|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Programme Academic  Standards that the course  contribute in achieving | A1, A2 & A3 | B1 & B7 | C1 & C4 | D4, D6 & D8 |

**Minoufiya University,**

**Faculty of Engineering,**

**Electrical Eng. Dept.,**

**Post Graduate Studies and Research.**

**Minoufiya University**

Faculty of Engineering

**Course Specification**



***Title: Overvoltage and Insulation Co-ordination***

***Code Symbol: ELE 619***

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

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

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

***B - Professional Information***

***B.1 Course Aims:***

The aims of this course are to provide the Student, with the skills of how to control the

overvoltages in power system. This course will also provide students with the ability to apply the

appropriate insulation coordination on real network. The skill of selecting the location of surge

arresters is also provided.

***B.2 Course Objectives***

1. Realizing of overvoltages causes and their controlling methods.

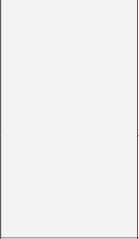
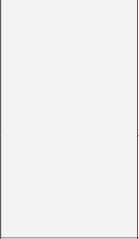
2. Analyzing the performance of the network under overvoltage conditions.

3. Demonstration of the insulation co-ordination methods.

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

|  |  |  |
| --- | --- | --- |
| Field | Programme ILOs that the  course contribute in achieving | Course ILOs |
| Knowledge &  Understanding | A1.      Theory,      basics      and  practices       of       mathematics,  sciences and various    electrical  power           and           machines  engineering technologies. | a1.1) Identify the causes of overvoltages.  a1.2) Recognize the factors affecting  switching and lightning overvoltages.  a1.3)    Define    the    terms:    insulation  coordination, back flashover, direct and  indirect strikes, risk of failure. |
| A2. The exchange effect among  the engineering practices and  reflection on the environment. | a2.1) Explain the controlling methods of  switching and lightning surges.  a2.2) Describe the methods to attenuate  the lightning overvoltage. |
| A3.             The             scientific  developments      in      electrical  power           and           machines  engineering. | a3.1) Recognize the principles and rules  of insulation coordination.  a3.2) Compare between conventional and  statistical      approach      methods      for  insulation coordination.  a3.3) Compare between compact and  conventional network. |
| Intellectual skills | B1. Analyze and evaluate the  data    and    use    it    to    solve  electrical power and machines  problems. | b1.1) Compute switching and lightning  overvoltages.  b1.2)    Carry out    the    insulation    co-  ordination procedure. |
| B7. Take the suitable decision  for       different       professional  situations. | b7.1) Determine the location of surge  arresters. |
| 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  engineering techniques. | c1.1) Perform insulation co-ordination on  a network.  c1.2) Apply the overvoltage controlling  methods on a network. |
| C4. Define, plan, analyze, and  solve the power and machines  problems to reach conclusions  and compare the results with  others. | c4.1) Analyz the performance of the  network subjected to overvoltages using  ATP/EMTP. |
| General and  Transferable Skills | D4. Use different resources to  obtain         knowledge          and  information. | d4.1) Use specialized books and related  internet websites to prepare reports and  presentations. |



***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* | Introduction | 3 | 3 | - | - | a1.1 & a1.3 |
| *Week-2* | System overvoltages: External  overvoltages, Internal overvoltages | 3 | 3 | - | - | a1.1 |
| *Week-3* | Switching overvoltages: Factors affecting  switching overvoltage (Source  configuration, Remnant charge,  Transmission line length) | 3 | 3 | - | - | a1.2 |
| *Week-4* | Switching overvoltages cont.: Factors  affecting switching overvoltage  (Compensation, Circuit-breaker pole  scatter, Point-on-wave of circuit-breaker  closure). | 3 | 3 | - | - | a1.2 |
| *Week-5* | Switching overvoltages cont.: computed  switching overvoltages, Methods of  controlling switching surges (Circuit-  breaker pre-insertion resistors). | 3 | 3 | - | - | b1.1, d4.1, d6.1 &  d8.1 |
| *Week-6* | Switching overvoltages cont.: Methods of  controlling switching surges (Circuit-  breaker point-on-wave control). | 3 | 3 | - | - | a2.1, c1.2, d4.1,  d6.1 & d8.1 |
| *Week-7* | Switching overvoltages cont.: Methods of  controlling switching surges (Comparison  of switching over-voltage control methods) | 3 | 3 | - | - | a2.1, c1.2, d4.1,  d6.1 & d8.1 |
| *Week-8* | lightning overvoltages: Factors affecting  lightning overvoltage entering substations  (Back flash-over, Direct strike) | 3 | 3 | - | - | a1.2 & a1.3 |
| *Week-9* | Lightning overvoltages cont.: Attenuation  of lightning overvoltage. computed  lightning overvoltages. | 3 | 3 | - | - | a2.2, b1.1 & d6.1 |
| *Week-*  *10* | Lightning overvoltages cont.: Methods of  controlling lightning over-voltage (Location  of surge arresters) | 3 | 3 | - | - | a2.1, b7.1, c1.2,  d4.1, d6.1 & d8.1 |
| *Week-*  *11* | Insulation coordination: conventional  method of insulation co-ordination | 3 | 3 | - | - | a1.3, a3.1, a3.2,  b1.2, c1.1& d6.1 |

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| Topic  No. | General Topics | Weeks |
| 1st | System Switching and lightning overvoltages | 2-10 |
| 2rd | Insulation coordination | 11-12 |
| 3th | Compact transmission lines | 13 |
| 4th | Network simulation and analysis | 14-15 |

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|  | D6. Work with a group and  manage the team. | d6.1) Cooperate with the colleagues to  present collaborative work. |
| D8.     Self     and     continuous  learning. | d8.1)      Provide      the      student      with  researching attitude. |



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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** |  | **x** |  |  |  |  |  |  |  |  |  |  |
| **a1.2** | **x** |  | **x** |  |  |  |  |  |  |  |  |  |  |
| **a1.3** | **x** |  | **x** |  |  |  |  |  |  |  |  |  |  |
| **a2.1** | **x** |  | **x** |  |  |  |  |  | **x** | **x** |  |  |  |
| **a2.2** | **x** |  | **x** |  |  |  |  |  | **x** | **x** |  |  |  |
| **a3.1** | **x** |  | **x** |  |  |  |  |  | **x** | **x** |  |  |  |
| **a3.2** | **x** |  | **x** |  |  |  |  |  | **x** | **x** |  |  |  |
| **a3.3** | **x** |  | **x** |  |  |  |  |  | **x** | **x** |  |  |  |
| **Intellectual**  **Skills** | **b1.1** | **x** |  | **x** |  | **x** |  |  |  | **x** |  |  |  |  |
| **b1.2** |  | **x** | **x** |  |  |  | **x** |  |  |  |  |  |  |
| **b7.1** | **x** |  | **x** |  |  |  |  |  | **x** | **x** |  | **x** |  |
| **Professional**  **and practical**  **Skills** | **c1.1** |  | **x** | **x** |  |  |  | **x** |  | **x** | **x** |  | **x** |  |
| **c1.2** |  | **x** | **x** |  |  |  | **x** |  | **x** | **x** |  | **x** |  |
| **c4.1** | **x** |  | **x** |  |  |  | **x** |  | **x** | **x** |  | **x** |  |
| **General and**  **transferable**  **Skills** | **d4.1** |  |  | **x** |  |  |  | **x** |  | **x** | **x** |  | **x** |  |
| **d6.1** |  |  |  |  |  |  | **x** |  | **x** | **x** |  |  |  |
| **d8.1** |  |  | **x** |  |  |  | **x** |  | **x** | **x** |  | **x** |  |

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| *Week-*  *12* | Insulation coordination cont.: Statistical  Approach to insulation co-ordination, Risk  of failure | 3 | 3 | - | - | a1.3, a3.1, a3.2,  b1.2, c1.1, d4.1 &  d8.1 |
| *Week-*  *13* | Compact transmission lines: insulation,  surge arresters, comparison between  compact and conventional network. | 3 | 3 | - | - | a3.3, d4.1, d6.1 &  d8.1 |
| *Week-*  *14* | Network simulation and analysis:  transmission lines, cables, circuit breakers,  transformers, network reduction. | 3 | 3 | - | - | c1.2, c4.1, d4.1,  d6.1 & d8.1 |
| *Week-*  *15* | Network simulation and analysis cont.:  transmission lines, cables, circuit breakers,  transformers, network reduction. | 3 | 3 | - | - | c1.2, c4.1, d4.1,  d6.1 & d8.1 |

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



**B. 8*Assessments:***

**Selflearning**

**Presentation**

**andMovies**

**Cooperative**

**Discovering**

**Discussion**

**Modelling**

**Sitevisits**

**Problem**

**solving**

**Brain**

**storming**

**Tutorial**

**Projects**

**Lecture**

**Playing**

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

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***Weighting of assessments:***

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

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

preparation of reports. So, the computers with sufficient electronic resources should be

available.

2.**Class room** facilitated by computer, white board and datashow.

3.**ATP/EMTP** and**MATLAB** packages**.**

***B.10 List of references:***

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2. A. Haddad, D. F. Warne, “Advances in high voltage engineering”, the institution of electrical

engineer, London, United Kingdom 2004.

3. J. R. Lucas, High Voltage Engineering, 2001, Sri Lanka

4. E. Kuffel, W.S. Zaengl and J. Kuffel, “High Voltage Engineering Fundamentals”, Butterworth-

Heinemann , 2000.

5. IEEE Std., IEEE Standard for Insulation Co-ordination Definitions, Principles and Rules, 2010.

6. K. H. Weck, “Principles and procedures of insulation co-ordination”, IEE Proceedings, Vol.

134, Pt. C, No. 2, MARCH 1987.

7. S. Mitra, D. Durga Praveen Kumar, Archana Sharma, K. V. Nagesh and D.P. Chakravarty,

“Study of Insulation Coordination in the Presence of Multiple Dielectric Materials” APAC

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8. A. Sekso-Telento, S. bojic, j. Trbus, “Some Questions of Insulation Coordination in Distributive

Networks in Regions with Hills and Mountaines in Croatia”, 18th International Conference on

Electricity Distribution, Turin, 6-9 June 2005.

9. Recent published journal and international conference papers.

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***

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

**Prof. Dr. Mohamed Izzularab** **Prof. Dr. Gamal Morsi**

**Dr. Nehmdoh A. Sabiha**

**Date:**