**Minoufiya University,**

**Faculty of Engineering,**

**Electrical Eng. Dept.,**

**Post Graduate Studies and Research.**

**Course Specification**

**Minoufiya University**

Faculty of Engineering

***Title: Electrical Materials***

***Code Symbol: ELE 608***

***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 select the materials and

composites materials in electrical engineering applications. This course will also provide students

with the ability to select the appropriate composites materials for electrical engineering

applications. The skill of evaluating the status of materials, devices and components is also

provided. It is also aimed that the student will get practical skills of polymer nanocomposites,

processing, manufacturing and application.

***B.2 Course Objectives***

1. Realizing of different materials in electrical engineering applications.

2. Demonstration the importance of composites materials and stability of their interface.

3. Studying the degradation mechanisms in materials, devices and components.

4. Demonstration of the polymer nanocomposites, processing, manufacturing and application.

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| 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) Discuss the conduction mechanism  of semiconductors.  a1.2) Recognize physics of dielectrics.  a1.3) Describe physical, mechanical and  chemical properties of dielectrics.  a1.4) Identify constituents of polymer  nanocomposites and common  nanoparticle geometries.  a1.5) Recognize structure and properties  of polymer nanocomposites. |
| A3. The scientific developments in  electrical power and    machines  engineering. | a3.1) Identify materials used for the  manufacture of electrical components in  industrial applications.  a3.2) Demonstrate preparation and  processing of polymer nanocomposites. |
| Intellectual skills | B5. Evaluate the risks in the  design of specific power and  machines engineering systems. | b5.1) Evaluate challenges in processing  and manufacturing of nanocomposites. |
| B6. Plan to develop performance  of power and machines systems. | b6.1) Develop the behavior of dielectrics  in services. |
| 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) Measure electrical characteristics  of dielectrics.  c1.2)    Apply the principles    of    the  nanocomposites preparation in the field.  c1.3) Use polymer nanocomposites in  different applications. |
|  | C4. Define, plan, analyze, and  solve the power and machines  problems to reach conclusions and  compare the results with others. | c4.1) Study the failure mechanism of  semiconductors devices.  c4.2) Study the degradation mechanisms  of materials, devices and components.  c4.3) Select the composites materials. |

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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 | B5 & B6 | C1 & C4 | D4, D6 & D8 |



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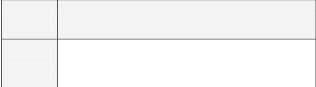
***B.3  Relationship between the course and the programme***

***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* | Conductors: Review: commonly used  conductor materials, properties and  applications. | 3 | 3 | - | - | a3.1, d4.1, d6.1,  d8.1 |
| *Week-2* | Conductors    continue:    resistor    materials:  properties and applications- materials used  for contacts, cables and wires- electrical  carbon materials. | 3 | 3 | - | - | a3.1, d4.1, d6.1,  d8.1 |
| *Week-3* | Semiconductors: conduction mechanism of  Semiconductors,                               compound  semiconductors,     failure     mechanism     of  semiconductors devices. | 3 | 3 | - | - | a1.1,c4.1, d4.1,  d6.1, d8.1 |
| *Week-4* | Magnetic      materials:      applications      in  electrical machines, instruments and relays. | 3 | 3 | - | - | a3.1, d4.1, d6.1,  d8.1 |
| *Week-5* | Dielectrics: physics of dielectrics. | 3 | 3 | - | - | a1.2, d4.1, d8.1 |
| *Week-6* | Dielectrics continue: measurement of the  electrical characteristics of dielectrics. | 3 | 3 | - | - | c1.1, d4.1, d6.1,  d8.1 |
| *Week-7* | Dielectrics continue: physical, mechanical  and chemical properties of dielectrics. | 3 | 3 | - | - | a1.3, d4.1, d6.1,  d8.1 |
| *Week-8* | Dielectrics continue: physical, mechanical  and chemical properties of dielectrics and  their behavior in services. | 3 | 3 | - | - | a1.3, b6.1, d4.1,  d6.1, d8.1 |
| *Week-9* | Composite materials: composite materials  selection, stability of the interface. | 3 | 3 | - | - | a3.1, c4.3, d4.1,  d6.1, d8.1 |
| *Week-*  *10* | Degradation     mechanisms     of     materials,  devices and components. | 3 | 3 | - | - | c4.2, d4.1, d6.1,  d8.1 |
| *Week-*  *11* | Degradation mechanisms of materials,  devices and components, continue. | 3 | 3 | - | - | c4.2 d4.1, d6.1,  d8.1 |
| *Week-*  *12* | Polymer    nanocomposit:    constituents    of  polymer nanocomposites, specific surface  area,                    Common                    particle | 3 | 3 | - | - | a1.4, a1.5, a3.2,  c1.2, c1.3, d4.1,  d6.1, d8.1 |

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| General and  Transferrable  skills | D4. Use different resources to  obtain knowledge and information. | d4.1) Use specialized books and related  internet websites to prepare reports and  presentations. |
| 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)    Providing    the    student    with  researching attitude. |

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| Topic  No. | General Topics | Weeks |
| 1st | Conductors, semiconductors and magnetic materials. | 1-4 |
| 2nd | Dielectrics: physics and properties. | 5-8 |
| 3rd | Composite materials. | 9 |
| 4th | Degradation mechanisms of materials, devices and components. | 10-11 |
| 5th | Polymer nanocomposits and challenges in their processing and manufacturing. | 12-15 |



***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** |  |  |  |  |  | **x** |  |  |  |  |
| **a1.3** |  | **x** |  |  |  |  |  |  | **x** | **x** |  |  |  |
| **a1.4** | **x** |  | **x** |  |  |  |  |  |  |  |  |  |  |
| **a1.5** | **x** |  | **x** |  |  |  |  |  |  |  |  |  |  |
| **a3.1** | **x** | **x** | **x** |  |  |  |  |  | **x** | **x** |  |  |  |
| **a3.2** |  | **x** | **x** |  |  |  |  |  | **x** | **x** |  |  |  |
| **Intellectual**  **Skills** | **b5.1** |  | **x** | **x** |  |  |  |  |  | **x** | **x** |  |  |  |
| **b6.1** |  | **x** | **x** |  |  |  |  |  | **x** | **x** |  |  |  |
| **Professional**  **and Practical**  **Skills** | **c1.1** |  | **x** | **x** |  |  |  |  |  | **x** | **x** |  |  |  |
| **c1.2** |  | **x** | **x** |  |  |  |  |  | **x** | **x** |  |  |  |
| **c1.3** |  | **x** | **x** |  |  |  |  |  | **x** | **x** |  |  |  |
| **c4.1** | **x** |  | **x** |  |  |  |  |  | **x** | **x** |  |  |  |
| **c4.2** | **x** | **x** | **x** |  |  |  |  |  | **x** | **x** |  |  |  |
| **c4.3** | **x** | **x** | **x** |  |  |  |  |  | **x** | **x** |  |  |  |
| **General and**  **Transferrable**  **Skills** | **d4.1** |  | **x** |  |  |  |  |  |  | **x** | **x** |  |  |  |
| **d6.1** |  | **x** |  |  |  |  |  |  | **x** | **x** |  |  |  |
| **d8.1** |  | **x** |  |  |  |  |  |  | **x** | **x** |  |  |  |

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|  | geometries,nanoplatelet-reinforced    Systems  (structre,      properties,      preparation      and  processing). |  |  |  |  |  |
| *Week-*  *13* | Polymer nanocomposit continue: Graphite  Nanoplatelet                                         Polymer  Composites(characterization,         simulation  and modeling), Alignment (Orientation) of  Silicate Layers, Atomic Scale Structure and  Binding    Energy    in    Polymer     Layered  Silicate Nanocomposites. | 3 | 3 | - | - | a3.2, c1.2, c1.3,  d4.1, d6.1, d8.1 |
| *Week-*  *14* | Polymer nanocomposit continue: Carbon  Nanotube-reinforced     Systems      (structure  properties,      synthesis,      processing      and  application) | 3 | 3 | - | - | a3.2, c1.2, c1.3,  d4.1, d6.1, d8.1 |
| *Week-*  *15* | Polymer    nanocomposit    continue:    Other  Nanocomposite        Systems        (Properties,  Manufacturing,           and          Application)-  Challenges          in          Processing          and  Manufacturing of Nanocomposites. | 3 | 3 | - | - | a3.2, b5.1, c1.2,  c1.3, d4.1, d6.1,  d8.1 |



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**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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| --- | --- | --- |
| **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 of reports. So, the computers with sufficient electronic resources should be

available.

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

***B.10 List of references:***

1. Yu. Koritsky, “Electrical Engineering Materials”, MIR Publishers, Moscow 1970.

2. Technical teachers training institute Madras, “Electrical Engineering Materials”, 1988

McGraw-Hill.

3. F. Hussain, M. Hojjati, M. Okamoto and R. Gorga, “Review article: Polymer-matrix

4. Nanocomposites, Processing, Manufacturing, and Application: An Overview”, Journal of

COMPOSITE MATERIALS, Vol. 40, No. 17/2006.

5. K. Lau, M. Piah, “Polymer Nanocomposites in High Voltage Electrical Insulation Perspective:

A Review”, Malaysian Polymer Journal, Vol. 6, No. 1, p 58-69, 2011.

6. J. Keith Nelson, “Overview of Nanodielectrics: Insulating Materials of the Future”, IEEE

Electrical Insulation, Symposium, Toronto, June 2006.

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

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

**Dr. Nehmdoh A. Sabiha**

**Date:**