*Republic of Iraq*

*Ministry of Higher Education & Scientific Research Supervision and Scientific Evaluation Directorate Quality Assurance and Academic Accreditation International Accreditation Dept.*

Academic Program Specification Form for The Academic

*University: Diyala*

*College: Engineering*

*Number Of Departments in The College: 01*

*Date Of Form Completion :17/9/2023*

Prof. Dr. Anees A. Khadom

The Dean

Date :17/9/2023

Signature

Assist. prof. Dr. Jabbar Q. Jabbar

Dean ’s Assistant for Scientific Affairs

Date :17/9/2023 Signature

Assist. prof. Dr. Salah N Farhan

The College Quality Assurance and University Performance Manager

Date :17/9/2023 Signature

Quality Assurance And University Performance Manager Date : / /

Signature

# TEMPLATE FOR PROGRAMME SPECIFICATION

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| HIGHER EDUCATION PERFORMANCE REVIEW: PROGRAMME REVIEW |

**PROGRAMME SPECIFICATION**

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| This Program Specification provides a concise summary of the main features of the program and the learning outcomes that a typical student might reasonably be expected to achieve and demonstrate if he/she takes full advantage of the learning opportunities that are provided. It is supported by a specification for each course that contributes to the program. |

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| 1. Teaching Institution | University of Diyala |
| 2. University Department/Centre | College of Engineering |
| 3. Program Title | Electrical Power and Machines Engineering |
| 4. Title of Final Award | BSc in Electrical Power and Machines Engineering |
| 5. Modes of Attendance offered | Courses |
| 6. Accreditation | N/A |
| 7. Other external influences | None |
| 8. Date of production/revision of this specification | 17/09/2023 |
| 9. Aims of the Program |
| * Prepare the students to engage theoretically and practically 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.
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| * Prepare the students to Engage in ongoing professional development activities by pursuing graduate studies and/or other learning opportunities to respond to the arising challenges.
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| * Advance in responsibility and leadership in their careers and compete with their peers according to the profession ethics.
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| * Promote students with the necessary scientific and practical skills in the discipline for solving engineering problems and treating them logically and scientifically.
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| * Promote students with the necessary skills administration, time management, team-work, communication and language skills, soft computing and programming skills.
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| * Providing students with scientific, practical and personal skills that enable them to solve practical problems and deal with them using scientific concepts.
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| 10. Learning Outcomes, Teaching, Learning and Assessment Methods |
| A 1- Acquiring knowledge of mathematics, computers, engineering and customary sciences, employing them and preparing the student for scientific research. A 2- The ability to diagnose engineering problems within the jurisdiction and know their causes and appropriate solutions. A 3- To familiarize students with the basic theories of power engineering, machines, electrical machines, power plants, and various industrial applications and applications. A4 - The student will be familiar with the basics of communication and control systems, electronics, digital technologies and their applications. A 5 - Knowledge of projects and leadership of work groups within the ethics of the profession and the principles of engineering economics.  |
| B. The skills goals special to the program. B1 - Empowering students with the basics of working on power systems, electromagnetic fields, high pressure, and skills of analysis and design programs for electrical networks.B2 - Skills of analyzing and designing electrical networks for transmission and distribution and designs of building networks, as well as enabling students to obtain knowledge of the practical framework in the field of energy types, energy transmission and distribution, operation and control.B3 - Enable students to obtain knowledge and understanding of conventional electric power generation, renewable energy of all kinds, and thermal power plants.B4 - Enabling students to obtain knowledge and understanding of fault diagnosis, protection and maintenance of devices and applications of machines, equipment and electric drivers.B5 - Empowering the student to manage, lead, and economic engineering projects and organize time, while adhering to the ethics of the engineering profession in solving problems encountered in the workplace and developing the ability for continuous self-learning. |
| Teaching and Learning Methods |
| * Studying the theoretical and practical academic program for the specialty lessons
* The theoretical program is taught using the smart board, whiteboard or data show connected to the personal computer, discussing ideas and facts with the students.
* Adopting the study through virtual electronic classes as an aid to the real classes.
* The practical program of specialization lessons is carried out by conducting laboratory or field experiments, collecting measurements by small groups of students, and analyzing, discussing and displaying the measurements.
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| Assessment methods |
| * Daily exams with practical and scientific questions.
* Participation marks for difficult competition questions among students.
* Assigning grades to homework assignments and reports assigned to them.
* Monthly exams for the curriculum in addition to the final exam.
 |
| C. Affective and value goals C1- Enhancing the ability to work collectively through practical groups in the laboratory, mini-projects and discussion panels C2- Comparing, criticizing, checking and developing the ideas of the proposed designs and modern technologies, while respecting the efforts of others and avoiding scientific theft C3 - The ability to suggest alternatives to approach engineering problems in an honest and sustainable manner, taking into account human rights and the environment and avoiding pollution and accidents |
| Teaching and Learning Methods |
| * Providing students with the basics, additional topics, and field experiences related to the outcomes of thinking and analysis.
* Forming discussion circles during or outside lectures to discuss scientific engineering topics that require thinking and analysis.
* Asking students, a set of thinking questions during lectures, such as (what, how, when, why) for specific topics.
* Giving students homework and periodic reports.
 |
| Assessment methods |
| * Daily exams with practical and scientific questions.
* Participation marks for difficult competition questions among students.
* Assigning grades to homework assignments and reports assigned to them.
* Semester exams for the curriculum in addition to the final exam.
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| D. General and Transferable Skills (other skills relevant to employability and personal development)D1- Ability to work with others disciplined within one work team, presenting ideas and discussing them orally, in writing and electronicallyD2 - A full awareness of the moral and practical responsibility for the work that the student will practice after graduationD3 - The ability to understand and communicate in English within the technical level related to the field of competence and the use of related engineering software. |
| Teaching and Learning Methods |
| * Through the Daily lectures by seminar and discussions
* discussion circles during lectures to discuss scientific engineering topics that require thinking and analysis.
* Asking students, a set of thinking questions during lectures, such as (what, how, when, why) for specific topics
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| Assessment Methods |
| * Evaluating the seminar and reports that submitted by students and providing them with the necessary feedback to improve their skills and self confidence

11. Program Structure |
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| ***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** |  |

13. Personal Development Planning |
| It is planned to develop the students’ personalities by holding discussion circles with them and asking them for periodic reports and seminars throughout the four stages and on various topics to develop their personal development. |
| 14. Admission criteria . |
| According to the rules and regulations of Ministry of Higher Education and Scientific Research. |
| 15. Key sources of information about the program |
| * College website.
* The department’s website and contact the department by email.
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| Year / Level | Course Code | Course Title | Core (C)Title or Option (O**)** | Knowledge and understanding | Subject-specific skills | General and Transferable Skills (or) Other skills relevant to employability and personal development |
| **A1** | **A2** | **A3** | **A4** | **B1** | **B2** | **B3** | **B4** | **C1** | **C2** | **C3** | **D1** | **D2** | **D3** |
| Fourth Year-1st Semester | **EP418** | **Power System Operation & Control** | o | √ | √ | √ | √ | √ | √ | √ | √ |  | √ | √ | √ | √ | √ |
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# TEMPLATE FOR COURSE SPECIFICATION

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| HIGHER EDUCATION PERFORMANCE REVIEW: PROGRAMME REVIEW |

**COURSE SPECIFICATION**

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| This Course Specification provides a concise summary of the main features of the course and the learning outcomes that a typical student might reasonably be expected to achieve and demonstrate if he/she takes full advantage of the learning opportunities that are provided. It should be cross-referenced with the programme specification. |

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| 1. Teaching Institution | University of Diyala |
| 2. University Department/Centre | College of Engineering |
| 3. Course title/code | EP418 / **Power System Operation & Control** |
| 4. Modes of Attendance offered | Class Lectures |
| 5. Semester/Year | 1st Semester – Fourth Year |
| 6. Number of hours tuition (total) | 60 hours |
| 7. Date of production/revision of this specification | 17/09/2023 |
| 8. Aims of the Course |
| Study the basic principles of electronics and the most important theories used  |
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| 9· Learning Outcomes, Teaching ,Learning and Assessment Methode |

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| A- Cognitive goals . A1- Students also learning basic definitions and introductory concepts of Economic Operation: Input Output Curves and Heat Rate Characteristics.A2- Calculate; Economic Dispatch Neglecting Losses and no Generator Limits.A3- Be familiar with Penalty Factor and Transmission Loss Formula ( B-Coefficients)..A4- Be able to apply the Economic Dispatch Including Losses..A5 – Design the and analytical Software Economic Dispatch.A6 – Work in groups and function on multi-disciplinary teams. |
| B. The skills goals special to the course. B1 - Identify, formulate and solve engineering related Load Frequency Control(LFC): Generator Model, Load Model, Prime Mover Model and Governor Model problems.B2 - Be familiar with Voltage and Reactive Power Control(AVR): Amplifier Model, Exciter Model, Generator Model and Sensor Model.B3- Understand professional, social and ethical responsibilities. B4- Use the techniques, skills, and modern engineering tools necessary for engineering practice in Power System Operation & Control applications. |
| Teaching and Learning Methods |
| 1- The teacher gives comprehensive theoretical lectures2- The teacher requests frequent reports on the basic topics of the subject.3- Using engineering software to understand the interrelationship of system elements with each other.4- Using some educational videos and practical visits to the sites of renewable energy plants |
| Assessment methods |
| * Daily discussion to determine the extent of students’ understanding of the material and to evaluate the daily contributions.
* Daily exams with various short scientific questions to understand the extent of their understanding of the material.
* Giving part of the semester’s grade to homework assignments.
* Daily exams (Quiz) and monthly exams for the curriculum and the final exam
 |
| C. Affective and value goals C1- Urging the student to understand the purpose of studying the subject in general.C2- Urging the student to understand the operation of each function or code within the language.C2- Urging the student to think about how to develop himself in the field of computers.C4- Making the student able to deal with the calculator and how to use the programs. |
| Teaching and Learning Methods |
| * Providing students with the basics, additional topics, and field experiences related to the outcomes of thinking and analysis.
* Forming discussion circles during or outside lectures to discuss scientific engineering topics that require thinking and analysis.
* Asking students, a set of thinking questions during lectures, such as (what, how, when, why) for specific topics.
 |
| Assessment methods |
| * Daily exams with practical and scientific questions.
* Participation marks for difficult competition questions among students.
* Assigning grades to homework assignments and reports assigned to them.
* Semester exams for the curriculum in addition to the final exam.
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| D. General and rehabilitative transferred skills(other skills relevant to employability and personal development)D 1- The skill of speaking in English within the specialtyD 2- The skill of using engineering softwareD3- Awareness of the effects of the electric power system on humans, the environment, and sustainable alternatives |

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| **10. Course Structure** |
| **Week** | **Hours** | **ILOs** | **Unit/Module or Topic Title** | **Teaching Method** | **Assessment Method** |
| **1st and 2nd weeks** | **4** | **Students also learning basic definitions and introductory concepts of Economic Operation: Input Output Curves and Heat Rate Characteristics.** | **Economic Operation: Input Output Curves and Heat Rate Characteristics** | **Lectures+ videos**  | **Weekly & monthly tests+ assignments+ seminars**  |
| **3rd and4th weeks** | **4** | **Calculate; Economic Dispatch Neglecting Losses and no Generator Limits.** | **Modeling of Fuel Costs for Thermal Generation, Operating Cost of a Thermal Plant** | **Lectures+ videos** | **Weekly & monthly tests+ assignments+ seminars** |
| **5th and 6th weeks** | **4** | **Be familiar with Penalty Factor and Transmission Loss Formula ( B-Coefficients).** | **Economic Dispatch Neglecting Losses and no Generator Limits** | **Lectures+ videos** | **Weekly & monthly tests+ assignments+ seminars** |
| **7th and 8th**  | **4** | **Design the and analytical Software Economic Dispatch.** | **The Kuhn-Tucker Conditions** | **Lectures+ videos** | **Weekly & monthly tests+ assignments+ seminars** |
| **9th**  | **2** | **Be able to apply the mathematical tools to calculation economic Dispatch Including Losses** | **9th**  | **2** | **Be able to apply the mathematical tools to calculation economic Dispatch Including Losses** |
| **10th and 11th**  | **4** | **Be familiar with Penalty Factor and Transmission Loss Formula ( B-Coefficients).** | **10th and 11th**  | **4** | **Be familiar with Penalty Factor and Transmission Loss Formula ( B-Coefficients).** |
| **12th and 13th**  | **4** | **Be able to apply the Economic Dispatch Including Losses.** | **12th and 13th**  | **4** | **Be able to apply the Economic Dispatch Including Losses.** |
| **14th and 15th**  | **4** | **- Use the techniques, skills, and modern engineering tools necessary for engineering practice in Power System Operation & Control applications.** | **14th and 15th**  | **4** | **- Use the techniques, skills, and modern engineering tools necessary for engineering practice in Power System Operation & Control applications.** |

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| 11. Infrastructure |
| 1. Books Required reading: | 1-Power system analysis, H. Sadaat 2- Operation and control in power systems, P. S. R. Murty. |
| 2. Main references (sources) | Principles of power system V. K. Mehta. |
| A- Recommended books and references (scientific journals, reports…). | * Any highly reputation international and local books, journal, or scientific magazine
 |
| B-Electronic references, Internet sites… | Recent webpages to updating the trends in technologies relevant to renewable energy |
| 12. The development of the curriculum plan |
| The Development of the curriculum consists of various practical examples of using diodes in daily used devices and gadgets  |