**Minoufiya University,**

**Faculty of Engineering,**

**Electrical Eng. Dept.,**

**Post Graduate Studies and Research.**

**Minoufiya University**

Faculty of Engineering

**Course Specification**

***Title: Thyristor-Controlled AC Loads***

***Code Symbol: ELE 530***

***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 recognise the importance of power electronic devices in electrical

systems by studying their characteristics, operation and application, with focusing our

investigation on the characteristics and performance of thyristor-controlled with AC loads.

Also, explain the operation of power factor correction and compensators types.

***B.2 Course Objectives***

**1. Demonstration of the knowledge and understanding of the importance of thyristor-**

**controlled AC loads.**

**2. Define the operation of compensators; including Shunt and series compensators.**

**3. Define the operation of power factor correction circuit.**

**4. Realizing of the different types of Ac voltage controller.**

**5. Analyze the Power electronic devices in transient states.**

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| Field | Programme ILOs that the course  contribute in achieving | Course ILOs |
| Knowledge&  Understanding | A1. Integrate theories, fundamentals  and knowledge of electrical  machine in practice. | a1-1) Integrate the definitions of  the elements used in the power  electronics circuits. |
| A2. Understand the basics of quality  in professional engineering  practice according to  electrical machine  specialization. | a2-1) Explain the design basic  principles of the schemes that are  used for power electronics  circuits. |
| Intellectual skills | B1. Identify and analyze problems  in the area    of    electrical  machine specialization and  rank the results according to  their priorities. | b1-1) Identify the operation of  Power electronic devices. |
| B2. Solve electrical engineering  problems in the area of electrical  machine specialization. | b2-1) Select the suitable solution  to solve transients in power  electronic    circuits    based    on  analysis. |
| Professional and  Practical Skills | C1.      Apply      the      professional  engineering technologies in  the      field      of      electrical  machine specialization. | c1-1)          Apply          computer  programmers to solve problems  of power electronic circuits |
| General and  Transferrable Skills | D1. Effective communication of all  kinds and sharing ideas with  different relevant teams. | d1-1) Effective communication  and collaborative learning  affords students enormous to  solve problems. |
| D2. Use of information technology  to serve the development of  engineering professional | d2-1) Use electronic  communication and computer-  based systems of hardware and |

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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, A2 | B1, B2 | C1 | D1, D2, D3,  D4, D7 |

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

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

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| ***Week***  ***No.*** | ***Sub. Topics*** | ***Total***  ***Hours*** | ***Contact hrs*** | | | ***Course ILOs***  ***Covered (By No.)*** |
| **Lec.** | **Tut.** | **Lab.** |
| *Week-1* | Power electronic devices. | 3 | 3 | - | - | a1-1, a2-1 |
| *Week-2* | Review of transients in electric  circuits. | 3 | 3 | - | - | a1-1, a2-1 |
| *Week-3* | Diodes with RC loads.  Diodes with RL loads. | 3 | 3 | - | - | a1-1, a2-1, b2-1,  c1-1 |
| *Week-4* | Diodes with LC loads.  Diodes with RLC loads. | 3 | 3 | - | - | a1-1, a2-1, b2-1,  c1-1, d3-1, d4-1,  d7-1 |
| *Week-5* | Principles of phase controlled  converter operation. | 3 | 3 | - | - | a1-1, a2-1,b1-1,  b2-1, c1-1, d1-1,  d2-1 d3-1, d4-1,  d7-1 |
| *Week-6* | Principles of on-off control.  Principles of phase control. | 3 | 3 | - | - | a1-1, a2-1, b2-1,  c1-1 |
| *Week-7* | Bidirectional ac switches.  Single phase controllers with inductive | 3 | 3 | - | - | a1-1, a2-1, b2-1,  c1-1 |

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|  | practice. | software and associated  processes through emphasis on  the information basis for  engineering. |
| D3.    Self-assessment    to    identify  personal learning needs. | d3-1) Use a wide range of formal  ways of identifying their own  learning needs like ordinary  investigations. |
| D4. Use of different sources for  information knowledge | d4-1) Refer to power electronics  handbook |
| D7.    Self-    learning    continuously  specially in electrical power branch. | d7-1) Apply statistical reports  and weekly auctions. |

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| Topic  No. | General Topics | Weeks |
| 1st | Power electronic devices | 1 |
| 2nd | Review of transients in electric circuits | 2 |
| 3rd | Transients in power electronic circuits | 5 |
| 4th | Principles of phase controlled converter operation | 6-7 |
| 5th | Ac voltage controller | 8-9 |
| 6th | Design of ac voltage controller | 10 |
| 7th | Power factor correction | 11 |
| 8th | Shunt and series compensators | 12-15 |



***B.5 Course Topics.***

***B.6 Course Topics/hours/ILOS***

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|  | loads. |  |  |  |  |  |
| *Week-8* | Three phase ac voltage controllers.  Transformer tap-changer using  thyristors. | 3 | 3 | - | - | a1-1, a2-1, b2-1,  c1-1, d3-1, d4-1,  d7-1 |
| *Week-9* | AC voltage controllers with PWM  control. | 3 | 3 | - | - | a1-1, a2-1, b2-1,  c1-1, d3-1, d4-1,  d7-1 |
| *Week-*  *10* | Design of ac voltage controller circuits. | 3 | 3 | - | - | a1-1, a2-1, b2-1,  c1-1, d3-1, d4-1,  d7-1 |
| *Week-*  *11* | Power factor correction | 3 | 3 | - | - | a1-1, a2-1, b2-1,  c1-1, d3-1, d4-1,  d7-1 |
| *Week-*  *12* | Principle of shunt compensation.  Thyristor-controlled reactors.  Thyristor-switched capacitor. | 3 | 3 | - | - | a1-1, a2-1, b2-1,  c1-1 |
| *Week-*  *13* | Static VAR compensators.  Advanced Static VAR compensators. | 3 | 3 | - | - | a1-1, a2-1,b1-1,  b2-1, c1-1, d1-1,  d2-1 d3-1, d4-1,  d7-1 |
| *Week-*  *14* | Principle of series compensation.  Thyristor-switched series capacitor.  Thyristor-controlled series reactors. | 3 | 3 | - | - | a1-1, a2-1,b1-1,  b2-1, c1-1, d1-1,  d2-1 d3-1, d4-1,  d7-1 |
| *Week-*  *15* | Forced-commutation-controlled.  Series capacitor.  Series static VAR compensators.  Advanced Series static VAR.  compensators. | 3 | 3 | - | - | a1-1, a2-1,b1-1,  b2-1, c1-1, d1-1,  d2-1 d3-1, d4-1,  d7-1 |

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| **Course Intended**  **learning outcomes**  **(ILOs)** | |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **Knowledge &**  **understanding** | **a1-1** | **x** | **x** |  | **x** | **x** |  |  |  |  |  |  |  |  |
| **a2-1** | **x** | **x** |  | **x** | **x** | **x** |  |  |  |  |  |  |  |
| **Intellectual**  **Skills** | **b1-1** | **x** | **x** | **x** | **x** | **x** | **x** |  |  | **x** |  |  | **x** |  |
| **b2-1** | **x** | **x** | **x** | **x** | **x** | **x** |  |  | **x** |  |  | **x** |  |
| **Professional**  **and Practical**  **Skills** | **c1-1** | **x** |  |  | **x** | **x** | **x** | **x** |  | **x** |  |  | **x** |  |
| **General and**  **Transferrable**  **Skills** | **d1-1** | **x** |  | **x** | **x** | **x** |  | **x** |  | **x** | **x** |  | **x** |  |
| **d2-1** | **x** |  | **x** | **x** | **x** |  | **x** |  | **x** | **x** |  | **x** |  |
| **d3-1** | **x** |  | **x** | **x** | **x** |  | **x** |  | **x** | **x** |  | **x** |  |
| **d4-1** | **x** |  | **x** | **x** | **x** |  | **x** |  | **x** | **x** |  |  |  |
| **d7-1** | **x** |  | **x** | **x** | **x** |  | **x** |  | **x** | **x** |  | **x** |  |



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

**Selflearning**

**Presentation**

**andMovies**

**Cooperative**

**Discovering**

**Discussion**

**Modelling**

**Sitevisits**

**Problem**

**solving**

**Brain**

**storming**

**Tutorial**

**Projects**

**Lecture**

**Playing**

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

***B. 8 Assessments:***

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

***Weighting of assessments:***

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

preparation the reports. At least one oral report should involve a significant component of

library research to encourage this component of study.

**B. Computer Usage:** Students are expected to use computers to prepare reports and conduct

some out-of-class assignments. Computers will be used to analyze data, prepare

engineering graphs for reports, and perform analytic studies of electrical motor and

generator performances. Knowledge of word-processing, spreadsheet, and mathematical

analysis software (viz., Mathcad, Matlab, Simulink, etc.) is required

***B.10 List of references:***

**1- Muhammad Rashid, "Power Electronics circuits, devices and applications," book,**

**Third Edition, Prentice Hall, 2004**

**2- Fang Lin Luo, Hong Ye and Muhammad Rashid, "Digital Power Electronics and**

**Applications," book, Elsevier Academic Press, 2005.**

**3- M. K. Nalbant and J. Klein, "Design of 1kW Power Factor Correction Circuit,"**

**Power Conversion October 1989 Proceedings, pp. 121-135.**

**4- Compliance Testing to the IEC 1000-3-2 (EN 61000-3-2) and IEC 1000-3-3 (EN**

**61000- -3) Standards, Application Note 1273, Hewlett Packard Co., December**

**1995.**

**5- D. G.Lamar, A.Fernandez, M.Arias, M. Rodriguez and Sebastian "A Unity**

**Power Factor Correction Preregulator With Fast Dynamic Response Based on a**

**Low-Cost Microcontroller," IEEE Transactions on Power Electronics,Vol. 23, No.**

**2, pp. 635-641, March 2008.**

**6- H. S. Patel and R. G. Hoft, "Generalized Technique of Harmonic Elimination and**

**Voltage Control in Thyristor Inverter," Part 1, IEEE Trans. Ind. Appl. Vol. IA-9,**

**PP. 310-317, 1973.**

**7- S. Silva, P. F. Donoso-Garcia and P. C. Cortizo, "A Three-Phase Series-Parallel**

**Compensated Line-Interactive UPS System with Sinusoidal Input Current and**

**Sinusoidal Output Voltage," in Conf. Rec. IEEE-IAS Annu. Meeting, PP. 826-832,**

**1999.**

**8- Fawzi A. Rahman, Al Jowder and Boon-Teck , "Series Compensation of Radial**

**Power System by a Combination of SSSC and Dielectric Capacitors," IEEE Trans**

**on Power Delivery, vol. 20, no. 1, pp. 458-465, january 2005.**

**9- Kin-ho Chu and Charles Pollock, "Series Compensation on Power System with**

**Very Low Harmonic Distortion," IEEE Trans. On Power Delivery, vol. 14, no. 2,**

**pp. 512-518, April 1999.**

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

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**Prof. Shokry Saad Shokralla**

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**Date:**