course, are trained to apply critical thinking skills to a wide range of challenging subjects from diverse academic disciplines. Course activities include writing various types of academic essays, acquiring advanced academic vocabulary, and getting involved in group discussions and debates. In addition, the course also includes other skills to consolidate the main skills, such as further readings and use of the Blackboard Suite.

**Course Number: EPE1212**

**Course Name: English II**

**Credit hours: (2-2-0-0)**

**Pre-requisite: English I**

**Course Contents:**  ***(New English course recommended by the Ministry council )*** or English 2 is an advanced academic writing course which provides an opportunity for the students to learn and practice the skills needed for a guided university-level academic paper related to their field of study. The course emphasizes the development of academic writing skills as well as the ability to read and think critically. Students will learn to use the library and appropriate online resources to find and evaluate sources to inform, develop and support their ideas in term paper writing. They will also learn skills for reading analysis, such as comprehension and inference. Assessment tools will include a common mid-term examination and two term papers (a total of approximately 2,500 words). Emphasis will be on the process of developing and improving academic papers over time, informed by peer and instructor feedback.

College Requirement

**College Requirements: 26 Credit Hours**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| ***No.*** | ***Course Code*** | ***Course Title*** | ***Cr. Hours*** | ***Weekly hours*** | | |
| ***Lec.*** | ***Tut.*** | ***Lab.*** |
| ***1*** | ***E101*** | ***Mathematics I*** | ***3*** | ***3*** | ***1*** | ***-*** |
| ***2*** | ***E102*** | ***Mathematics II*** | ***3*** | ***3*** | ***1*** | ***-*** |
| ***3*** | ***E103*** | ***Physics*** | ***2*** | ***2*** | ***-*** | ***-*** |
| ***4*** | ***E104*** | ***Engineering Drawing I*** | ***1*** |  | ***-*** | ***3*** |
| ***5*** | ***E105*** | ***Engineering Drawing II*** | ***1*** |  | ***-*** | ***3*** |
| ***6*** | ***E106*** | ***Workshop Skills I*** | ***1*** |  | ***-*** | ***3*** |
| ***7*** | ***E107*** | ***Workshop Skills II*** | ***1*** |  | ***-*** | ***3*** |
| ***8*** | ***E108*** | ***Programming*** | ***2*** | ***1*** | ***-*** | ***2*** |
|  |  | ***TOTAL for 1st Year*** | ***14*** | ***9*** | ***2*** | ***14*** |
| ***9*** | ***E201*** | ***Applied Mathematics I*** | ***3*** | ***3*** | ***1*** | ***-*** |
| ***10*** | ***E202*** | ***Applied Mathematics II*** | ***3*** | ***3*** | ***1*** | ***-*** |
|  |  | ***TOTAL for 2nd Year*** | ***6*** | ***6*** | ***2*** | ***-*** |
|  |  | ***TOTAL for 3rd Year*** | ***0*** | ***0*** | ***-*** | ***-*** |
| ***11*** | ***E401*** | ***Engineering Profession Ethics*** | ***2*** | ***2*** | ***-*** | ***-*** |
| ***12*** | ***E402*** | ***Eng. Graduation Project I*** | ***1*** | - | ***-*** | ***2*** |
| ***13*** | ***E403*** | ***Eng. Graduation Project II*** | ***1*** | - | ***-*** | ***2*** |
| ***14*** | ***E404*** | ***Engineering Economy*** | ***2*** | ***2*** | ***-*** | ***-*** |
|  |  | ***TOTAL for 4th Year*** | ***6*** | ***4*** | ***-*** | ***4*** |
|  | ***Total*** | | ***26*** | ***21*** | ***4*** | ***18*** |
| ***43*** | | |

**Course Number: E101**

**Course Name: MATHMATICS I**

**Credit Hours: (3-3-1-0)**

**Pre-requisite: None.**

**Course Content:** Inequalities: absolute value, greatest integer. Functions: domain and range operations on functions. (Algebraic functions), limits: definitions and its theorems, Continuity: definition and its theorems, Derivative: definition, rules of differentiation, chain rule, implicit differentiation, higher order derivatives, applications: related rates, maximum and minimum, concavity, graphs of functions, mean value and roll's theorems, Inverse function. Determents and matrices.

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**Course Number: E102**

**Course Name: MATHMATICS II**

**Credit Hours: (3-3-1-0)**

**Pre-requisite: MATHMATICS I**

**Course Content:** Trigonometric functions and their inverse functions. Complex numbers and complex geometry, Integration: definite and indefinite integrals, rules of integration. Applications on definite integrals: area, volumes, length of a plane curves and the area of surface of revolution, the fundamental theorem of integral calculus, The functions ln(x), exp(x) and their inverse functions, Method of integration, improper integrals, Conic sections, translation and rotation of axes, Vectors in the plane, vector valued functions velocity and acceleration, ,

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**Course Number: E103**

**Course Name: Physics**

**Credit Hours: (2-2-0-0)**

**Pre-requisite: None**

**Course Content:** Physics and Measurements, the Laws of Motion, Work and Energy, Linear Momentum and Collision, Rotational Motion, Angular Momentum, Elasticity, Universal Gravitation, Waves, Temperature, Heat.

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**Course Number: E104**

**Course Name: Engineering Drawing I**

**Credit hours: (1-0-0-3)**

**Pre-requisite: None**

**Course Contents:** Introduction to engineering drawing and its uses as engineering language in industry dimensioning symbols and terms used in drawing, metric system, Types of Engineering Tools and Their Uses, Engineering Operations, names and dimensions of lines used in drawings. Projections, The Conclusion Projected third Projection Stereo. Isometric Projection. Drawing various types of geometrical patterns (Traeery), Various methods of drawing ellipses, various types of tangents., Drawing according to scale, drawing various views of an actual object, rejections of all views necessary for a given object, projection of views using first and third angle projection methods. Freehand sketching proper and reasonable proportion.

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**Course Number: E105**

**Course Name: Engineering Drawing II**

**Credit hours: (1-0-0-3)**

**Pre-requisite: None**

**Course Contents:** The use of CAD in engineering drawing. Description of menu Bar and toolbars. Drawing Ellipse, Rectangle, line, Ray, Circle, point, Arc, ---------- etc.

CAD Electrical, Mechanical/ Special features

The use of various layers. Drawing electrical symbols on simple architectural plans.

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**Course Number: E108**

**Course Name: Workshop Skills I**

**Credit Hours: (1-0-0-3)**

**Pre-requisite: None**

**Course Content:** The workshop training program is designed to satisfy the following

objectives Teaching safety rules and regulations on-site in an industrial environment Proper use of working tools, instruments, and machines, Introducing basic workshop practices, production, labor, and time-requirements of workshop operations. The students are introduced to training programs in nine workshops: electrical wiring, welding, forging, fitting , turning and milling, carpentry, plumbing auto-mechanics, and casting. The student is to spend 6 hours of training in every workshop

**Course Number: E109**

**Course Name: Workshop Skills II**

**Credit Hours: (1-0-0-3)**

**Pre-requisite: None**

**Course Content:** The workshop training program is designed to satisfy the following

objectives Teaching safety rules and regulations on-site in an industrial environment Proper use of working tools, instruments, and machines, Introducing basic workshop practices, production, labor, and time-requirements of workshop operations. The students are introduced to training programs in nine workshops: electrical wiring, welding, forging, fitting , turning and milling, carpentry, plumbing auto-mechanics, and casting. The student is to spend 6 hours of training in every workshop

**Course Number: E112**

**Course Name: Programming**

**Credit hours: (2-1-0-3)**

**Pre-requisite: None**

**Course Contents:** Introduction to computer system & computer architecture, Algorithms and flowcharts. Introduction to C-programming language, Programming by C++. (i) Constants & variables. (ii) Input & output statement. (iii) Control statements.(if, switch ) (iv) Loops.(for ,while, do….while) (v)string processing (vi) Subscripted variables (one and two dimension array ) pointer (vii) subprograms ( functions).(viii) files (xi) introduction to structure.

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***Second Year***

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**Course Number: E201**

**Course Name: Applied Mathematics I**

**Credit Hours: (3-3-1-0)**

**Pre-requisite: Mathematics II**

**Course Content:** First Order: Variable Separable and Homogenous Differential equations, Linear, Bernoulli and Exact Differential Equations, Second Order: Homogeneous and non Homogeneous Differential equations, Higher Order Differential equations, Laplace Transform: Definition, Properties, Gamma and Unit Step Functions; Inverse Laplace Transform: Properties and Partial Fractions; Solution of Differential Equations Using Laplace Transform; Applications: Solution of Electric Circuits Using Laplace Transform; Vectors: Dot and Cross Product, Equations of Lines and Planes; Vector Function, Velocity and Acceleration; Curvature and the Unit Normal Vectors; Partial Differentiation: Function of Two or More Variables and the Chain Rule; Directional Derivatives and Gradient Vectors; Tangent planes and normal Lines;

Maximum, Minimum and Saddle Points.

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**Course Number: E202**

**Course Name: Applied Mathematics II**

**Credit Hours: (3-3-1-0)**

**Pre-requisite: Applied Mathematics I**

**Course Content:** Sequence and Series: Convergence and Divergence Test, Geometric Series and Partial Sum, Integral, Comparison, Ratio and Root Tests, Alternating series, Power Series, Taylor and Maclaurin Series, Applications of Power Series, Matrices: Eigen Values and Eigen Vectors, Gauss Elimination, Rank of Matrix,

Applications of Matrices in Electric Circuits, Fourier Series: Periodic and non Periodic Functions, Euler Formulas, Even and Odd functions, Half Range Expansion(Fourier Sine and Fourier Cosine), Complex Fourier Series (Exponential), Applications of Fourier Series in Electric Circuits, Multiple Integral: Double and Triple Integral, Area and Volume, Double Integral in Polar Form, Triple Integrals in Rectangular Coordinates, Surface Integrals

***Third Year: None***

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***Fourth Year***

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**Course Number: E401**

**Course Name: Engineering Profession Ethics**

**Credit Hours: (2-2-0-0)**

**Pre-requisite: None**

**Course Content:** Introduction: Why Professional Ethics?, What Is A Profession?, Professions as Social Practices, Models Of Professionalism, The Business Model, The Professional Model, Types Of Ethics Or Morality, Responsibility in Engineering, Engineering Standards, Framing the Problems, Resolving Problems, The Social and Value Dimensions of Technology, Trust and Reliability, Risk and Liability in Engineering, Engineers in Organizations, Engineers and the Environment, Cases should be presented for use in conjunction with materials (over the world & local)

**Text Book: Engineering Ethics, Concepts And Cases**, *Charles E. Harris, Michael S. Pritchard, and Michael J. Rabins, 2009, 2005 Wadsworth, Cengage Learning, USA*

*ISBN-10: 0-495-50279-0*

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**Course Number: EPE402**

**Course Name: Eng. Graduation Project I**

**Credit hours: (2-1-0-2)**

**Pre-requisite: None**

**Course Contents:** : Analytical, design, experimental, or field work carried out in accordance with a preapproved project plan under the supervision of faculty member(s).

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**Course Number: E403**

**Course Name: Eng. Graduation Project II**

**Credit hours: (2-1-0-2)**

**Pre-requisite: None**

**Course Contents:** : Continuation of previous work-Analytical, design, experimental, or field work carried out in accordance with a preapproved project plan under the supervision of faculty member(s).

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**Course Number: E404**

**Course Name: Engineering Economy**

**Credit Hours: (2-2-0-0)**

**Pre-requisite: None**

**Course Content:** Principles of Engineering Economy. Equivalence and compound interest formula. Single payment model. Uniform payment model. Gradient payment model. Decision criteria for single and multiple alternatives: Present worth, annual worth, future worth, internal rate of return, and benefit cost ratio. Before and after tax analysis.

Department's Requirement

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| ***Course No.*** | ***Course Title*** | ***Cr. Hours*** | ***Weekly hours*** | | |
| ***Lec.*** | ***Tut.*** | ***Lab.*** |
| ***EP101*** | ***Digital Techniques I*** | ***3*** | ***2*** | **-** | ***2*** |
| ***EP102*** | ***Digital Techniques II*** | ***3*** | ***2*** | **-** | ***2*** |
| ***EP103*** | ***Electrical Engineering Fundamentals I*** | ***4*** | ***3*** | ***1*** | ***3*** |
| ***EP104*** | ***Electrical Engineering Fundamentals II*** | ***4*** | ***3*** | ***1*** | ***3*** |
| ***EP105*** | ***Engineering Mechanics I***  ***(Statics)*** | ***2*** | ***2*** | ***-*** | ***-*** |
| ***EP106*** | ***Engineering Mechanics II***  ***(Dynamics)*** | ***2*** | ***2*** | ***-*** | ***-*** |
| ***EP107*** | ***Physical Electronics*** | ***2*** | ***2*** | ***-*** | ***-*** |
| ***EP108*** | ***Entertainment & Culture Activity*** | ***0*** | ***-*** | ***-*** | ***1*** |
|  | ***TOTAL for 1st Year*** | ***20*** | ***16*** | ***2*** | ***11*** |
| ***EP201*** | ***Electronics I*** | ***3*** | ***2*** | **-** | ***2*** |
| ***EP202*** | ***Electronics II*** | ***3*** | ***2*** | **-** | ***2*** |
| ***EP203*** | ***Electric Circuits Analysis I*** | ***2*** | ***2*** | ***1*** | ***-*** |
| ***EP204*** | ***Electric Circuits Analysis II*** | ***2*** | ***2*** | ***1*** | ***-*** |
| ***EP205*** | ***Advanced Programming*** | ***2*** | ***1*** | ***-*** | ***2*** |
| ***EP206*** | ***Software Eng. Application*** | ***2*** | ***1*** | ***-*** | ***2*** |
| ***EP207*** | ***Machines I (DC)*** | ***3*** | ***2*** | ***-*** | ***2*** |
| ***EP208*** | ***Machines (Transformer) II*** | ***3*** | ***2*** | ***-*** | ***2*** |
| ***EP209*** | ***Electro-Magnetics I*** | ***2*** | ***2*** | ***1*** | ***-*** |
| ***EP210*** | ***Electro-Magnetics II*** | ***2*** | ***2*** | ***1*** | ***-*** |
| ***EP211*** | ***Thermodynamics*** | ***2*** | ***2*** | ***-*** | ***-*** |
| ***EP212*** | ***Power Plants*** | ***2*** | ***2*** | ***-*** | ***-*** |
| ***EP213*** | ***Entertainment & Culture Activity*** | ***0*** | ***-*** | ***-*** | ***1*** |
|  | ***TOTAL for 2nd Year*** | ***28*** | ***22*** | ***4*** | ***13*** |
| ***EP301*** | ***Electric Power Engineering I*** | ***3*** | ***2*** | ***1*** | ***2*** |
| ***EP302*** | ***Electric Power Engineering II*** | ***3*** | ***2*** | ***1*** | ***2*** |
| ***EP303*** | ***Measurement & Instruments*** | ***2*** | ***2*** | ***-*** | ***-*** |
| ***EP304*** | ***Electronic Systems and Signals*** | ***2*** | ***2*** | ***1*** | ***-*** |
| ***EP305*** | ***Communication Systems*** | ***2*** | ***2*** | ***-*** | ***-*** |
| ***EP306*** | ***High Voltage Engineering*** | ***3*** | ***2*** | ***-*** | ***2*** |
| ***EP307*** | ***AC-Machines I (Synchronous)*** | ***3*** | ***2*** | ***1*** | ***2*** |
| ***EP308*** | ***AC-Machines II (Induction)*** | ***3*** | ***2*** | ***1*** | ***2*** |
| ***EP309*** | ***Power Electronics I*** | ***3*** | ***2*** | **-** | ***2*** |
| ***EP310*** | ***Power Electronics II*** | ***3*** | ***2*** | **-** | ***2*** |
| ***EP311*** | ***Control Theory I*** | ***3*** | ***2*** | ***-*** | ***2*** |
| ***EP312*** | ***Control Theory II*** | ***3*** | ***2*** | ***-*** | ***2*** |
| ***EP313*** | ***Electric Power Generation*** | ***2*** | ***2*** | ***-*** | ***-*** |
| ***EP314*** | ***Microcontroller*** | ***2*** | ***2*** | ***-*** | ***-*** |
| ***EP315*** | ***Engineering Analysis*** | ***3*** | ***3*** | **-** | - |
| ***EP316*** | ***Engineering Numerical Methods*** | ***3*** | ***3*** | **-** | - |
| ***EP317*** | ***Entertainment & Culture Activity*** | ***0*** | ***-*** | ***-*** | ***1*** |
|  | ***TOTAL for 3rd Year*** | ***43*** | ***34*** | ***5*** | ***19*** |
| ***EP401*** | ***Power System Analysis 1*** | ***3*** | ***2*** | ***-*** | ***2*** |
| ***EP402*** | ***Power System Analysis II*** | ***3*** | ***2*** | ***-*** | ***2*** |
| ***EP403*** | ***Power System Protection*** | ***3*** | ***2*** | ***-*** | ***2*** |
| ***EP404*** | ***Electric Power Distribution*** | ***2*** | ***2*** |  | ***-*** |
| ***EP405*** | ***Electrical Design & sustainability*** | ***2*** | ***2*** | ***-*** | ***-*** |
| ***EP406*** | ***Special Machines*** | ***3*** | ***2*** | ***-*** | ***2*** |
| ***EP407*** | ***Electrical Drives*** | ***3*** | ***2*** | ***-*** | ***2*** |
| ***EP408*** | ***Administration &Leadership skills*** | ***2*** | ***2*** | ***-*** | ***-*** |
|  | ***TOTAL for 4th Year*** | ***21*** | ***16*** | ***0*** | ***10*** |
| ***TOTAL*** | | ***112*** | ***88*** | ***11*** | ***53*** |
| **151** | | |

**Course Number: EP101**

**Course Name: Digital Techniques I**

**Credit Hours: (3-2-0-2)**

**Pre-requisite: None**

**Course Contents:** Decimal Numbers , Binary Numbers , Binary arithmetic , Octal Numbers , Hexadecimal Numbers , Binary coded decimal [BCD] , Digital codes , Logic gates , Boolean algebra , Demorgans theorems , The karnaugh map , The universal property of the NAND and NOR gates.

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**Course Number: EP102**

**Course Name: Digital Techniques II**

**Credit Hours: (3-2-0-2)**

**Pre-requisite: None**

**Course Contents:** Adders , Subtracters , Magnitude comparators , Decoders , Encoders , Multiplexers Demultiplexers , Flip-Flops , Asynchronous counters , Synchronous counters , Up/Down synchronous counters , Shift register , Integrated circuit .======================================================

**Course Number: EP103**

**Course Name: Fundamentals’ of Elect. Eng. I**

**Credit hours: (3-3-1-2)**

**Pre-requisite: None**

**Course Contents:** Introduction ,DC circuit Analysis, Basic Definitions, KCL, KVL, Conservation of power, Series and Parallel connection of elements, Ohm's Law, delta and star transformation, Node Voltage Method, Mesh Current Method, Source Transformation, Thevenin Theorem, Norton Theorem, Maximum Power Transfer, Principle of Superposition.

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**Course Number: EP104**

**Course Name: Fundamentals’ of Elect. Eng. II**

**Credit hours: (3-3-1-2)**

**Pre-requisite: Fundamentals’ of Elect. Eng. I**

**Course Contents:** Capacitors, Inductors, Series and Parallel connection, AC circuit Analysis, Sinusoidal Review, Complex Numbers, Sinusoidal Circuits, Impedance and Admittance, Series and Parallel connection and phase relation in Sinusoidal Circuits, Phasor Diagram, More Sinusoidal Circuits, Analysis Theorems and Methods for AC Circuits, Instantaneous, Average, Apparent Power and Power Factor and reactive power, Complex Power and Power Triangle, RMS Values, Resonant Circuit. Magnetic filed, characteristics of lines of magnetic flux, magnetic filed due to an electric current, mmf, magnetic filed strength, magnetic constants reluctance, Kirchffs laws for magnetic circuit, series and parallel magnetic circuit.

**Course Number: EP105**

**Course Name: Engineering Mechanics I (Statics)**

**Credit Hours: (2-2-0-0)**

**Pre-requisite: None**

**Course Content:** Static: Force system, unit system, parallelogram law, force + components, Result of Coplanar force components of force in space, moment of A force, moment of couples, Equilibrium: free body diagram, coplanar system, analysis of trusses, friction nature of friction, theory of friction, coefficient of friction, centurions & center of gravity, centurions of area, Centurions determined by integration, moment of inertia: parallel Axes Theorem, 2nd moment of area by integration, radius, moment of inertia of Composite area.

Strength of materials : Hooks law, tension and compression stress thin – walled cylinders and spheres, combined stress (Mohr's circle) shear and normal stress, stresses in beams (initial principal).

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**Course Number: EP106**

**Course Name: Engineering Mechanics II (Dynamics)**

**Credit Hours: (2-2-0-0)**

**Pre-requisite: Engineering Mechanics I (Statics)**

**Course Content:** Dynamics: Kinetics of particle, rectilinear motion, curvilinear motion, rectangular components of curvilinear motion, normal and tangential component of Acceleration, kinetics: force, mass and acceleration, kinetics of particle Newton's 2nd law.

Thermodynamics: Introduction, Active materials & their specification, work and heat in ideals gasses and steam 1st law thermodynamics practical law in steam and gasses, 2nd law of thermodynamics practical law in steam and gasses.

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**Course Number: EP107**

**Course Name: : Physical Electronics**

**Credit hours: (2-2-0-0)**

**Pre-requisite: None**

**Course Contents:** Energy Levels and Atomic Structure, The atomic models, wave nature of light, dual nature of matter wave unction, energy – band theory of metals, insulators and Semiconductors, Crystal structure, ionic, covalent and metallic bounding energy hand of crystal. Internal structure of material cell, packing miller indices, crystal and directions, brags law and X-ray diffraction, electronic ballistics. Electrical Conduction in Metals, Mobility and conduction, energy distribution of electrons, Fermi level work function. Semiconductors materials (S1, GE, and compound Semiconductors) Extrinsic semiconductors, Fermi – level in semiconductor, diffusion and Carrier life time Half effect. P-N junction in equilibrium current – voltage characteristics, charge control decryption of a diode transition and diffusion capacitance, diode switching times, diode model, small-signal model and load line concept, introduction To hetero junctions and double hetero junctions.

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***Second Year***

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**Course Number: EP201**

**Course Name: Electronics. I**

**Credit hours: (3-2-0-2)**

**Pre-requisite: Physics II (Electronic Physics)**

**Course Contents:** Semiconductor Materials and PN Junction: Forward biased, reverse biased, and I-V relationship, Diodes: models and circuit analysis. Diode applications (rectifiers and others). Transistors: Bipolar Junction Transistors(BJTs),. DC Biasing Circuits of BJTs ..

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**Course Number: EP202**

**Course Name: Electronics. II**

**Credit hours: (3-2-0-2)**

**Pre-requisite: Electronics. I**

**Course Contents:** BJT modeling and AC, Junction field effect transistor, and metal-oxide-semiconductor field effect transistor (JFET & MOSFET). DC and small signal AC analysis. Electronic circuits applications (at least five Samples in details). Operational Amplifiers, Amplifier configurations. Multistage amplifiers.

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**Course Number: EP203**

**Course Name: Electric Circuit Analysis. I**

**Credit hours: (3-3-0-0)**

**Pre-requisite: Fundamentals’ of Elect. Eng. II**

**Course Contents:** - Non – Sinusoidal Waves : The Fourier series, Fourier coefficients, analysis of circuits with non – sinusoidal waves, illustrative applications, active power calculations with periodic functions, r.m.s value of periodic functions. Circuits with Mutual inductance: The concept of mutual inductance, polarity and the dot convection, the ideal transformer, equivalent circuits for magnetically coupled coils, Transformer. Locus Diagrams: Concept, locus diagrams of simple series and parallel circuit. Electric Transients (Classical Method): The natural and forced response of series and parallel circuits, circuit with zero and non zero initial conditions. Application of computers in solving circuit problems (Recommended).

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**Course Number: EP204**

**Course Name: Electric Circuit Analysis. II**

**Credit hours: (3-3-0-0)**

**Pre-requisite: Electric Circuit Analysis. I**

**Course Contents:** - Electric Transients (Laplace Method) : Applications of Laplace transformation in transient analysis, circuits elements in the S- domain, Laplace equivalent circuits, inverse transformation., Electric Filters: Simple passive filter, low – pass, high – pass and band – pass filter. Three – Phase Networks: Three phases voltage source, phase sequence, line and phase qualities, analysis of YY, YD, DY, DD connected circuits, power calculations and measurements in three phase circuit, the method of symmetrical components. Two – Port Network: Introduction terminal equations, two port parameters (z, y, h and ABCD), equivalent circuits, interconnected two – ports. Application of computers in solving circuit problems (Recommended).

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**Course Number: EP205**

**Course Name: Advanced Programming**

**Credit hours: (2-1-0-3)**

**Pre-requisite: Programming**

**Course Contents:** Introduction to MATLAB. Algebra & trigonometric function. Boolean & Matrix Operation. Complex Number. Array Indexing. Graphing. The switch Construct. If construct. while statement loop. Introduction to Simulink. Algebra & Trigonometric function representation as a block diagram. Simulation of First order systems & check their response. Simulation of Second order systems & check their response. Import & export data from/to workspace. Import & export data from/to M-file. Creation of Mask & Subsystem.

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**Course Number: EP206**

**Course Name: Software Engineering Application**

**Credit hours: (2-1-0-3)**

**Pre-requisite: Advanced Programming**

**Course Contents:** Introduction to software application in engineering, electric circuits simulation using Electronic work bench software, Design and simulate analog and digital circuits using PSPICE software, The use of AutoCAD in engineering drawing. Description of menu Bar and toolbars. Drawing Ellipse, Rectangle, line, Ray, Circle, point, Arc, ---------- etc. The use of various layers. Drawing electrical symbols on simple architectural plans.

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**Course Number: EP207**

**Course Name: Machines I (DC)**

**Credit hours: (3-2-0-2)**

**Pre-requisite: Fundamentals’ of Elect. Eng. II**

**Course Contents:** Generator-principle of rotating electrical machines and calculation of induced e.m.f., energy, power and torque in D.C. machines. Construction of D.C. machines and function of commutator. Type of armature windings. Calculation of m.m.f. per pole. Type of excitation connections. Armature reaction. Commutation. Type and characteristic of D.C. generator .Parallel operation of D.C. generators. Losses and efficiency of D.C. generators. Motors-principle of operation of D.C. motors. Calculation of speed, torque, starting of D.C. motors characteristic (shunt, series, compound, separately), speed control, electric breaking.

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**Course Number: EP208**

**Course Name: Machines II(Transformer )**

**Credit hours: (3-2-0-2)**

**Pre-requisite: Machines I (DC)**

**Course Contents:** Transformer-types of transformer, construction, phasor diagram, losses in transformers, the equivalent circuit of the transformer, efficiency, regulation, auto-transformer, three phase transformer: Construction, connection groups, applications, phase conversion, scott connection, multi-winding transformers, parallel operation, harmonic in transformer, Power Transformer, Computer Aided Transformer Design.. ======================================================

**Course Number: EP209**

**Course Name: Electro-Magnetics I**

**Credit hours: (2-2-1-0)**

**Pre-requisite: Fundamentals’ of Elect. Eng. II, Mathematics II**

**Course Contents:** Vector analysis: scalars and vectors, vector algebra, the Cartesian coordinate system, vector component and unitvector, the vector field, the dot product, the cross product, circular cylindrical coordinate system, spherical coordinate system, the transformation between coordinate system, differentialelements (volume, surface, and line), Coulomb's law and electric field intensity: the experimental law of Coulomb, electric field intensity, field of n point charges, electric fields due to continuous charge distributions (line charge,surface charge andvolume chargedistributions), steamline and sketches of fields, Electric flux density, Gauss's law-electric flux density, gauss's law, some symmetrical charge distribution, application of gauss's law; divergence, Maxwell's first equation (for electrostatics), the vector operator and the divergence theorem, Energy and potential-energy expended in moving a point charge in an electric field, the line integrals, potential difference and potential, the potential field of a point charge, the potential field of a system of charges, conservative property, potential gradient, the dipole energy density in the electrostatic field, conductors, Dielectrics and capacitance-current and current density, continuity of current, metallic conductors, conductor properties and boundary conditions, the method of mages, semiconductors, the nature of dielectric materials, boundary conditions for perfect dielectric materials, capacitance, capacitance of some useful configuration, capacitance of a two wire line, Poisson's and Laplace's equations-Poisson's and Laplace equations, uniqueness theorem, solution of Laplace’s equation in certain situation, solution of Poisson's equation in certain situation, product solution of Laplace’s equation.

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**Course Number: EP210**

**Course Name: Electro-Magnetics II**

**Credit hours: (2-2-1-0)**

**Pre-requisite: Electro-Magnetics I**

**Course Contents:** The steady of magnetic field, biot- savart law, the curl, stocke's theorem, ampere's circuit law, application of ampere's law, magnetic flux and magnetic flux density, the scalar and vector magnetic potential, derivation of steady magnetic field laws, Magnetic forces, materials and inductance-force on a moving charge, force on a differential current element, force between differential current elements, force and torque on a closed circuit, the nature of magnetic materials, magnetization and permeability, magnetic boundary conditions, the magnetic circuit, potential energy and forces on magnetic materials, inductance and mutual inductance, time varying fields and Maxwell's equations-faraday's law, displacement current, Maxwell’s equations in point form, Maxwell’s equations integral form, the retarded potentials.

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**Course Number: EP211**

**Course Name: Thermodynamics**

**Credit hours: (2-2-0-0)**

**Pre-requisite: Eng. Mechanics II**

**Course Contents:** Thermodynamics: Definitions/ Dimensions, Units, Mass, Force, Work and Power, Unit of Energy, Heat and System, Phase System, Open System, Close System, Property, State of a system, Process, Path, Density, State Function, Cycle, Cyclic Process, Heat Reservoir, Working Substance, Pure Substance, Pressure, Absolute and Gage Pressure, Manometer and Barometer, Thermal Equilibrium, The Zeroth Law of Thermodynamics, The First Law of Thermodynamics, Energy/ Potential energy, Kent ice energy, Internal energy, Flow energy, Work and Flow Work, Enthalpy. Steady Flow Energy Equation: Work of Steady Flow Open System, Applications of Energy Equation on Closed System, Applications on Steady Flow Energy Equation/ Nozzle, Throttling, Condenser, Boiler, Compressor, Turbine, Heat Exchange. The Second Law of thermodynamics, Specific Heat, The Constant volume Specific heat, The Constant Pressure Specific heat, Reversibility and Irreversibility, Entropy, The Carnot Cycle. Ideal Gas/ Boyles law, Charles Two Parts, Equation of State an Ideal gas, Jouls Law, Energy Relation of an Ideal Gas, Molar Specific Heat, Entropy of Perfect Gas, Constant Volume Process, Constant Pressure Process, Constant Temperature Process, Constant Entropy Process, General Process.

Heat Transfer: Conduction, Convection, Radiation, Insulations

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**Course Number: EP212**

**Course Name: Power Plants**

**Credit hours: (2-2-0-0)**

**Pre-requisite: Thermodynamics**

**Course Contents:** Fluids: Definitions/ Uniform Flow, Steady Flow, Unsteady Flow, Mean Velocity. Continuity of Flow, Liquids in Motion, Compressity, Compressibility for Gas, Passcal Law, Bernoullis Equation.

Power Plant: Definitions/ Power, Power Plant, Power Sources, Energy of Power, Power Plant Classification, Saturation Temp, Wet Mixture, Moisture Content, Dryness Fraction, Superheated Uapour, Degree of Superheated, Mollier Chart, Steam Power Cycle/ Carnot Cycle, Rankine Cycle, Boiler, Turbine, Condenser, Pump, Burner.

Isentropic Efficiency , Work Ratio. Rankine Cycle with Superheated, Method of increasing the cycle efficiency, Method applied in re-super heating, Thermal Efficiency, Types of feed water heaters, Heat Balance of the heater, Characteristic of Steam Power Plant, Gas Turbine. Hydro Turbine, Methods of increasing the work ratio, Factors Effecting in power generation and variable load , General Power Surface.

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***Third Year***

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**Course Number: EP301**

**Course Name: Electric Power I**

**Credit hours: (3-2-1-2)**

**Pre-requisite: Electric Circuits II & Mathematics IV**

**Course Contents:** Introduction, general background, Elements of power system , Transmission line constants, resistance, inductance, single phase two wire, three phase, symmetrical distance, unsymmetrical distance, flat arrangement, horizontal arrangement, hexagonal arrangement. Capacitance, single phase two wire, three phase, symmetrical distance, unsymmetrical distance, flat arrangement, horizontal arrangement, and earth effect.

Performance of T.L, short T.L, equivalent circuit, voltage regulation, phasor diagram, Medium T.L, equivalent circuit, voltage regulation, phasor diagram, T model, pi model, Long T.L, equivalent circuit, voltage regulation, phasor diagram.

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**Course Number: EP302**

**Course Name: Electric Power II**

**Credit hours: (3-2-1-2)**

**Pre-requisite: Electric Power I**

**Course Contents:** 2 port network, ABCD constants., Power circle diagram, Power flow through T.L. ,Corona, Overhead T.L insulators, string insulators, voltage distribution. Mechanical Design of T.L.: Sag and stress calculations, parabola equation, effect of ice and wind, different level supports. Economic operation. Underground cables.

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**Course Number: EP303**

**Course Name: Engineering Analysis**

**Credit Hours: (3-3-1-0)**

**Pre-requisite: Mathematics IV**

**Course Content:** Fourier Transform: Complex Fourier series, line spectra Fourier transform, continuous spectra, comparison with Laplace transform, general convolution applied to Laplace and Fourier transforms. The Z-transform: Region of convergence, properties of Z –transform, Z-transform pairs, the inverse of Z-transform, analysis and discrete-time systems, applications. Matrix Analysis: Quadratic form, characteristic equation, functions of a square matrix, Cayley-Hamilton theorem. Partial Differential Equations: solution of boundary condition problems, Wave equation, Laplace general solution, solution by separation of variables.

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**Course Number: EP304**

**Course Name: Engineering Numerical Methods**

**Credit Hours: (3-3-1-0)**

**Pre-requisite: Engineering Analysis**

**Course Content:** Introduction: why numerical methods, Solution of non-linear equations (roots finding): graphical method, bisection method, method of iteration, Newton's method, the secant method. Solving sets of linear equations: matrix notation, Gaussian elimination method, evaluation of the inverse of a matrix, matrix inverse method, LU factorization method, gauss-seidel iteration method, Eigen values and Eigenvectors. Solving set of set of nonlinear equations. Numerical interpolation: polynomial interpolation, linear interpolation, quadratic interpolation, higher degree interpolation (LaGrange's interpolation), error in polynomial interpolation. Numerical differentiation and integration: derivatives from interpolating polynomials, trapezoidal & Simpson’s rules for numerical integration.

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**Course Number: EP305**

**Course Name: Measurement Instruments**

**Credit hours: (2-2-0-0)**

**Pre-requisite: None**

**Course Contents:** Systems of Units and Standards of Measurement, Systems of units, International system of units, electrical standard, time and frequency standards, IEEE standards. Measurement and Error: Definitions, accuracy, precision, resolution, composition of measuring system, selection factors and trends, types of error: gross, systematic, random, and limiting errors. Statistical Analysis of Data, Instruments for Measuring Basic Electrical Parameters, Bridges and their Applications, Oscilloscopes, Transducers: Position, pressure, velocity, acceleration, force, torque, temperature, Photosensitive transducers. Data Recording Instruments, Noise: Limits to sensitivity, accuracy & speed in both analog and digital systems. S/N enhancement techniques, Computer-based Instrumentation and Measurement

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**Course Number: EP306**

**Course Name: Electronic Systems and Signals**

**Credit hours: (2-2-1-0)**

**Pre-requisite: Electronics II**

**Course Contents:** Multistage system and frequency consideration: General cascaded system, RC –coupled amplifier, direct-coupled amplifiers, frequency response. Feedback amplifier: Feedback concepts, properties of negative feedback amplifier ,connection types general analysis ,multistage feedback amplifiers, OP-Amp and applications, Oscillators, Large Signal Amplifier: Amplifier classes and efficiency, class (A), class (B), class (AB), class (C), power BJTs, junction temperature, thermal resistance, power dissipation versus temperature, transistor case and heatsink, power field effect transistors (VMOS), integrated circuit power amplifier. Introduction to Programmable Logic Devices, Interfacing: Digital and analog interfacing, D/A & A/D conversions, internal system interfacing, standard buses, digital system application. Arithmetic Processes, Electronic memory circuits.

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**Course Number: EP307**

**Course Name: Communications**

**Credit hours: (2-2-0-0)**

**Pre-requisite: Electronic Systems and Signals**

**Course Contents:** Elements of Communication Systems, channel bandwidth and rate of transmission, bandpass signals and filters, Amplitude modulation: AM-DSB-LC mod/demod, multiplexing (FDM), DSB-SC, SSB-SC, VSB, Angle modulation: FM and PM signals, bandwidth of angle modulated signals, FM mod/demod, PLL. **Noise analysis:** review of probability theory and random processes, Gaussian, white and filtered noise, Signal-to-Noise ratio. **Introduction to Digital communication systems**: the sampling theory, Reconstruction and aliasing, PCM (Uniform and Non-Uniform Quantizing, Companding).

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**Course Number: EP308**

**Course Name: High Voltage Engineering**

**Credit hours: (3-2-0-2)**

**Pre-requisite: None**

**Course Contents:** Electrical Breakdown in Gases, Solids and Liquids 18 Hrs.

Classical gas laws, the sparking voltage-Paschen's law, the breakdown field strength, breakdown in uniform and non-uniform fields, partial breakdown and corona, polarity effect, breakdown in solids and liquids. Electrostatic Fields: Electrostatic field distribution, breakdown strength of insulating materials, fields in homogeneous materials, fields in multilayer materials, stress control, experimental field analysis techniques. Generation of High Voltages: AC, DC, and impulse high voltages, testing transformers, series resonant circuits, impulse voltages, operation and construction of impulse generators. Measurement of High Voltages: Voltage measurements by spark gaps, sphere gaps, uniform field gaps, electrostatic voltmeters, voltage dividers. Over-voltages and Insulation Coordination: The lightning mechanism, simulated lightning surges for testing, protection against over-voltages, insulation coordination.

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**Course Number: EP309**

**Course Name: AC-Machines I**

**Credit hours: (3-2-0-2)**

**Pre-requisite: Machines II**

**Course Contents:** Principle of Operation; Stationary Field System Type; Rotating Field System Type; Advantages of Rotating Field System; Frequency of Induced EMF; Prime-movers for Synchronous Generators; Stator Construction; Rotor Construction; Types of Rotor; Damper Windings; Electrical and Mechanical Degrees; Three Phase Winding; Types of Three-phase Windings; Double Layer Winding Detail; Winding Factors; EMF Equation; Open Circuit Characteristic. Load Characteristics: Alternator Operation; Causes For Voltage Variations; Winding Resistance; Leakage Reactance; Armature Reaction; Representation of Smooth Cylindrical Type Alternator; Synchronous reactance; Synchronous Impedance; Phasor Diagrams for different Power-factor; Load Angle; Load Characteristics; Voltage Regulation; Definition of Voltage Regulation; Regulation Characteristics; Excitation Required for Constant Terminal Voltage; Equations for Power Generated and Power Output; Self-excited Alternators; Three-phase Self-excited Alternator; Single-phase Self-excited Alternator. Predetermination of Voltage Regulation: Necessity for Predetermination; Methods of Predetermination; Synchronous Impedance/EMF Method; Ampere-turn/MMF Method; Potier/ZPF Method.Parallel Operation: Conditions for Synchronising; Synchronising Methods; Synchronising Power and Torque; Maximum Synchronising Power; Load Sharing; Prime-mover Characteristic; Effect of Change in Prime-mover Input; Effect of Change in Excitation; Two Generators in Parallel; “n” Generators in Parallel. Operation on Infinite Bus-bars: Infinite Bus-bars; Generator Operation at different Power-factor; Synchronous Motors: Characteristic Features; Principle of Operation; Methods of Starting; Speed-Torque Characteristic; Network Equations; Phasor diagrams; Torque-angle characteristic; Equations for Power Developed and Power Input; Maximum Value of P\_d and P\_i; Equation for P-d and Pi with R=0; Power-Angle/Torque-Angle Characteristic; V and inverted V curves; Effect of Excitation on Current and pf; Synchronous phase modifier; Hunting of Synchronous machines: Machine Dynamics; Effect of dampers ; Machines with Dampers; Machines Without Dampers; Frequency of oscillations; Two Reaction Theory: Effect of Saliency in Armature Reaction; Direct and Quadrature Axes Reactances; Phasor Diagram; Generator Operation; Motor Operation; Power Angle Relation; Equation for Power Developed; Synchronising Power; Condition for maximum Power Developed; Power-Angle Characteristics; Reluctance Power; Advantage of Salient Pole Machines

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**Course Number: EP310**

**Course Name: AC-Machines II**

**Credit hours: (3-2-0-2)**

**Pre-requisite: AC-Machines I**

**Course Contents:** Introduction; Advantages and Disadvantages of Three-phase Induction Motors; Stator Construction; Rotor Construction; Types of Rotors. Principle of operation: Rotating Magnetic Field; Standstill Condition: Starting Torque, Condition for Maximum Starting Torque, Effect of Change in Supply Voltage, Starting Torque in Squirrel cage and Slip-ring Motor; Running Condition: Slip, Torque under Running Condition, Effect of Supply Voltage on Torque and Slip, Condition for Maximum Torque, Load Torque and Maximum Torque, Starting Torque and Maximum Torque; Torque-slip Characteristics; Speed-torque Characteristics; Modes of Operation. Losses: Types of Losses; Power Stages in Induction Motors; Power Stages in Induction Generators; Efficiency.Equivalent Circuit: Derivation of Exact Equivalent Circuit; Approximate Equivalent Circuit; Phasor Diagram with K=1; Performance Equations: Power Developed, Maximum Power Developed, Torque Developed, Maximum Torque Developed, Load Torque and Maximum Torque, Starting Torque and Maximum Torque.Testing and Performance Prediction: No Load Test; Blocked Rotor Test; Measurement of Stator Resistance; Performance Prediction Using Equivalent Circuit; Performance Prediction Using Circle Diagram: Principle of Circle Diagram, Circle Diagram for the Approximate Equivalent Circuit, Construction of Circle Diagram, Advantage and Disadvantage, Performance Prediction; Separation of Losses; No-load Test at Synchronous Speed; No-load Test at Variable Voltage; Determination of Efficiency by loss subtraction method; Direct Load Test: Advantages of the Direct Load Test, Disadvantage of the Direct Load Test.Miscellaneous Topics on Three Phase Induction Machines: Crawling; Cogging; Double Cage Motor; Construction of Double-cage Rotor; Torque-Slip Characteristics; Equivalent Circuits; Induction Generators; Power Flow Equations; Types of Induction Generators; Separately Excited Induction Generator; Self-excited Induction Generators; Control of Three-phase Induction Motors: Methods of Starting; Direct-on-line (DOL) Starter, Stator Resistance Starter, Autotransformer Starter, Star-Delta Starter, Rotor Resistance Starter; Methods of Speed Control: Speed Control by Changing Frequency, Speed Control by Changing Number of Poles, Speed Control by Changing Slip; Methods of Braking: Regenerative Braking, Plugging, Dynamic Braking.

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**Course Number: EP311**

**Course Name: Power Electronics I**

**Credit hours: (3-2-0-2)**

**Pre-requisite: Electronics II**

**Course Contents:** Power Semiconductor Devices: Power Diode, Thyristor, Diac, Triac, BJT Transistor, Mosfet. AC/DC converters(Rectifier), Uncontrolled and Controlled Half and Full wave Rectifier. DC/DC Convertor (Choppers), DC/AC Convertor (Inverters), AC/AC Convertor (Cycloconverters). Static Switches.

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**Course Number: EP312**

**Course Name: Power Electronics II**

**Credit hours: (3-2-0-2)**

**Pre-requisite: Power Electronics I**

**Course Contents:** Static Switches: Static Power Converters: Controlled rectifier circuits, single and poly phase inverter operation, dual converter, four quadrant operation, harmonics and power factor considerations, ideal and practical operation. Square and stepped waveforms, PWM inverters. Industrial Applications: General applications, DC motor control, transportation, thyristor-controlled reactors and capacitors. Introduction to FACTS ( Flexible AC Transmission Systems) Devices, STATCOM, SVC and DVR.

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**Course Number: EP313**

**Course Name: Control Theory I**

**Credit hours: (3-2-0-2)**

**Pre-requisite: None**

**Course Contents:** : Introduction: Basic Components of a Control System ,its Applications ,Open & Closed -Loop Control Systems, What is Feedback & its effects ?Types of Feedback Control Systems mathematical Foundation, Laplace Transform , Block Diagrams of Control Systems &B.D. reduction Signal-Flow Graphs (SFGs) ,Modeling of Physical Systems, Electrical Networks Mechanical Systems Elements ,Stability of Linear Control Systems, Transient response analysis, Effects of Integral and Derivative Control Actions on System Performance 28 Steady – state error in unity- feedback control system Methods of Determining Stability, Routh-Hurwitz Criterion

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**Course Number: EP314**

**Course Name: Control Theory I**

**Credit hours: (3-2-0-2)**

**Pre-requisite: None**

**Course Contents:** : Introduction to stability thermos ,Root-Locus Analysis ,Lead Compensation ,Lag Compensation ,Lag-Lead Compensation , Frequency-Response Analysis, , Bode diagram, Polar plot Three term controller, Sampled data system, Analysis of control systems in state space. Computer analysis of transfer functions, time domain responses, Analogue computers, solution of differential equations.

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**Course Number: EP315**

**Course Name: Electric Power Generation**

**Credit hours: (2-2-0-0)**

**Pre-requisite: None**

**Course Contents:** : Introduction, general background, Main Energy Resources, Elements of power system Generation, thermal plants, Hydro plants, Steam plants, Nuclear plants. Operation Factors: Load factor, capacity factor, Plant use factor, Diversity Factor, … etc. Combined Cycles, Selection Considerations of Combined Cycles and Cogeneration Plants, Applications of Cogeneration and Combined-Cycle Plants, Cogeneration Application Considerations, Economic and Technical Considerations for Combined-Cycle Performance Enhancement Options.

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**Course Number: EP316**

**Course Name: Microcontroller**

**Credit hours: (2-2-0-0)**

**Pre-requisite: None**

**Course Contents:** : Memory Types & Expansion: RAM, ROM, PROM, EPROM, EAROM, static & dynamic memories, memory cycle time, address decoding, linear & matrix expansion, virtual memories. MPU Hardware: Microprocessor hardware, 4-, 8-, 16-, and 32-bit MPU's, single chip microcomputer 8085,8086, & 8088, MPU details.

Input/output (I/O) and Buses: MPU, buses, serial parallel I/O, programmable I/O, start-up & reset, test & skip, microcomputer peripherals. Interfacing & Applications: Buffers, opto-compiler & circuit, protection, interface adapters, multi-tasking, time delays, daises chains, interfacing examples. Microcomputer Software : Memories mapping, program debugging at machine language & assembly language levels, application examples.

Parallel Processing: Multi-processing, stems, microcomputer networks, local and wide area networks, co-processors, arithmetic processors, microcomputer arithmetic & logic details. Introduction to 16-bit micro-controllers: 8097 Micro controller architecture and its applications. Applications of microprocessors in electrical systems. Introduction to FPGA

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***Fourth Year***

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**Course Number: EP401**

**Course Name: Power System Analysis I**

**Credit hours: (3-2-0-2)**

**Pre-requisite: Electric Power II**

**Course Contents:** : Power System Modeling, Modeling of generators, transformers, lines, cables, and loads. The per-unit system. Fault Current Calculations, Types of fault, calculation of three-phase balanced fault currents, Symmetrical components and sequence networks and unsymmetrical fault calculation, fault current limiting. Nodal analysis, Connection matrix.

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**Course Number: EP402**

**Course Name: Power System Analysis II**

**Credit hours: (3-2-0-2)**

**Pre-requisite: Power System Analysis I**

**Course Contents:** : Load flow. Gauss method, Newton method, Synchronous machines in power system, Concepts, steady-state, transient and dynamic stability, equal-area criterion, Introduction to FACTS (Flexible AC Transmission Systems), STATCOM, SVC , UPFC and DVR.

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**Course Number: EP403**

**Course Name: Power System Protection**

**Credit hours: (3-2-0-2)**

**Pre-requisite: Electric Power II**

**Course Contents:** : Basic Principles & Relay Types, Definitions and terminology, basic requirements, protection zones, primary and back-up protection. Basic types of relays, moving coil relays, induction relays, thermal, static, and computer relaying, Over-current Protection: Constant time relays, inverse time-lag relays, time-current grading and coordination. Directional over-current relays, examples of time and current grading. Distance Protection: Principles, characteristics & performance, protection zone, relay setting, reactance and mho relays. Differential Protection : Operating principles, current setting, use of bias, applications, Protective Schemes: Transformer protection, generator and generator-transformer protection, bus-bar protection, protection TL, feeders and induction motors.

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**Course Number: EP404**

**Course Name: Electric Power Distribution**

**Credit hours: (2-2-0-0)**

**Pre-requisite: Electric Power II**

**Course Contents:** : Distribution System Configuration: Various distribution system circuit components, representation and parameters radial, ring, spike, spindle, and interconnected systems. Electrical Design of Distribution Systems: Voltage level, selecting various system components, transformers, cables, overhead lines, switching and protective gear, voltage drop & power loss calculations, economical considerations. Distribution Inside Large Buildings: Single rising mains, individual floor supply, ring supply, double feed and grouped supply, vertical and horizontal supply systems, main, sub main, and final distribution boards. Industrial Power Distribution: Special features, equipment layout, cable trenches, cable trays, Grounding, emergency power supply.

Reactive Power Control in Distribution Systems: Individual, grouped, and centralized compensation, advantages, size and location of reactive power control equipment.

Electrical Load Management: Objectives, devices controlled, various methods of load control, practical implementation problems.

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**Course Number: EP405**

**Course Name: Electrical Design & sustainability**

**Credit hours: (3-3-0-0)**

**Pre-requisite: None**

**Course Contents:** : Definitions, Regulations and Standards : Basic design concepts, IEE wiring regulations, National Electrical Code (NEC), national & international standards, Iraqi wiring Installation Code, Iraqi Specification of Electrical Equipment, graphical electrical symbols for architectural plans. Interior Lighting Design: Definition of terms, lamp types, light fittings, mounting methods, fitting layout, photometric data, lighting calculations, economical considerations. Computer aided lighting design.

Wiring Methods & Regulations: Light and power circuit wiring, circuit loading, conduit types, switches, socket outlets, telephone outlets, junction boxes, low-voltage circuit protection, fuses and miniature circuit breakers, cable routes, cable trays. Main Sub-main and Final Distribution Boards: Selection and sizing of main, sub-main, & final distribution boards, board location. Specifications and Bill of Quantities: Preparation of electrical specifications and bill s of quantities for contract documents. Sustainability features consideration in electrical design =====================================================

**Course Number: EP406**

**Course Name: Special Machines**

**Credit hours: (3-2-0-2)**

**Pre-requisite: AC Machines I & II**

**Course Contents:** : Introduction to unified theory of machines, Special Control Machines: Two phase control motors-servomotors, synchros, AC tachometers, synchros & control transformers, applications ( error detection, angular position ). Stepping Motors: Definition & construction, variable reluctance SM, permanent magnet SM, hybrid SM, drive circuit specification & performance characteristics, advantages & disadvantages of SM. Linear Electric Machines (LEM): Introduction, types of LEM, electromagnetic field analysis of LEM, linear IM, approximate performance analysis. Brushless DC Motors : Unipolar & bipolar brushless DC motors, speed control of brushless DC motors, Important features & applications. ======================================================

**Course Number: EP407**

**Course Name: Electrical Drives**

**Credit hours: (3-2-0-2)**

**Pre-requisite: AC Machines I & II**

**Course Contents:** : Classes of Electronic AC Drives, Variable-Frequency Speed Control of a SCIM, Variable Voltage Speed Control of a SCIM, Speed Control of a SCIM with Rectifier Inverter System, Chopper Speed Control of a WRIM, Electronic Speed Control of Synchronous Motors, Speed Control by Current fed D.C. Link, Synchronous Motor and Cycloconverter, Digital Control of Electric Motors,

Application of Digital Control.

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**Course Number: EP108, EP213 and EP317 Courses**

**Name: University Culture Activity I, II & III**

**Credit hours: (0-1-0-0)**

**Pre-requisite: None**

**Course Contents:** These courses are designed to give the student the required skills in human development such as preparing engineering report, presentation to a large gathering of people, team cooperation, preparing and participation of some university activities, and everything that might be needed in successful and modern life style.

Culture Connect: Experience the cultures of the world (samples), To expose students to the life ways of a diversity of cultures around the world. To help students understand that all people need the same basic things and use what they have available in their environment to obtain those things. To teach students to respect cultural differences.

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**Course Number: EP408**

**Name: Administration and Leadership skills**

**Credit hours: (2-2-0-0)**

**Pre-requisite: None**

**Course Contents:** This course is designed to give the student the required skills in Administration and leadership that he needs in his career life.

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Electives

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| ***Course No.*** | ***Course Title*** | ***Cr. Hours*** | ***Weekly hours*** | | |
| ***Lec.*** | ***Tut.*** | ***Lab.*** |
| ***4th Year*** | ***4th Year*** | ***4th Year*** | ***4th Year*** | ***4th Year*** | ***4th Year*** |
| ***EP409*** | ***Renewable Energy Utilization*** | ***2*** | ***2*** | ***-*** | ***-*** |
| ***EP410*** | ***Smart Grid*** | ***2*** | ***2*** | ***-*** | ***-*** |
| ***EP411*** | ***Digital Signal Processing (DSP)*** | ***2*** | ***2*** | ***-*** | ***-*** |
| ***EP412*** | ***Electric Heating*** | ***2*** | ***2*** | ***-*** | ***-*** |
| ***EP413*** | ***Industrial Application of AC Motors*** | ***2*** | ***2*** | ***-*** | ***-*** |
| ***EP414*** | ***Distribution System Automation*** | ***2*** | ***2*** | ***-*** | ***-*** |
| ***EP415*** | ***Information Theory*** | ***2*** | ***2*** | ***-*** | ***-*** |
| ***EP416*** | ***Lighting Engineering*** | ***2*** | ***2*** | ***-*** | ***-*** |
| ***EP417*** | ***Grounding*** | ***2*** | ***2*** | ***-*** | ***-*** |
| ***EP418*** | ***Power System Operation & Control*** | ***2*** | ***2*** | ***-*** | ***-*** |
| ***EP419*** | ***Artificial Intelligence*** | ***2*** | ***2*** | ***-*** | ***-*** |
| ***EP420*** | ***Servomechanism*** | ***2*** | ***2*** | ***-*** | ***-*** |
| ***Total*** | | ***24*** | ***24*** | ***-*** | ***-*** |
| **24** | | |

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**Course Number: EP409**

**Course Name: Renewable Energy Utilization**

**Credit hours: (2-2-0-0)**

**Pre-requisite: Electric Power Generation**

**Course Contents:** Overview of energy use: Today’s energy use , Fossil fuels and environmental impact, Renewable energy source and devices, Solar Energy: Solar radiation, Solar thermal energy, Photovoltaics (Solar cells), CO2 capture and solar fuels, Wind Energy and Hydroelectricity: Availability of wind energy, Wind turbines, wind parks and power control, Water sources and power: Water turbines and hydroelectric plants. Energy Storage: Smart grid systems, Hybrid vehicles, Forms of energy storage, Batteries, • Super-capacitors. Overview on Hydrogen and Fuel Cells, Coal-fired plants and integrated gassifier fuel cell (IGFC) systems, Biomass and Bio-energy

Thermoelectricity and Waste-Heat Utilization. Utilization of Renewable energy plants as Distributed generation sources in power systems.

**Course Number: EP410**

**Course Name: Smart Grid**

**Credit hours: (2-2-0-0)**

**Pre-requisite: None**

**Course Contents:** Smart Grid: Definition, Applications, Government and Industry , Standardization , Smart Grid Communications: Two-way Digital Communications Paradigm, Network Architectures, IP-based Systems, Power Line Communications, Advanced Metering Infrastructure , Demand Response: Definition, Applications and State-of-the Art , Pricing and Energy Consumption Scheduling , Controllable Load Models, Dynamics, and Challenges , Electric Vehicles and Vehicle-to-Grid Systems , Demand Side Ancillary Services , Renewable Generation: Carbon Footprint, Renewable Resources: Wind and Solar , Micro grid Architecture , Tackling Intermittency, Stochastic Models and Forecasting, Distributed Storage and Reserves,

• Wide Area Measurement: Sensor Networks , Phasor Measurement Units, Communications Infrastructure, Fault Detection and Self-Healing Systems , Applications and Challenges

• Security and Privacy: Cyber Security Challenges in Smart Grid, Load Altering Attacks , False Data Injection Attacks, Defense Mechanisms , Privacy Challenges ,

• Economics and Market Operations: Energy and Reserve Markets , Market Power , Generation Firms, Location Marginal Prices , Financial Transmission Rights

**Course Number: EP411**

**Course Name: Digital Signal Processing (DSP)**

**Credit hours: (2-2-0-0)**

**Pre-requisite: None**

**Course Contents:** Discrete-time signals and systems, The z and Fourier transforms, Discrete transforms, Digital filters, FIR filter approximations, IIR filter approximations, Spectral estimation, Multi-rate systems, Filter banks, Wavelet transforms, Finite-precision digital signal processing, Efficient FIR structures, Efficient IIR structures.

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**Course Number: EP412**

**Course Name: Electric Heating**

**Credit hours: (2-2-0-0)**

**Pre-requisite: None**

**Course Contents:** Advantages of Electric Heating, Different Methods of Heat Transfer , Methods of Electric Heating, Resistance Heating, Requirement of a Good Heating Element, Resistance Furnaces or Ovens, Temperature Control of Resistance Furnaces, Design of Heating Element , Arc Furnaces, Direct Arc Furnace, Indirect Arc Furnace, Induction Heating, Core-type Induction Furnace, Vertical Core-Type Induction Furnace, Indirect Core-Type Induction Furnace, Coreless Induction Furnace, High Frequency Eddy-current Heating, Dielectric Heating, Dielectric Loss-Advantages of Dielectric Heating, Applications of Dielectric Heating, Choice of Frequency. Infrared Heating .

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**Course Number: EP413**

**Course Name: Industrial Application of AC Motors**

**Credit hours: (2-2-0-0)**

**Pre-requisite: None**

**Course Contents:** Classification of Electric Drives, Advantages of Individual Drive, Selection of a Motor, Electrical Characteristics, Types of Enclosures, Bearings, Transmission of Power , Noise, Motors of Different Industrial Drives, , Advantages of Electrical Braking Over Mechanical Braking , Types of Electric Braking, Plugging Applied to DC Motors, Plugging of Induction Motors, Rheostatic Braking, Rheostatic Braking, of DC Motors, Rheostatic Braking Torque, Rheostatic Braking of Induction Motors , Regenerative Braking, Energy Saving in Regenerative Braking. Size and Rating , Estimation of Motor Rating , Different Types of Industrial Loads, Heating of Motor or Temperature Rise. Equation for Heating of Motor , Heating Time Constant , Equation for Cooling of Motor or Temperature Fall , Cooling Time Constant , Heating and Cooling, Curves , Load Equalization, Use of Flywheels, Flywheel Calculations, Load Removed (Flywheel Accelerating) , Choice of Flywheel.

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**Course Number: EP414**

**Course Name: Distribution Automation**

**Credit hours: (2-2-0-0)**

**Pre-requisite: None**

**Course Contents:** Need Based Energy Management (NBEM) , Advantages of NBEM, Conventional Distribution Network, Automated System, Sectionalizing Switches, Remote Terminal Units (RTU’s), Data Acquisition System (DAS), Communication Interface , Power line carrier communication (PLCC), Fiber optics data communication, Radio communication, Public telephone communication, Satellite communication, Polling scheme, Distribution SCADA, Man - Machine Interface, A Typical SCADA

System , Distribution Automation , Load Management in DMS Automated Distribution System , Data acquisition unit , Remote terminal unit (RTU) , Communication unit , Substation Automation , Requirements , Functioning , Control system , Protective System , Feeder Automation , Distribution equipment , Interface equipment , Automation equipment , Consumer Side Automation , Energy Auditing, Advantages of Distribution Automation , Reduced line loss , Power quality , Deferred capital expenses – Energy cost reduction , Optimal energy use , Economic benefits , Improved reliability Compatibility.

**Course Number: EP415**

**Course Name: Information Theory**

**Credit hours: (2-2-0-0)**

**Pre-requisite: None**

**Course Contents:** Model of communication system, Elements of a digital communication system, Measure of Information, lnformation content of a message, Average information content [Entropy], Marko statistical model for information source, Entropy & information rate of Markov source, Encoding of the source output, Shannon's Encoding Algorithm, Huffman Encoding Algorithm, Fano Encoding Algorithm, communication channels, capacity of discrete memoryless channel, capacity of physical channel, optimum decision level, linear block codes (error correction & detection), binary cyclic codes (syndrome calculation error detection & error correction), convolutional codes (encoding, decoding and performance), convolution/deconvolution methods.

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**Course Number: EP416**

**Course Name: Lighting Engineering**

**Credit hours: (2-2-0-0)**

**Pre-requisite: None**

**Course Contents:** Definitions , Measuring Light and Illumination Terms, Laws of Illumination, Calculation of Luminance (L) of a Diffuse Reflecting Surface, Laws Governing Illumination of Different Sources , How to Select the Recommended Illuminance Level , Zonal Cavity Method of Calculating Illumination, Lamp Characteristics and Selection Guide, How Light Affects Color, Integrating Sphere or Photometer, Diffusing and Reflecting Surfaces: Globes and Reflectors, Lighting Schemes ,Illumination, Required for Different Purposes , Space / Height Ratio, Design of Lighting Schemes and Lay-outs, Utilization, Factor or Coefficient of Utilization [CU] , Light Loss Factor (LLF) or Depreciation Factor (p) , Floodlighting , Artificial Sources of Light , Incandescent Lamp, Filament Dimensions , Incandescent Lamp Characteristics, Clear and Inside, frosted Gas-filled Lamps, Discharge Lamps, Sodium Vapour Lamp, High- pressure Mercury Vapour Lamp , Fluorescent Mercury, Vapour Lamps, Fluorescent Lamp, Circuit with Thermal Switch , Startless Fluorescent Lamp Circuit , Stroboscopic Effect of Fluorescent Lamps , Comparison of Different Light Sources

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**Course Number: EP417**

**Course Name: Grounding**

**Credit hours: (2-2-0-0)**

**Pre-requisite: None**

**Course Contents:** Introduction : Grounding concept, need for neutral and neutral grounding. Neutral Point Grounding : Isolated and solidly grounded systems, resistance and reactance grounding, Peterson's coil grounding. Grounding of different neutral points in power systems. Grounding Systems: Grounding electrodes, resistance of grounding rods. Calculation of grounding rod resistance. Soil resistively measurement and ground resistance measurement. Grounding System Assessment: Calculation of touch and step voltages. Touch and step voltages according to specifications. Improving of grounding system performance. Practical Grounding Systems in Iraq : Grounding of 11/0.4 kV and 33/11 kV systems. Experience & problems.

**Course Number: EP418**

**Course Name: Power System Operation & Control**

**Credit hours: (2-2-0-0)**

**Pre-requisite: Electric Power Generation**

**Course Contents:** : Economic Dispatch Neglecting Losses and no Generator Limits, Economic Dispatch Neglecting Losses and Including Generator Limits, Penalty Factor and approximate Penalty Factor , Transmission Loss Formula ( B-Coefficients)

Economic Dispatch Including Losses, Hydro Plants Characteristics, Hydro Electric Plant Models, Incremental Water Rate Characteristics, Energy Scheduling Method

Optimal Operation of Hydrothermal Systems, The Coordination Equations

Application of Computers in Economic Operation, Unit Commitment: Priority - List Method, Dynamic Programming Method (Forward), Dynamic Programming Method (Backward)

**Course Number: EP419**

**Course Name: Artificial Intelligence**

**Credit hours: (2-2-0-0)**

**Pre-requisite: None**

**Course Contents:** Introduction to artificial intelligence ,Problem representation and search techniques ,Search in game trees , Vision: scene analysis and the blocks world , Constraint Satisfaction , Knowledge representation techniques including logic and semantic networks , Machine learning , Natural language understanding: grammars, parsing and natural language processing systems , Project presentations , Examples, Introduction to Optimization Techniques.

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**Course Number: EP420**

**Course Name: Servomechanism**

**Credit hours: (2-2-0-0)**

**Pre-requisite: None**

**Course Contents:** Definition of a servomechanism.Open /closed loop. Electrohydraulic proportional control systems; basic elements. Explanation of basic elements: - power source - control element - feedback sensor -error activator. The servovalve (including three stage valves if required). Feedback sensors - transducers - the LVDT, loadcell and pressure transducer (including Rcal. and calibration). The error activator - the error path.

• The application of the basic elements in a closed loop control system. Step response - marginally stable criteria (include three stage valves if required). Electronics - amplifiers - proportional, integrating and differential. The P I D. Control modes. Dither and servovalve balance. Servomechanisms with DC motors. Control and supply circuits of DC motors. Servomechanisms with AC motors and their control and supply circuits. Servomechanisms with hybrid motors. Mathematical model of discrete motor.Supply and control circuits of stepper motors. Stepper motors in actuating devices of servomechanisms. Frequency converter with scalar and vector control. DC impulse converters for dynamic drives in CNC machines. AC drives with voltage converters with asynchronous motors. Servosystems with synchronous motors. Sensor systems used in

servomechanisms. Electromagnetic compatibility of CNC machines. The servovalve (including three stage valves if required).

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***Summary Table***

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| --- | --- | --- | --- | --- | --- | --- | --- |
| ***No*** | ***Class*** | ***Study Hours*** | | | ***No. of Units*** | | |
| ***First Semester*** | ***Second Semester*** | ***Total*** | ***First Semester*** | ***Second Semester*** | ***Total*** |
| ***1*** | ***First Year*** | ***450*** | ***480*** | ***930*** | ***20*** | ***20*** | ***40*** |
| ***2*** | ***Second Year*** | ***345*** | ***360*** | ***705*** | ***17*** | ***17*** | ***34*** |
| ***3*** | ***Third Year*** | ***375*** | ***435*** | ***810*** | ***21*** | ***22*** | ***43*** |
| ***4*** | ***Fourth Year*** | ***360*** | ***300*** | ***660*** | ***20*** | ***17*** | ***37*** |
| ***Total*** | | ***1530*** | ***1575*** | ***3105*** | ***78*** | ***76*** | ***154*** |