



**King Saud University**  
**College of Applied Medical Sciences**  
**Department of Biomedical Technology**

**BMT336 Optical Biomedical Instrumentation 3 (2-1-0)**

**Current Instructor:** Mr. Mohammad Zarrar Sharif, Dr. Javeed Shaikh Mohammed

**Course Coordinator:** Dr. Javeed Shaikh Mohammed

**Coordinator's email:** [jshaikhmohammed@ksu.edu.sa](mailto:jshaikhmohammed@ksu.edu.sa)

**Textbook(s) and/or Other Required Materials: Primary:** Physics by Paul E. Tippens (7<sup>th</sup> edition), 2007, McGraw-Hill AND Introduction to optics by Frank L Pedrotti, Leno M Pedrotti, Leno S Pedrotti (3<sup>rd</sup> edition), 2006, Pearson Education

**Course Description (catalog):** This course covers: Quantum theory of light, Electromagnetic spectrum, applications of electromagnetic radiation in medical field; Reflection and Mirrors, Mirror equation, Spherical aberration, Fermat's principle and reflection laws; Refraction, Index of refraction, Fermat's principle and Snell's law Prisms, Prism spectrometer; Lenses, lens-maker's equation, Lens aberrations, Microscope; Interference, diffraction and polarization of light, Michelson Interferometer, Young's experiment, Diffraction grating, Resolving power of instruments; Optics of the eye, Biological structure, Parts of the eye, Photometry, Functions of the eye, Vision correction with the external lenses; Light sources, detectors, and displays; Laser basics, Essential elements of lasers, Stimulated emission, Stimulated absorption, Spontaneous emission, Characteristics of laser light, Biomedical applications of lasers; Fiber optic: Optic of propagation, Fiber optic sensors and their applications in medical field, Endoscopes; Laboratory instrumentation: Spectrophotometer.

[http://faculty.ksu.edu.sa/javeed/BMT 336/Forms/AllItems.aspx](http://faculty.ksu.edu.sa/javeed/BMT%20336/Forms/AllItems.aspx)

**Prerequisites:** None

**Co-requisite:** None

**Course Type:** Mandatory

**Course Learning Outcomes:**

Upon completing BMT336, students should have the following capabilities:

- Knowledge of the basic principles of optics including quantum theory, electromagnetic spectrum, reflection, refraction, interference, diffraction and polarization.
- Knowledge of optics of eye and instruments such as lasers, fiber optics, endoscopes, spectrophotometer.
- Knowledge of the basic optical principles of different optical biomedical instrumentation.
- Ability to use optical biomedical instrumentation.
- Knowledge of biomedical applications of optical components and instrumentation.

**Student Outcomes Covered by Course:**

a. an ability to select and apply the knowledge, techniques, skills, and modern tools of biomedical technology to include the application of circuit analysis, analog and digital electronics, microcomputers, biomechanics, biomedical instrumentation systems, and safety in the building, testing, operation, and maintenance of biomedical equipment.

Students apply the knowledge, techniques, skills, and modern tools of optics to biomedical instrumentation

b. an ability to select and apply a knowledge of mathematics, chemistry, physics, and biological sciences, engineering, and technology to building, testing, operation, and maintenance of biomedical equipment and the ability to utilize statistics/probability, transform methods, discrete mathematics, or applied differential equations in support of biomedical systems.

Students select and apply knowledge of mathematics, science, engineering, and technology to optical biomedical instrumentation problems

c. an ability to conduct standard tests and measurements; to conduct, analyze, and interpret experiments; and to apply experimental results to improve processes.

Students conduct standard tests and measurements; conduct, analyze, and interpret experiments using optical biomedical components/instrumentation

d. an ability to analyze, design, and implement biomedical systems, components or processes for broadly-defined engineering technology problems appropriate to program educational objectives.

e. an ability to function effectively as a member or leader on a technical team.

f. an ability to identify, analyze, and solve broadly-defined biomedical technology problems.

g. an ability to apply written, oral, and graphical communication in both technical and nontechnical environments; and an ability to identify and use appropriate technical literature.

h. an understanding of the need for and an ability to engage in self-directed continuing professional development.

i. an understanding of and a commitment to address professional and ethical responsibilities including a respect for diversity.

j. a knowledge of the impact of engineering technology solutions in a societal and global context and an understanding of the clinical application of biomedical equipment.

Students gain the knowledge of biomedical applications of optical components/instrumentation

k. a commitment to quality, timeliness, and continuous improvement.

**Major Topics covered and schedule in weeks:**

1. Overview: Introduction to the course
- 2-3. The Nature of Light
- 3-4. Reflection and Mirrors
- 6-7. Refraction
- 7-8. Lenses and Optical Instruments
- 8-9. Interference, Diffraction, and Polarization
11. Optics of Eye
12. Light Sources, Lasers
13. Fiber Optics
15. Laboratory Instrumentation