

שתלים אורטופדיים
Orthopedic Implants
336520
Updated: January, 2021

Instructor: Mark M. Levy, M.D., D.Sc.
Orthopedic Surgeon
Assistant: Majd Machour

Scope: 2-hours lecture per week
1-hour frontal exercise per week

Credit: 2.5 Points

Course Topics:

1. Introduction: course overview, terminology, bone repair, implants for fractures, joint replacement and spine disorders
2. Bone and joint characteristics: biology, structure and biomechanics, main pathologies and treatment strategies
3. Fracture implants for internal fixation: materials, IM nails, plates, screws, sliding screws for hip fractures, biomechanics of implant bone system, overview of ASTM tests
4. Fracture implants for external fixation: simple fixators, Ilizarov and Taylor systems
5. Total joint replacement: materials, engineering principles of fixation and bearing surfaces, joint stability, failure and complications, partial Vs total replacement, overview of ASTM tests.
6. Main total joint replacement: total hip arthroplasty, total knee arthroplasty, shoulders and other joints, use of FEA
7. Spine anatomy and biomechanics: overview
8. Spine implants for: scoliosis, fractures, disc space (cages, disc replacement), vertebral bone. Biomechanics of fixation systems and overview of ASTM tests
9. New trends in Orthopedics: Additive manufacturing (3D printing) of implants, use of surgical robotics, computer assisted and navigation, VR and AI in orthopedic surgery
10. Ortho-biologics, biodegradable implants, biological repairs (grafts), tissue engineering, stem cells, Factors, HA and combinations. Biologic implants.
11. Introduction to Biocompatibility concepts of orthopedic implants
12. Regulation basics: FDA, CE mark; application to orthopedic implants
13. Introduction to R&D of orthopedic implants, market and commercialization

Bibliography and complementary material:

1. Lecture notes (lecture slides and cited references)
2. Anatomy: Gray's Anatomy 3rd Ed, others
3. Orthopedic Surgery: Campbell's Operative Orthopaedic 12th Ed, others

4. Strength or Mechanics of Materials: (Beer, Popov, Timoshenko, others)
5. Basics biomechanics of the musculoskeletal system, Nordin 4th Ed
6. The Medical device R&D handbook, Kucklick 2nd Ed
7. Biomedical Engineering textbooks
8. Literature publications: throughout the lecture slides
9. Websites: FDA, USPTO, CE, AAOS, WHO, Medical device companies, etc.

Grades:

Final Exam (on orthopedic implants principles and exercise materials)

Homework assignments: mandatory submission

Optional: Final project (done and presented in groups)