**University,**

**Faculty of Engineering,**

**Electrical Eng. Dept.,**

**Post Graduate Studies and Research.**

**Course Specification**

**Minoufiya University**

Faculty of Engineering

***Title: Power Electronics (1)***

***Code Symbol: ELE 616***

***Department offering the course: Electrical Eng. Dept***

***Date of specification approval: / /2012***

***A- COURSE IDENTIFICATION AND INFORMATION:***

***B - Professional Information***

***B.1 Course Aims:***

This course aims to explore power electronics applications, components, modules,

packaging and reliability. Also, solve and apply analytical approaches for studying power

electronic problems and learn about power electronic devices in industry areas.

***B.2 Course Objectives***

**1. Learning about power electronic devices and their use in actual circuits.**

**2. Studying power control techniques using power electronics.**

**3. Learning about power supply conditioning using power electronic converters.**

**4. Studying the principles of power semiconductor circuit analysis.**

**5. Solve and apply analytical approaches for studying power electronic problems.**

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| Field | Programme ILOs that the course  contribute in achieving | Course ILOs |
| Knowledge&  Understanding | A1. Understand theory, basics  and practices of mathematics,  sciences and various electrical  engineering technologies. | a1.1) Illustrate the basics of  power electronics.  a1.2) Discuss the principle of  operation and performance of  selected converter circuits. |
| A3.     Know     the     scientific  developments     in     electrical  engineering. | a3.1)      Applying      analytical  approaches    used    in    power  electronic. |
| Intellectual skills | B1. Analyze and evaluate the  data and use them to solve the  electrical                 engineering  problems. | b1.1)          Develop          his/her  understanding about the circuits  containing    power    electronic  switches.  b1.2) Deduce and develop the  principle     of     operation     of  various converter circuits. |
| B2.    Produce    solutions    to  problems         through         the  application        of        specific  electrical                 engineering  discipline knowledge based on  limited          and          possible  information. | b2.1) Analyze and evaluate  circuit data and use it to solve  the power electronics problems. |

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| Field | Academic Reference Standards For Electrical Engineering  Postgraduates (ARSEP-ELE) | | | |
| Knowledge &  Understanding | Intellectual  Skills | Professional  and Practical  Skills | General and  Transferrable  Skills |
| Programme Academic  Standards that the course  contribute in achieving | **A1, A3** | **B1,B2, B3** | **C1, C3, C4** | **D1, D3, D4** |

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***B.3 Relationship between the course and the programme***

***B.4 Course Intended Learning Outcomes (ILOs)***

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|  | B3. Deal with different and  contradicting    knowledge    to  solve the problems. | b3.1) Deal with different and  contradicting     knowledge     to  solve         power         electronic  problems. |
| Professional and  Practical Skills | C1.     Use      efficiently      the  available tools as computer  programs      and      measuring  instruments      as      well      as  building       ideas       in       the  laboratory         or         through  simulation and apply electrical  engineering techniques. | c1.1)        Studying        practical  applications of some converter  circuits. |
| C3. Evaluate the available  methods and tools in electrical  engineering field. | c3.1) Learning about special  treatments required to solve  power electronic circuits. |
| C4. Define, plan, analyze, and  solve         the         engineering  problems to reach conclusions  and compare the results with  others. | c4.1) Studying how to use  power electronic switches in  practical circuits. |
| General and  Transferrable Skills | D1. Communicate effectively  in     writing,     verbally     and  through      illustrations      and  mathematical equations. | d1.1) Improving the engineer  ability to discuss problems and  work in a group.  d1.2) Sharing ideas with others  through                           effective  communication of all kinds. |
| D3. Evaluate him-self and  determine        his        personal  education needs. | d3.1) Evaluate him/herself and  determine     his/her     personal  education needs to solve power  electronic problems. |
| D4. Use different resources to  obtain        knowledge        and  information. | d4.1) Use different sources to  obtain         knowledge         and  information required to analyze  power electronic circuits. |

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| ***Week***  ***No.*** | ***Sub. Topics*** | ***Total***  ***Hours*** | ***Contact hrs*** | | | ***Course ILOs***  ***Covered (By No.)*** |
| **Lec.** | **Tut.** | **Lab.** |
| *Week-1* | Power        diode        and        thyristors:  characteristics,          operation,          and  protection. | 3 | 3 | - | - | a1.1, b1.1, b2.1,  b3.1, c4.1, d4.1 |
| *Week-2* | Power       transistors       and       IGBTs:  characteristics,          operation,          and  protection. | 3 | 3 | - | - | a1.1, b1.1, b2.1,  b3.1, c4.1, d4.1 |
| *Week-3* | A.C. voltage controllers: phase-control. | 3 | 3 | - | - | a1.2, a3.1, b1.1,  b2.1, b3.1, c1.1,  c3.1, d1.2, d3.1,  d4.1 |
| *Week-4* | A.C.      voltage     controllers:     On-Off  control, combined phase and On-Off  control. | 3 | 3 | - | - | a1.2, a3.1, b1.1,  b2.1, b3.1, c1.1,  c3.1, d1.2, d3.1,  d4.1 |
| *Week-5* | Thyristor-controlled parallel loads. | 3 | 3 | - | - | a3.1, b1.1, b1.2,  b2.1, b3.1, c1.1,  c3.1, d1.1, d1.2,  d3.1, d4.1 |
| *Week-6* | Single-phase controlled rectifiers. | 3 | 3 | - | - | a1.2, a3.1, b1.1,  b2.1, b3.1, c1.1,  c3.1, d1.2, d3.1,  d4.1 |
| *Week-7* | 3-phase controlled rectifiers. | 3 | 3 | - | - | a1.2, a3.1, b1.1,  b2.1, b3.1, c1.1,  c3.1, d1.2, d3.1,  d4.1 |
| *Week-8* | Controlled    rectifiers:    effect    of    the  supply inductance and dual converters | 3 | 3 | - | - | a3.1, b1.1, b2.1,  b3.1, c1.1, c3.1,  d1.2, d3.1, d4.1 |
| *Week-9* | Power factor improvement using series  controlled rectifiers | 3 | 3 | - | - | a3.1, b1.1, b1.2,  b2.1, b3.1, c1.1,  c3.1, d1.1, d1.2,  d3.1, d4.1 |
| *Week-*  *10* | Power     factor     improvement:     using  extinction       angle       control,       using  symmetrical angle control. | 3 | 3 | - | - | a3.1, b1.1, b1.2,  b2.1, b3.1, c1.1,  c3.1, d1.2, d3.1,  d4.1 |
| *Week-*  *11* | Thyristor chopper circuits. | 3 | 3 | - | - | a1.2, a3.1, b1.1,  b2.1, b3.1, c1.1,  c3.1, d1.2, d3.1, |

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| Topic  No. | General Topics | Weeks |
| 1st | Power electronic devices: characteristics, operation, and protection. | 2 |
| 2nd | A.C. voltage controllers. | 3 |
| 3rd | Controlled rectifiers. | 3 |
| 4th | Power factor improvement. | 2 |
| 5th | Chopper circuits. | 2 |
| 6th | Inverters. | 3 |



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***B.5 Course Topics.***

***B.6 Course Topics/hours/ILOS***

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| **Course Intended**  **learning outcomes**  **(ILOs)** | |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **Knowledge &**  **understanding** | **a1.1** | **X** |  |  |  |  |  |  |  |  |  |  |  |  |
| **a1.2** | **X** |  |  |  |  |  |  |  |  |  |  |  |  |
| **a3.1** | **X** |  |  |  |  |  |  |  |  |  |  |  |  |
| **Intellectual**  **Skills** | **b1.1** |  |  |  |  |  |  |  |  | **X** |  |  |  |  |
| **b1.2** |  |  |  | **X** | **X** |  |  |  | **X** |  |  |  |  |
| **b2.1** |  |  |  | **X** | **X** |  |  |  | **X** |  |  |  |  |
| **b3.1** |  |  |  | **X** | **X** |  |  |  | **X** |  |  |  |  |
| **Professional**  **and Practical**  **Skills** | **c1.1** | **X** |  |  |  |  |  |  |  |  |  |  |  |  |
| **c2.1** | **X** |  |  |  |  |  |  |  |  |  |  |  |  |
| **c3.1** | **X** |  |  |  |  |  |  |  |  |  |  |  |  |
| **General and**  **Transferrable**  **Skills** | **d1.1** |  |  |  | **X** | **X** |  |  |  |  |  |  |  |  |
| **d2.1** |  |  |  | **X** | **X** |  |  |  |  |  |  |  |  |
| **d3.1** |  |  |  | **X** | **X** |  |  |  | **X** |  |  |  |  |
| **d4.1** |  |  |  | **X** | **X** |  |  |  | **X** |  |  |  |  |

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|  |  |  |  |  |  | d4.1 |
| *Week-*  *12* | Power transistor choppers. | 3 | 3 | - | - | a1.2, a3.1, b1.1,  b2.1, b3.1, c1.1,  c3.1, d1.2, d3.1,  d4.1 |
| *Week-*  *13* | Synchronized inverters. | 3 | 3 | - | - | a1.2, a3.1, b1.1,  b2.1, b3.1, c1.1,  c3.1, d1.2, d3.1,  d4.1 |
| *Week-*  *14* | D.C. link inverters. | 3 | 3 | - | - | a1.2, a3.1, b1.1,  b2.1, b3.1, c1.1,  c3.1, d1.2, d3.1,  d4.1 |
| *Week-*  *15* | Cycloconverters. | 3 | 3 | - | - | a1.2, a3.1, b1.1,  b2.1, b3.1, c1.1,  c3.1, d1.2, d3.1,  d4.1 |

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| **Assessment Method** | **Mark** | **Percentage** |
| **Final Examination (*written*)** | **100** | **100%** |
| **Total** | **100** | **100%** |



**B.7*Teaching and Learning Method:***

**Selflearning**

**Presentation**

**andMovies**

**Cooperative**

**Discovering**

**Discussion**

**Modelling**

**Sitevisits**

**Problem**

**solving**

**Brain**

**storming**

**Tutorial**

**Projects**

**Lecture**

**Playing**

**B. 8*Assessments:***

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***Weighting of assessments:***

***B.9 Facilities required for teaching and learning:***

**A. Library Usage:** Students should be encouraged to use library technical resources in the

preparation of reports.

**B. Indicate requirements for the course including size of classrooms and laboratories** (i.e.;

classrooms and laboratories, extent of computer access, etc.).

***B.10 List of references:***

1- Essential books (text books):

2- M.H. Rashid."Power Electronics" third edition, pearson, Prentice-

Hall,2004.

3- S.B. Dewan, and A. Straughen. "Power semiconductor circuits" Jhn Wiley

& sons, 1984.

4- Periodicals, Web sites, Course notes, etc:

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**Course Coordinators:** **Head of Department**

**Prof. Dr. A.S. Abdel-Karim** **Prof. Dr. Gamal Morsi**

**Prof. Dr. A. E. Lashine**

**Date:**