**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.

1/ELE 608

|  |  |  |
| --- | --- | --- |
| Field | Programme ILOs that the coursecontribute in achieving | Course ILOs |
| Knowledge&Understanding | A1. Theory, basics and practicesof    mathematics,    sciences    andvarious        electrical power andmachines                      engineeringtechnologies. | a1.1) Discuss the conduction mechanismof semiconductors.a1.2) Recognize physics of dielectrics.a1.3) Describe physical, mechanical andchemical properties of dielectrics.a1.4) Identify constituents of polymernanocomposites and commonnanoparticle geometries.a1.5) Recognize structure and propertiesof polymer nanocomposites. |
| A3. The scientific developments inelectrical power and    machinesengineering. | a3.1) Identify materials used for themanufacture of electrical components inindustrial applications.a3.2) Demonstrate preparation andprocessing of polymer nanocomposites. |
| Intellectual skills | B5. Evaluate the risks in thedesign of specific power andmachines engineering systems. | b5.1) Evaluate challenges in processingand manufacturing of nanocomposites. |
| B6. Plan to develop performanceof power and machines systems. | b6.1) Develop the behavior of dielectricsin services. |
| Professional andPractical Skills | C1.Use efficiently the availabletools as computer programs andmeasuring instruments as well asbuilding ideas in the laboratory orthrough    simulation    and    applyengineering techniques. | c1.1) Measure electrical characteristicsof dielectrics.c1.2)    Apply the principles    of    thenanocomposites preparation in the field.c1.3) Use polymer nanocomposites indifferent applications. |
|  | C4. Define, plan, analyze, andsolve the power and machinesproblems to reach conclusions andcompare the results with others. | c4.1) Study the failure mechanism ofsemiconductors devices.c4.2) Study the degradation mechanismsof materials, devices and components.c4.3) Select the composites materials. |

|  |  |
| --- | --- |
| Field | Academic Reference Standards For Electrical EngineeringPostgraduates (ARSEP-ELE) |
| Knowledge &Understanding | IntellectualSkills | Professionaland PracticalSkills | General andTransferrableSkills |
| Programme AcademicStandards that the coursecontribute in achieving | A1 & A3 | B5 & B6 | C1 & C4 | D4, D6 & D8 |



2/ELE 608

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

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

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ***Week******No.*** | ***Sub. Topics*** | ***Total******Hours*** | ***Contact hrs*** | ***Course ILOs******Covered (By No.)*** |
| **Lec.** | **Tut.** | **Lab.** |
| *Week-1* | Conductors: Review: commonly usedconductor materials, properties andapplications. | 3 | 3 | - | - | a3.1, d4.1, d6.1,d8.1 |
| *Week-2* | Conductors    continue:    resistor    materials:properties and applications- materials usedfor contacts, cables and wires- electricalcarbon materials. | 3 | 3 | - | - | a3.1, d4.1, d6.1,d8.1 |
| *Week-3* | Semiconductors: conduction mechanism ofSemiconductors,                               compoundsemiconductors,     failure     mechanism     ofsemiconductors devices. | 3 | 3 | - | - | a1.1,c4.1, d4.1,d6.1, d8.1 |
| *Week-4* | Magnetic      materials:      applications      inelectrical 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 theelectrical characteristics of dielectrics. | 3 | 3 | - | - | c1.1, d4.1, d6.1,d8.1 |
| *Week-7* | Dielectrics continue: physical, mechanicaland chemical properties of dielectrics. | 3 | 3 | - | - | a1.3, d4.1, d6.1,d8.1 |
| *Week-8* | Dielectrics continue: physical, mechanicaland chemical properties of dielectrics andtheir behavior in services. | 3 | 3 | - | - | a1.3, b6.1, d4.1,d6.1, d8.1 |
| *Week-9* | Composite materials: composite materialsselection, 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    ofpolymer nanocomposites, specific surfacearea,                    Common                    particle | 3 | 3 | - | - | a1.4, a1.5, a3.2,c1.2, c1.3, d4.1,d6.1, d8.1 |

|  |  |  |
| --- | --- | --- |
| General andTransferrableskills | D4. Use different resources toobtain knowledge and information. | d4.1) Use specialized books and relatedinternet websites to prepare reports andpresentations. |
| D6. Work with a group andmanage the team. | d6.1) Cooperate with the colleagues topresent collaborative work. |
| D8. Self and continuous learning. | d8.1)    Providing    the    student    withresearching attitude. |

|  |  |  |
| --- | --- | --- |
| TopicNo. | 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***

3/ELE 608

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **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** |  |  |  |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | geometries,nanoplatelet-reinforced    Systems(structre,      properties,      preparation      andprocessing). |  |  |  |  |  |
| *Week-**13* | Polymer nanocomposit continue: GraphiteNanoplatelet                                         PolymerComposites(characterization,         simulationand modeling), Alignment (Orientation) ofSilicate Layers, Atomic Scale Structure andBinding    Energy    in    Polymer     LayeredSilicate Nanocomposites. | 3 | 3 | - | - | a3.2, c1.2, c1.3,d4.1, d6.1, d8.1 |
| *Week-**14* | Polymer nanocomposit continue: CarbonNanotube-reinforced     Systems      (structureproperties,      synthesis,      processing      andapplication) | 3 | 3 | - | - | a3.2, c1.2, c1.3,d4.1, d6.1, d8.1 |
| *Week-**15* | Polymer    nanocomposit    continue:    OtherNanocomposite        Systems        (Properties,Manufacturing,           and          Application)-Challenges          in          Processing          andManufacturing of Nanocomposites. | 3 | 3 | - | - | a3.2, b5.1, c1.2,c1.3, d4.1, d6.1,d8.1 |



4/ELE 608

**Selflearning**

**Presentation**

**andMovies**

**Cooperative**

**Discovering**

**Discussion**

**Modelling**

**Sitevisits**

**Problem**

**solving**

**Brain**

**storming**

**Tutorial**

**Projects**

**Lecture**

**Playing**

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

|  |  |  |
| --- | --- | --- |
| **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.

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

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

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

**Dr. Nehmdoh A. Sabiha**

**Date:**