**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 coursecontribute in achieving | Course ILOs |
| Knowledge&Understanding | A1. Integrate theories, fundamentalsand knowledge of electricalmachine in practice. | a1-1) Integrate the definitions ofthe elements used in the powerelectronics circuits. |
| A2. Understand the basics of qualityin professional engineeringpractice according toelectrical machinespecialization. | a2-1) Explain the design basicprinciples of the schemes that areused for power electronicscircuits. |
| Intellectual skills | B1. Identify and analyze problemsin the area    of    electricalmachine specialization andrank the results according totheir priorities. | b1-1) Identify the operation ofPower electronic devices. |
| B2. Solve electrical engineeringproblems in the area of electricalmachine specialization. | b2-1) Select the suitable solutionto solve transients in powerelectronic    circuits    based    onanalysis. |
| Professional andPractical Skills | C1.      Apply      the      professionalengineering technologies inthe      field      of      electricalmachine specialization. | c1-1)          Apply          computerprogrammers to solve problemsof power electronic circuits |
| General andTransferrable Skills | D1. Effective communication of allkinds and sharing ideas withdifferent relevant teams. | d1-1) Effective communicationand collaborative learningaffords students enormous tosolve problems. |
| D2. Use of information technologyto serve the development ofengineering professional | d2-1) Use electroniccommunication and computer-based systems of hardware and |

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| Field | Academic Reference Standards For Electrical EngineeringPostgraduates (ARSEP-ELE) |
| Knowledge &Understanding | IntellectualSkills | Professionaland PracticalSkills | General andTransferrableSkills |
| Programme AcademicStandards that the coursecontribute 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 electriccircuits. | 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 controlledconverter 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 associatedprocesses through emphasis onthe information basis forengineering. |
| D3.    Self-assessment    to    identifypersonal learning needs. | d3-1) Use a wide range of formalways of identifying their ownlearning needs like ordinaryinvestigations. |
| D4. Use of different sources forinformation knowledge | d4-1) Refer to power electronicshandbook |
| D7.    Self-    learning    continuouslyspecially in electrical power branch. | d7-1) Apply statistical reportsand weekly auctions. |

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| TopicNo. | 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 usingthyristors. | 3 | 3 | - | - | a1-1, a2-1, b2-1,c1-1, d3-1, d4-1,d7-1 |
| *Week-9* | AC voltage controllers with PWMcontrol. | 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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