Brief Description of Courses in Biomedical Engineering, Bachelor's Program

- **General mathematics I**

Description: Introduction to Calculus, Cartesian coordinates, differentiation and limit functions, approximation of roots of equations- 48 hours-

- **General mathematics II**

Description: Introduction to differential calculus, integral double and triple, three-variable equations, and Matrix series analysis, partial derivative

Duration: 48 hours

Source: Calculus: Several Variables. Robert A. Adams. Prentice Hall. 2006

- **General Physics I**

Description: Familiarity with sorts of movements- Cinematic and Dynamic motion analysis. Measurement, motion in one dimension, motion in one page

Duration: 48 hours

- **Physics I Laboratory** - Related to the course

Duration: 48 hours

- **General Physics II**

Description: Understanding the principles and concepts of static electricity and magnetism, and magnetic field and electric potential

Duration: 48 hours

- **General Physics II Laboratory** - Related to the course source

Duration: 48 hours

Source: Fundamentals of Physics. D. Halliday and R. Resnick (1986). John Wiley & Sons. Inc.

- **Differential Equations**

Description: The use of second-order equations in physics, Laplace transforms, curves and vertical routes

Duration: 48 hours

Source: Elementary Differential Equations and Boundary Value Problems. 8th Edition. William E. Boyce and Richard C. DiPrima Wiley, 2004

- **Numerical Calculation**

Description: Calculation of Errors, Lagrange Method, Simson Method, Euler's Method, ...

Source: Numerical Methods and Software . Kahan, Moler and Nash, Prentice - Hall, 1981.

- **The principles and fundamental of computers and networks**

Description: Familiarity with computer hardware, software useful for medical research, computer networks and global communication medium

Duration: 32 hours

Source: Computer essentials for beginners. Springer press. 2005

- **Biostatistics and Probability**

Description: Statistical parameters, random sampling, sampling methods, ANOVA, regression and possibilities

Duration: 48 hours

Source: Probability and Statistics, Athanasios Papoulis. Prentice Hall. 1989

- **Algorithmic Calculation**

Description: Structure of programming, flowcharts and basic knowledge of rules in programming

Duration: 32 hours

Source: The Scheme Programming Language (3rd Edition). R.K. Dybvig. MIT Press, 2003

- **Physiology**

Description: Cardiovascular physiology, respiratory, gastrointestinal, central nervous system, kidney and urinary tract

Duration: 48 hours

- **Physiology Laboratory** - Related to the course source

Duration: 48 hours

Source: Textbook Of Medical Physiology, C. Guyton and John E. Hall, Elsevier. 2006 (11 th Edition)

- **Anatomy**

Description: Introduction to the anatomy of human body

Duration: 32 hours

Source: Gray's Anatomy for Students. Richard Drake, Wayne Vogl, Adam Mitch ell. Churchill Livingstone, 2004

- **Medical Physics**

Description: Solid state physics, the physics of fluids in the body, pressure physics of sound in the ears and hearing, physics of vision - the use of ultrasound in medical diagnosis - use of electricity in the body

Duration: 48 hours

Source: Medical Physics, JR. Cameron and JG. Skofrnnick. John Wilcv and Sons. 1978

- **Introduction to Biomedical Engineering**

Description: Introduction to Bioelectrics, Biomaterials and Biomechanics, transducers and electrodes, biopotentials, amplify and filtering of biosignals

Duration: 48 hours

Source: introduction to Biomedical Engineering, Bronzino

- **Medical Informatics I**

Description: Medical Terminology, Factors to determine the patient's condition and the information extracted from them, how to record and archive patient information

Duration: 48 hours

Source: Handbook of Medical informatics. J.H. Yan BemmeL M.A. MU SEN. IC Helder Houten/Diegem. 1997

- **Research methodology and medical informatics**

Description: Various methods of searching databases, how to write a thesis proposal, description of subject and variables

Duration: 32 hours

- **Computer Programming (Web)**

Description: Introduction to Visual Studio, and programming with MATLAB

Duration: 32 hours

Source: Sams Teach Yourself C# in 24 Hours. J. Foxall and W. Haro-Chun. Sams Publishing, 2002

- **Hospital General Standards, Safety and Protection**

Description: Standards of safety, electrical safety tests, GFCI systems, physiological effects of current passing through the body, IEC standard systems, Isolation, Micro and Macro Shock

Duration: 32 hours

Source: Principles of Medical Equipment Design, Webster

- **Engineering Mathematics**

Description: Fourier series, Fourier integral, Fourier and wave equations

Duration: 48 hours

Source: Complex Variables and Applications, James Ward Brown, Ruel V. Churchill, McGraw-Hill Science, 2008

- **Hospital and Medical clinics general equipment**

Description: Brief introduction for medical equipment, categorized by invasive or non-invasive medical device based, imaging, diagnosis, treatment, laboratory use

Duration: 32 hours

Source: Joseph J. Carr and John M. Brown," Introduction to Biomedical Equipment Technology

- **General Equipment workshop of Hospitals and medical Clinics -** Related to the course source

Duration: 48 hours

- **General Public Health**

Description: The history of medical issues, health care, maternal and child health, environmental health, nutrition and eating habits

Duration: 16 hours

Source: WHO publications

- **Principles of Rehabilitation and its Equipment**

Description: Joints and kinesiology, orthotics and prosthetics, gait analysis, muscle biomechanics, Physiotherapy

Duration: 48 hours

Source: Essential Physical Medicine and Rehabilitation. G. Cooper and N.E. Strauss. Humana Press. 2006

- **Principles and Generalities of Health Services Management**

Description: Financial management, the various stages of planning in health care, hospital management systems, international organizations

Duration: 32 hours

- **Principles of Medical Imaging and Radiology**

Description: X-ray generator, X-ray tube, radiology history, physics of radiology, scattering and absorption of radiation, Sonography, MRI

Duration: 48 hours

Source: The Physics of Diagnostic Imaging. David J. Dowsett, Patrick A. Kenny and R. Eugene Johnston, Oxford University Press. 2006 (Second Edition)

- **Technical English Language**

Description: Medical Terminology, Suitable Translation and Pronunciation

Duration: 32 hours

Source: The Biomedical Engineering Handbook, J.D. Bronzino, CRC Press.

- **Biophysics**

Description: Introduction to Biology, Molecular Structures and Interaction, Cellular Membrane and role of Proteins, Carbohydrates, Nucleic Acids and Lipids in Body

Duration: 32 hours

- **Special Topic I (Ultrasound)**

Description: Physics of Mechanical and Sound Waves, Ways to produce these waves and their application in ultrasound, different modes of Imaging, Resolution, Doppler and Power Doppler Imaging, Cardiovascular Imaging, …

Duration: 48 hours

Source: Diagnostic Ultrasound, Imaging and Blood flow Measurements, K. Kirk Shung, 2005

- **Educational and introductory workshop on health and treatment centers**

Duration: 32 hours

- **Educational and introductory practical workshop on health and treatment centers**

Description: 160 hours of Internship in a Hospital or Company

Duration: 48 hours

- **Electrical Circuits I**

Description: Compact circuits, KVL, KVL, Linear and nonlinear resistances, Operational Amplifiers, RL and RC Circuits

Duration: 48 hours

Source: C.A. Desoer, E.S. Kuh, "Basic Circuit Theory", McGraw-Hill. 1970

- **Electrical Circuits I Laboratory** - Related to the course

Duration: 48 hours

- **Electrical Circuits II**

Description: Linear and Nonlinear Circuits, Graphs, Mesh and Nodal analysis, Bipolar, State Equations in Circuits, Matrix

Duration: 48 hours

Source: C.A. Desoer, E.S. Kuh, "Basic Circuit Theory", McGraw-Hill, 1970

- **Electronics I**

Description: Introduction to Semi-conductors (Diodes) and their application, Design of Transistors (FET, JFET, MOS)

Duration: 48 hours

Source: Electronic devices and circuit theory, R. Boylestad,L. Nashlesky, 4th edition, Prentice-Hall, 1987

- **Electronics I Laboratory** - Related to the course

Duration: 48 hours

- **Electronics II**

Description: Differential amplifiers, positive and negative feedback, power amplifier applications in biomedical engineering, Structure of amplifiers

Duration: 48 hours

Source: Electronic Devices and Circuit Theory {91h Edition), R. L. Boylestad, L. Nashelsky, Prentice Hall, 2006

- **Bioelectric Phenomena**

Description: Production of biopotentials in excitable cells and strings, EEG, ECG and EMG receiving

Duration: 48 hours

Source: Bioelectricity: A Quantitative Approach. Third Edition, by Robert Plonsey and Roger C. Barr, ISBN 978-0-387-48864-6, e-ISBN 978-0-387-48865-3, Springer Science Business Media, LLC, 2007.

- **Logical Circuits**

Description: Numerical Systems, Codes, Logic gates, Simplify Boolean functions, Flip-flops, Combined Logical Circuits (Decoder, MUX, ..), ICs and ASM design

Duration: 48 hours

Source: Digital Design, M. Mano, Pearson/Prentice-Hall, 3rd Edition, 2008

- **Logical Circuits Lab** - Related to the course

Duration: 48 hours

- **Computer Architectures**

Description: Introduction to CPU, RISC, CISC, Assembly Language, Different types of Memories, Basic Design of a Computer

Duration: 32 hours

Source: Computer System Architecture, M. Mano, Prentice-Hall, 3rd Edition, 1993

- **Microprocessor I**

Description: AVR microprocessors, programming with Code-Vision and circuit design with Proteous

Duration: 48 hours

Source:1. Microprocessors and Interfacing, Programming and Hardware, Douglas Hall, McGraw-hill, 1997

2. IBM PC and Compatible Computers: Assembly Language, Design, and Interfacing Volumes I & II (41h Edition). Muhammad Ali Mazidi, Janice Gillispie-Mazidi,, Prentice-Hall, 2003

- **Microprocessor Lab** Related to the course

Duration: 48 hours

- **Electrical Machines (AC, DC)**

Description: Electromagnetic Circuits, Ideal and Real Transformers and their structure, DC machines, AC asynchronous and synchronous motors

Duration: 48 hours

Source: Principles of Electric Machines and Power Electronics, P.C Sen, 1993

- **Introduction to Biological and computational Intelligence**

Duration: 48 hours

Source: Neural Networks and Artificial Intelligence for Biomedical Engineering, D. L. Hudson, M. E. Cohen, Wiley-IEEE Press, 1999

- **Signals and Systems Analysis**

Description: Time Continuous and discrete signals, LTI systems, Fourier Conversion, Frequency response, phase and amplitude display

Duration: 48 hours

Source: A.V. Oppenheim, A.S. Willsku and S.H. Nawab ," Signals and Systems" . 2"d ed. Prentice-Hall ,1997

- **Linear Control systems**

Description: Analysis of Classic and Modern Control Systems, Phase and Time-based Control, Nyquist sampling, bode plot, Modeling linear systems

Duration: 48 hours

Source: R B.C. Kuo, F. Golnaraghy, "Automatic Control systems", 81h ed. ,Jog wiley, 2003

- **Electronic Measurement**

Description: Displacement Sensors such as: Laser, LVDT, Light Sensors and accelerometers such as Piezoelectric, stress-strain sensors and Temperature sensors

Duration: 32 hours