

Department of Restorative Dental Sciences

Course Specification

Basic Dental Material Science

Course No: RDS-231

Course Director: Prof HalaBahgat

Second year/ First semester

Academic year 1435-1436H [2014-2015G]

Course information:

Course Designation: 0703231

Course Number: RDS-231

Level: Second year/ First semester

Prerequisite Courses: BIOL 102; ENGL 101; CHEM 112; DTEDU 111; PHYS 122; DTEDU 121; ENGL 132

Academic Year: 1435-1436 H [2014-2015 G]

Credit Hours: 2 hours [2 Lectures / week]

Course Director: Prof HalaBahgat

Participating faculty members information:

1. **DrRasha Al Sheikh.**
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2. **Dr Ahmed Rahuma.**
Assistant Professor
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Room#038 Extension 117
3. **DrNeveenMokhtar**
Associate Professor
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4. **Prof HalaBahgat**
Professor
Course Director
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Room#083 Extension 136

Course Description:

Basic Dental Material Sciences is designed to expose the students to the principles related to the structure of materials, the basics of the chemical, physical and mechanical properties of materials and to the behavioral aspects of the different classes of materials.

Intended Learning Outcomes:

I. Knowledge:

By the end this course the students will be able to:

1. Identify the different states of matter.
2. Describe the different types of atomic bonding and arrangements in solids.
3. Recognize the different classes of materials.
4. Recall the inherent physical properties of the different classes of materials.
5. Discuss the inherent chemical properties of the different classes of materials.
6. Express the rheological behavior of the different classes of materials.
7. State the principles of bonding between different substrates.
8. Explain the behavior of the different classes of materials under mechanical stresses.
9. Underline the methods of altering the properties of different classes of materials.

II. Cognitive Skills:

By the end of this course the students will be able to:

1. Describe the evolution and development of science of dental materials.
2. Discuss the basics in ceramics.
3. Examine the basics in polymers.
4. Apply the basics in metallurgy.
5. Analyse the microstructure - properties relationship in the different classes of materials.
6. Relate the principles of altering the properties of the different classes of materials to the different dental applications.
7. Interpret the stress strain relationship of different classes of materials.
8. Interpret the strain time relationship of dental materials.
9. Sketch the phase diagram of different types of dental alloys.

III. Interpersonal Skills and Responsibility

Not applicable

IV. Communication, Information Technology and Numerical Skills

Not Applicable

V. Psychomotor Skills

Not applicable

Teaching and Learning methods:

1. Interactive lectures.
2. Audiovisual presentations.
3. Assignment. [Team work]

Assessment:

I. Assessment Guidelines:

| Continuous assessment 60% | | | Final assessment 40% | Total |
|---------------------------|--------|--------------------------|-------------------------|-------|
| Exam 1 | Exam 2 | Department discretion | Written | |
| 20% | 20% | 20% | 40% | 100% |

II. General Rules:

1. In order to pass the course:
 - a. The student should achieve a cumulative minimum of 60% in the didactic component (Continuous Assessment + Final Assessment)
 - b. The student will not be awarded by marks for attendance.
 - c. Student with an absence of 25% or more will not be allowed to sit for the Final Examination, and therefore would be required to repeat the course.
2. Written exams will be objective:
 - a. Multiple choices,
 - b. True or false,
 - c. Match sets,
 - d. Short essays [Give reason, comparisons, enumeration]
 - e. Schematic drawings. [To draw or to comment]
3. Department discretion:
 - a) Weekly quizzes 10%
 - A quiz is performed at the beginning of each lecture.
 - It is composed of 5 questions related to the previous lecture.
 - It is evaluated out of 5 marks.
 - In case of absence, there is **no make up quiz**.
 - Only the best ten quizzes will be taken into consideration.
 - b) Weekly group assignments 10%
 - The class will be divided into groups.
 - The assignment will be given at the end of each lecture.
 - It will be in the form of questions.
 - It should be submitted in the following lecture.
 - It will be evaluated out of 5 marks as follows:
 - 1mark for the due date.

- 1mark for the presentation form.
- 3 marks for the content.

N.B.:In case of copying the assignments between the groups, the assignment will be marked as zero for all the members of the different groups.

- **Only** the best ten assignments will be taken into consideration.

Principal References: [Available in the college library]

1. Anusavice: Phillips' science of dental materials, 11th edition, 2003, Saunders.
2. O'Brien W.: Dental Materials & Their Selection. 4th edition, 2009, Quintessence Publishing.

Additional References: [Available in the college library]

1. Powers & Sakaguchi: Craig's restorative dental materials, 13th edition, 2012, Mosby Elsevier.
2. Van Noort R.: Introduction to Dental Materials. 3rd edition, 2007, Mosby.

| Lecture | Objectives |
|---|--|
| Syllabus | Explain the details of the syllabus. |
| Structure of matter | <ol style="list-style-type: none"> 1. Describe the atomic structure. 2. Explain the four states of matter. 3. Identify the different types of atomic bonding. 4. Identify the different arrangements of atoms in space. 5. Correlate between the type of bonding, microstructure and properties of different classes of materials. |
| Physical properties Part 1: Mass & Thermal properties | <ol style="list-style-type: none"> 1. Define physical properties. 2. Identify the different physical properties. 3. Define mass properties [Density – Specific gravity] 4. Define thermal properties. [Melting temperature – Heat of fusion and latent heat of fusion – Thermal conductivity – Thermal diffusivity – Coefficient of thermal expansion] 5. Explain the clinical significance of the mass and thermal properties. |
| Physical properties Part 2: Optical properties | <ol style="list-style-type: none"> 1. Define: Light, Transparency, Translucency, Opacity, and Luminescence, Color parameters: Hue, Chroma, and Value. 2. Differentiate between: <ol style="list-style-type: none"> a. Specular reflection & Diffuse reflection |

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| | <ul style="list-style-type: none"> b. Fluorescence & Phosphorescence c. Primary, Secondary, and complimentary colors d. Metameric pair & Isomeric pair <ol style="list-style-type: none"> 3. Correlate scattering centers in composite resin to its shade. 4. Explain factors affecting color appearance and selection 5. Discuss some dental applications of different light spectra |
| Mechanical Properties Part 1: Static Mechanical Properties | <ol style="list-style-type: none"> 1. Define force, stress & strain terms. 2. Name their different types. 3. Recall the static properties. 4. Define the different properties of stress strain relationship. 5. Compare between ductile & brittle fracture. 6. Interpret stress strain curves of dental materials. 7. Explain the clinical significance of the static mechanical properties. 8. Identify the mechanical properties of tooth structure. |
| Mechanical Properties Part 2: Other Static Mechanical Properties /Dynamic Mechanical Properties | <ol style="list-style-type: none"> 1. Describe the bending properties. 2. Define tear strength. 3. Identify fracture toughness. 4. Describe hardness 5. Explain the dynamic properties. 6. Describe the dental significance of the aforementioned properties. 7. Summarize the failure of restoration under mechanical stresses. |
| Principles of Bonding | <ol style="list-style-type: none"> 1. Differentiate between adhesion & cohesion. 2. Name the different types of adhesive joints. 3. Explain the interface relationship. 4. Discuss the factors affecting the strength of the adhesive junction. 5. Name the types of failure. 6. Name the obstacles in obtaining adhesion to tooth structure. 7. Explain the different steps of tooth surface treatment. |
| Rheological Properties | <ol style="list-style-type: none"> 1. Define the rheological terms. 2. Identify mixing, working and setting time. 3. Differentiate between Newtonian & Non- |

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| | <p>Newtonian flows.</p> <ol style="list-style-type: none"> 4. Explain viscoelasticity. 5. Describe the properties of visco-elastic materials. 6. Clarify its implications on the behavior of dental materials. |
| Basics in Polymers Part 1 | <ol style="list-style-type: none"> 1. Define important terms in polymer. 2. Describe the structure of polymers. 3. Discuss the different classification systems of polymers. |
| Basics in Polymers Part 2 | <ol style="list-style-type: none"> 1. Review the types of polymerization reactions. 2. List the general properties of polymers. 3. Explain the factors influencing the properties of polymer. |
| Basics in Ceramics | <ol style="list-style-type: none"> 1. Define important terms in ceramics. 2. Differentiate between the different phases of ceramic structure. 3. Explain the role of the chemical constituents of each phase in ceramic structure. 4. Discuss the different classification systems in ceramics. 5. Describe the composition, and properties of ceramics of different microstructure categories. 6. Determine the properties of ceramics |
| Basics in Metallurgy Part 1: Metals | <ol style="list-style-type: none"> 1. Define important terms in metals. 2. List the general properties of metals. 3. Name the different methods of shaping of metals. 4. Review the solidification mechanism of metals. 5. Define the cast metal structure. 6. Explain the factors affecting grain size in castmetal structure 7. Define the wrought metal structure. 8. Relate the microstructure to the mechanical properties of metal. 9. Discuss the annealing heat treatment of the wrought metal structure. |
| Basics in Metallurgy Part 2: Alloys | <ol style="list-style-type: none"> 1. Define important terms in alloys. 2. Discuss the different classification systems of alloys. |

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|------------------------------|---|
| | <ol style="list-style-type: none"> 3. Differentiate between the different types of alloys. 4. Discuss the different solid state reactions in the alloy system. 5. Explain the different strengthening mechanisms in metallurgy. |
| Tarnish and corrosion | <ol style="list-style-type: none"> 1. List the characteristics of the oral environment. 2. Define tarnish & corrosion. 3. Identify the different types of tarnish. 4. Identify the different types of corrosion. 5. Explain the different types of corrosion. 6. Discuss the protective measures against corrosion. |

Schedule of Lectures for the Female Students

| No | Day | Date | Topic | Lecturer |
|-----------|---------------|-------------------|-----------------------------------|--------------------------|
| 1 | Monday | 1/9/2014 | Introduction to the Course | DrHalaBahgat |
| 2 | Monday | 8/9/2014 | Structure of Matter | Dr Ahmed Rahuma |
| 3 | Monday | 15/9/2014 | Mechanical Properties 1 | Dr Hala Bahgat |
| 4 | Monday | 22/9/2014 | Mechanical Properties 2 | Dr Hala Bahgat |
| 5 | Monday | 13/10/2014 | Physical Properties 1 | Dr Neveen Mokhtar |
| 6 | Monday | 20/10/2014 | Physical Properties 2 | Dr Neveen Mokhtar |
| 7 | Monday | 27/10/2014 | Principles of Bonding | DrRasha El Sheikh |
| 8 | Monday | 3/11/2014 | Rheological Properties | DrHalaBahgat |
| 9 | Monday | 10/11/2014 | Basics in Polymers1 | Dr Ahmed Rahuma |
| 10 | Monday | 17/11/2014 | Basics in Polymers2 | Dr Ahmed Rahuma |
| 11 | Monday | 24/11/2014 | Basics in Ceramics | DrNeveenMokhtar |
| 12 | Monday | 1/12/2014 | Basics inMetallurgy1 | DrHalaBahgat |
| 13 | Monday | 8/12/2014 | Basics in Metallurgy 2 | DrHalaBahgat |
| 14 | Monday | 15/12/2014 | Tarnish & Corrosion | DrHalaBahgat |
| 15 | Monday | 22/12/2014 | Revision | All |

Schedule of Lectures for the Male Students

| No | Day | Date | Topic | Lecturer |
|-----------|------------------|-------------------|-----------------------------------|---------------------------|
| 1 | Wednesday | 3/9/2014 | Introduction to the Course | DrHalaBahgat |
| 2 | Wednesday | 10/9/2014 | Structure of Matter | Dr Ahmed Rahuma |
| 3 | Wednesday | 17/9/2014 | Mechanical Properties 1 | Dr Hala Bahgat |
| 4 | Wednesday | 24/9/2014 | Mechanical Properties 2 | Dr Hala Bahgat |
| 5 | Wednesday | 15/10/2014 | Physical Properties1 | Dr Neveen Mokhtar |
| 6 | Wednesday | 22/10/2014 | Physical Properties2 | Dr Neveen Mokhtar |
| 7 | Wednesday | 29/10/2014 | Principles of Bonding | Dr Rasha El Sheikh |
| 8 | Wednesday | 5/11/2014 | Rheological Properties | DrHalaBahgat |
| 9 | Wednesday | 12/11/2014 | Basics in Polymers1 | Dr Ahmed Rahuma |
| 10 | Wednesday | 19/11/2014 | Basics in Polymers2 | Dr Ahmed Rahuma |
| 11 | Wednesday | 26/11/2014 | Basics in Ceramics | DrNeveenMokhtar |
| 12 | Wednesday | 3/12/2014 | Basics inMetallurgy1 | DrHalaBahgat |
| 13 | Wednesday | 10/12/2014 | Basics in Metallurgy 2 | DrHalaBahgat |
| 14 | Wednesday | 17/12/2014 | Tarnish & Corrosion | DrHalaBahgat |
| 15 | Wednesday | 24/12/2014 | Revision | All |