Course Specifications

University: Benha University

Faculty: Benha Faculty of engineering

Course specifications
Program(s) on which the course is given: Control and Measurements Dep.
Major or minor element of programs: Major
Department offering the program: Electrical Engineering technology Dep.
Department offering the course: Electrical Engineering technology Dep.
Academic year / Level: Third year
Date of specification approval: 2009

A- Basic Information
Title: Biomedical Instruments
Code: E372
Credit Hours: N.A.
Lecture: 2
Tutorial: 1
Practical: 1
Total: 4

B- Professional Information

1 - Overall aims of course
This is an introductory course in Biomedical Instruments. It provides a grounding in the theory of biomedical measurement systems, including sensors, signal conditioning methods, measurement techniques, patient interfacing and instrumentation used in biomedicine. It covers the biological instrumentation, low power consuming circuits especially for implantable pass members, digital signal processing, biomedical applications, microinatuirsation, special electromechanical devices.

2- Intended learning outcomes of course (ILOs)
a- Knowledge and understanding:
On successful completion of the module the student should:

- Explain the principles of operation of the most important sensors used in biomedical instrumentation and measurement, and the technical specifications of commercially produced sensors that are used for this purpose;
- Illustrate the instrumentation and measurement systems that employ these sensors and which, as appropriate, enable them to interact with the human body safely;
• Mention the characteristics of the physiological signals being measured;
• Write realistic solutions to clinical measurement problems and to justify the choices;
• List ideas for new designs of biomedical sensors and instruments.

b- Intellectual skills
By the end of this course, the student should be able to:
• analyze the operation of the sensors used in biomedical instrumentation and measurement, and the technical specifications of commercially produced sensors that are used for this purpose;
• Compare between the instrumentation and measurement systems that employ these sensors and which, as appropriate, enable them to interact with the human body safely;
• Analyze the characteristics of the physiological signals being measured;
• Suggest realistic solutions to clinical measurement problems.
• Suggest ideas for new designs of biomedical sensors and instruments.

c- Professional and practical skills
By the end of this course, the student should be able to:
• Perform different measurements on basic instruments.
• Perform simple Lab experiments.
• Collect information from collected data in the lab.

d- General and transferable skills
By the end of this course, the student should be able to:
• Work cooperatively and effectively in a group
• Present information independently

3- Contents

<table>
<thead>
<tr>
<th>Topic</th>
<th>No. of Hours</th>
<th>Lecture</th>
<th>Tutorial/Practical</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction</td>
<td>4</td>
<td>2</td>
<td>1/1</td>
</tr>
<tr>
<td>Physiological quantities, basic concepts and principles of</td>
<td>12</td>
<td>6</td>
<td>3/3</td>
</tr>
</tbody>
</table>
medical instrumentation used in physiological measurement

<table>
<thead>
<tr>
<th>Course Title</th>
<th>Hours</th>
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<tbody>
<tr>
<td>Origin of bio-potentials, bio-potential electrodes and amplifiers</td>
<td>12</td>
</tr>
<tr>
<td>Static and dynamic characteristics of measurement systems</td>
<td>8</td>
</tr>
<tr>
<td>Measurement constraints in the clinical environment</td>
<td>8</td>
</tr>
<tr>
<td>Biomedical sensors, including resistive, inductive, capacitive, photoelectric, piezoelectric, electrochemical transducer principles</td>
<td>12</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>56</strong></td>
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</table>

4– **Teaching and learning methods**

4.1- Lectures
4.2- Tutorials
4.3- Practice in Laboratories
4.4- Internet collected information and Self-study projects

5- **Student assessment methods**

5-1 Written exams (Final and Midterm), assignments and quizzes to assess knowledge and understanding, solving problems skills and interpretation capabilities of physical phenomena.
5-2 Oral exams to assess the abilities of discussing physical concepts
5-3 Practical exam to assess measuring and professional skills

**Assessment schedule**

<table>
<thead>
<tr>
<th>Exam Type</th>
<th>Time Frame</th>
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<tbody>
<tr>
<td>Quiz 1</td>
<td>Week No. 4</td>
</tr>
<tr>
<td>Midterm</td>
<td>Week No. 8</td>
</tr>
<tr>
<td>Quiz 2</td>
<td>Week No. 12</td>
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</tbody>
</table>
Oral and Practical exam........Week No. 14
Final written exam ...............Week No. 15

Weighting of assessments

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>Final-term examination</td>
<td>60%</td>
</tr>
<tr>
<td>Semester work</td>
<td>40%</td>
</tr>
<tr>
<td>Total</td>
<td>100%</td>
</tr>
</tbody>
</table>

6- List of references

- Essential books
  1. *Introduction to Biomedical Equipment Technology*, by Joseph J. Carr, John M. Brown
  2. *Medical Instrumentation: Application and Design*, by John G. Webster

7- Facilities required for teaching and learning

Lecture rooms – Tutorial section rooms – Experimental Labs - computers – Virtual simulation programs

Course coordinator: Assoc. Prof. Ghada Amer
Head of Department: Assoc. Prof. Ghada Amer
Date: