Mashreq University

Faculty of Technology and Community Development

Department of Biomedical Engineering

Program for Technical Diploma In:

Biomedical Engineering

برنامج الدبلوم التقني في:

الهندسة الطبية الحيوية

Designed by:

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1.1 Introduction

Biomedical Engineering involves and incorporates life sciences, engineering sciences, design, and manufacturing, so as to define and solve problems in healthcare community. Biomedical Engineering is one of the fastest growing engineering areas in terms of student enrollment, graduate employment, research funding, and industry.

The current situation in the Sudan, and the regional; indicates that there is a gap and lankness of professional and highly-skilled biomedical engineers, and teachers to fully facilitate the health care community, industry, and higher-education.

In order to meet current and future challenges the program of Technical Diploma in Biomedical Engineering was planned to quality Biomedical engineers in several aspects, and to enhance and supplement a student's primary qualification with advanced skills, and to offer intensive, focused training in the professional practice, which will enhance the students prospects of a successful career in Sudan, in the region, globally and across the world. Thus, proposed program will be beneficial to students who plan to pursue industrial and academic careers. Moreover, the program will provide students who plan to pursue further graduate education.

1.2 Justifications

1. The scarcity of highly qualified and well-trained specialists in the field of Biomedical engineering.
2. Who understand state-of-the-art principles, applications, equipment, and regulatory policies of Health Care, and fill the gap.
3. The need to improve and upgrade the Biomedical engineering industry through the introduction of state of the art facilities.
4. The ever-increasing demand for highly-skilled professionals, and adoption of techniques tailored towards solving the health problems.
5. The need of highly qualified academic and research staff members in the field of Biomedical engineering.
6. Rapid changes and development, in Medical technology, healthcare and academia workplace.

1.3 Program Objectives

1.3.1 General objective:

The proposed Technical Diploma program is intended to create generations of highly qualified Technicians in the field of Biomedical engineering through strengthening the knowledge updating, theoretical background and augmenting the practical skills of the candidates.

1.3.2 Specific Objectives (Graduate Characteristics):

1. Give the students an in depth study of Biomedical Engineering.
2. Demonstrate appropriate knowledge, methods, and skills associated with Biomedical Engineering.

3. Enable students to think deeply, identify and solve problems by using analytical and experimental tools.
4. Enable students to apply acquired knowledge and skills for testing, calibrating, operating, utilizing, and managing biomedical systems.
5. Prepare students for positions in the Medical-Equipment industry and academic institute.
6. Advance applied research in the field of Biomedical Engineering.

1.4 Course Objectives

1. To prepare graduate engineers with high standards of knowledge and academic skills in Biomedical Engineering.
2. To prepare BME graduates with high standards in basic engineering education, so as to acquire deeper knowledge and techniques in life sciences, electronics, computer sciences and information engineering.
3. To prepare BME graduate engineer, with high knowledge in the theory and practice of BM Engineering to acquire adequate skills in operation, installation, trouble-shooting, quality control, evaluation, maintenance, calibration and to carry-out technical and scientific research.
4. Prepare BME graduate capable to practice and participate in the information technology field, in hospital engineering, manufacturing and teaching.

1.5 Admission requirements

Admission of the students for the program is according to the Ministry Admission Regulation.

1.6 Registration Procedures

Registration of candidate for the program is according to the University Academic Regulations of Undergraduate Studies for the year (2003 and modified by 2013).

1.7 Duration of the study

The Program duration of the study is three academic years, and it is follows the University Academic Regulations of Undergraduate Studies for the Year (2003 and modified by 2013).

1.8 Program Structure

The program consists, normally, of sex semesters (15 weeks each). A total academic-load of (100) credit hours are offered. In addition to the (40) taught courses, three training modules, and a final year project is undertaken. The number of contact hours is (150), (69) hours allocated to

lectures, (10) hours for tutorials, and (78) hours for practical work, as shown in the Academic Courses Structure Plate.

1.9 Language of Instruction

The language of instruction for all activities of the program is English.

1.10 Academic Evaluation

Candidates enrolled in the program are evaluated according to the University Academic Regulations of Undergraduate Studies for the Year (2003 and modified by 2013).

1.11 Degree Awarded

The University senate awards the candidate a "**Technical Diploma in Biomedical Engineering"** after passing all courses and scoring a CGPA of 2.00 or more and successfully completing the requirements of the Program.

1.12 Coding System

The following coding system is adopted where, for example, the code BS 123:
BS: stands for Basic Science.
1: stands for the first academic year.
2: stands for second semester.
3: stands for the serial number of the subject.
L: Lecture
TUT: Tutorial
PRA: Practical
Cr.H: Credit Hours
BME: Biomedical Engineering Course
ES: Engineering Sciences
EL: Electrical Engineering
EE: Electronics Engineering

1.13 Subjects Distribution:

Semester	No. of Subjects	Lectures	Tutorials	Practical	Contacts Hrs.	Cr. Hrs.
One	**8**	**15**	**2**	**12**	**29**	**20**
Two	**8**	**13**	**6**	**12**	**31**	**21**
Three	**7**	**13**	**2**	**12**	**27**	**18**
Four	**6**	**12**	**0**	**09**	**21**	**15**
Five	**7**	**12**	**0**	**15**	**27**	**16**
Sex	**4**	**04**	**0**	**21**	**15**	**10**
Total	**40**	**69**	**10**	**81**	**150**	**100**

1.14 Subjects categories:

Category	No. of Subjects	Cr. Hrs.	Percentage	Engineering Council
Mathematics and Basic Sciences	09	25	**25%**	15%-20%
Basic Engineering Sciences	06	17	**17%**	15%-20%
Applied Sciences	18	44	**44%**	50%-60%
Humanities	07	14	**14%**	10%-15%
Total	40	100	100%	

1.15 Degree Components and Credit Hours

1.15.1 Humanities

No.	Subject	Cr. Hrs.
1.	Arabic Language -1 لغة عربية 1	**2**
2.	English Language -1 لغة انجليزية 1	**2**
3.	Islamic Culture-1 ثقافة اسلامية 1	**2**
4.	Sudanese Studies دراسات سودانية	**2**
5.	Arabic Language -2 لغة عربية 2	**2**
6.	English Language -2 لغة انجليزية2	**2**
7.	Islamic Culture -2 ثقافة اسلامية2	**2**
Total		**14**

1.15.2 Mathematics and Basic Sciences

No.	Subject		Cr. Hrs.
1.	Introduction to Computer	مقدمة في الحاسوب	**2**
2.	Calculus -1	الحسبان 1	**3**
3.	General Physics	الفيزياء العامه	**3**
4.	General Chemistry	الكيمياء العامة	**3**
5.	Calculus -2	الحسبان 2	**3**
6.	Algebra and Complex Numbers	الجبر والاعداد المركبة	**3**
7.	Computer Programming	لغة برمجة	**3**
8.	Differential Equations	معادلات تفاضلية	**3**
9.	Probability and Bio-Statistics	الاحتمالات والاحصاء الحيوية	**2**
Total			**25**

1.15.3 Basic Engineering Sciences

No.	Subject		Cr. Hrs.
1.	Electric Circuits	الدوائر الكهربائية	3
2.	Principles of Mechanical Engineering	مبادئ الهندسة الميكانيكية	2
3.	Mechanicsميكانيكا		3
4.	Semiconductors and Electronics' Devices	اشباه الموصلات والاجهزة الالكترونية	3
5.	Digital Electronics	الالكترونيات الرقمية	3
6.	Analog Circuits	الدوائر التماثلية	3
Total			17

1.15.4 Applied Sciences (Specialization)

No.	Subject		Cr. Hrs.
1.	Anatomy and Physiology	التشريح ووظائف الاعضاء	2
2.	Engineering Drawing	الرسم الهندسي	2
3.	Medical recording and Monitoring Instrument	أجهزة الرصد والمتابعة الطبية	3
4.	Nuclear Physics and Radiotherapy	فيزياء الطب النووي والعلاجي	2
5.	Biophysics	الفيزياء الطبية الحيوية	2
6.	Biomaterials and Biomechanics	الميكانيكا الحيوية و المواد الطبية	2
7.	Rehabilitation and Artificial Organs	الاعضاء الاصطناعية والتاهيل	2
8.	Electrical Machines	الالات الكهربائية	3
9.	Medical Laboratory Equipment	اجهزة المعامل الطبية	3
10.	Ionizing Imaging Systems	انظمة التصوير المؤين	3
11.	Non-ionizing imaging Systems	انظمة التصويرغير المؤين	3
12.	Radiation Protection and safety	السلامة والوقاية من الاشعاع	2
13.	Engineering Workshops	ورش هندسية	2
14.	Bi-Senor and Measurements	المتحسسات الحيوية والقياسات	3
15.	On-Job Training-I	تدريب على رأس العمل 1	2
16.	On-Job Training-I	تدريب على راس العمل 2	2
17.	Microcontrollers	المتحكمات الدقيقة	3
18.	Graduation Project	مشروع التخرج	3
Total			44

المستحق	المعيار	**نوع الساعات**
2355	2400-2200	**عدد ساعات الاتصال**
100	110-90	**الساعات المعتمدة**
44%	لا تزيد عن 45%	**نسبة ساعات النظري لساعات الاتصال الكلية**
56%	ما لا يقل عن 55%	**نسبة ساعات المتابعة والعملي لساعات الاتصال الكلية**

1.16 Plate of Academic Courses Structure

1st Year:

Semester one								
S/N	Course Code	Course Title	Hours/ Week			Contact Hrs.	Exam Hrs.	Cr.H
			L	TUT	PRA			
1	CS1101	Introduction to Computer مقدمة في الحاسوب	1	0	3	4	2	2
2	MA1102	Calculus -1 الحسبان 1	2	2	0	4	3	3
3	PH1103	General Physics الفيزياء العامة	2	0	3	5	3	3
4	HL1104	Arabic Language -1 لغة عربية 1	2	0	0	2	2	2
5	HL1105	Islamic Culture-1 ثقافة اسلامية1	2	0	0	2	2	2
6	HL1106	English Language -1 لغة انجليزية 1	2	0	0	2	2	2
7	CH1107	General Chemistry الكيمياء العامة	2	0	3	5	3	3
8	EL1108	Electric Circuits الدوائر الكهربائية	2	0	3	5	3	3
Total			15	2	12	29	20	20

Semester Two								
S/N	Course Code	Course Title	Hours/ Week			Contact Hrs.	Exam Hrs.	Cr.H
			L	TUT	PRA			
1	MA1201	Calculus -2 الحسبان 2	2	2	0	4	3	3
2	HL1202	Arabic Language -2 لغة عربية2	2	0	0	2	2	2
3	HL1203	English Language -2 لغة انجليزية2	2	0	0	2	2	2
4	MA1204	Algebra and Complex Numbers الجبر والاعداد المركبة	2	2	0	4	3	3
5	ES1205	Engineering Drawing الرسم الهندسي	1	0	3	4	3	2
6	EE1206	Semiconductors and Electronics' Devices اشباه الموصلات والاجهزة الالكترونية	2	0	3	5	3	3
7	PH1207	Mechanics الميكانيكا	2	2	0	4	3	3
8	WS1208	Engineering Workshops ورش هندسية	0	0	6	6	2	2
Total			13	6	12	31	21	20

2nd Year:

Semester Three								
S/N	Course Code	Course Title	Hours/ Week			Contact Hrs.	Exam Hrs.	Cr.H
			L	TUT	PRA			
1	MA2101	Probability and Bio-Statistics الاحتمالات والاحصاء الحيوية	2	0	0	2	2	2
2	EL2102	Bio-sensors and Measurements المتحسسات الحيوية والقياسات	2	0	3	5	3	3
3	EE2103	Digital Electronics الالكترونيات الرقمية	2	0	3	5	3	3
4	ES2104	Principles of Mechanical Engineering مبادء الهندسة الميكانيكية	2	0	0	2	2	2
5	MA2105	Differential Equations المعادلات التفاضلية	2	2	0	4	3	3
6	BME2106	Anatomy and Physiology التشريح ووظائف الاعضاء	1	0	3	4	2	2
7	EE2107	Analog Electronics الالكترونيات التماثلية	2	0	3	5	3	3
Total			13	2	12	27	18	18

Semester Four								
S/N	Course Code	Course Title	Hours/ Week			Contact Hrs.	Exam Hrs.	Cr.H
			L	TUT	PRA			
1	EE2201	Electrical Machines الالات الكهربائية	2	0	3	5	3	3
2	HL2202	Islamic Culture -2 ثقافة اسلامية 2	2	0	0	2	2	2
3	CS2203	Computer Programming لغة برمجة	2	0	3	5	3	3
4	BME2204	Medical recording and Monitoring Instrument اجهزة المراقبة والمتابعة الطبية	2	0	3	5	3	3
5	BME2205	Nuclear Physics and Radiotherapy فيزياء الطب النووي والعلاجي	2	0	0	2	2	2
6	BME2206	Biophysics الفيزياء الطبية الحيوية	2	0	0	2	2	2
Total			12	0	09	21	15	15

3rd Year:

Semester Five								
S/N	Course Code	Course Title	Hours/ Week			Contact Hrs.	Exam Hrs.	Cr.H
			L	TUT	PRA			
1	BME3101	Biomaterials and Biomechanics الميكانيكا الحيوية والمواد الطبية	2	0	0	2	2	2
2	BME3102	Rehabilitation and Artificial Organs الاعضاء الاصطناعية والتاهيل	2	0	0	2	2	2
3	BME3103	Medical Laboratory Equipment اجهزة المعامل الطبية	2	0	3	5	3	3
4	BME3104	Ionizing Imaging Systems انظمة التصوير المؤين	2	0	3	5	3	3
5	ENG3105	Microcontrollers المتحكمات الدقيقة	2	0	3	5	3	3
6	BME3106	On-Job Training -1 تدريب على راس العمل 1	0	0	6	6	1	2
7	HL3107	Sudanese Studies دراسات سودانية	2	0	0	2	2	2
Total			12	0	15	27	16	17

Semester Six								
S/N	Course Code	Course Title	Hours/ Week			Contact Hrs.	Exam Hrs.	Cr.H
			L	TUT	PRA			
1	BME3201	Non-ionizing imaging Systems انظمة التصويرغير المؤين	2	0	3	5	3	3
2	BME3202	Radiation Protection and safety السلامة والوقاية من الاشعاع	2	0	0	4	2	2
3	BME3203	On-Job Training -2 تدريب على راس العمل 2	0	0	6	6	1	2
4	PR3204	Graduation Project مشروع التخرج	0	0	12	0	1	4
Total			4	0	21	15	6	11

Basic and On-job Training (Practical Duration→ 6 weeks)				
S/N	Code	Title	Semester	On-job Hours
1	WS1208	Engineering Workshops	2	180
2	BME3106	On-Job Training -1	5	180
3	BME3203	On-Job Training -2	6	180

1.17 Courses Description

Course Title	**CS1101 Introduction to Computer Science**
Level /Semester	1/1
Credit Hours	2
Pre-requisite(s)	Non.
Objective(s)	To provide the students with skills and knowledge necessary for using computers in their future courses. Emphasis will be given to applications and independent work. Also the course helps students to pass ICDL exams.
Course Contents	Computer history. Computer system's terminology. Definitions of software and hardware. Computer main units. Computer peripherals. Digital and analog computers. Data representation in digital computer. Types of operating systems. GUI and DOS prompt commands. Overview of programming languages. Packages, word processing and spread sheets. Solving problems by computers using programming language. Main internal external commands. Examples and practice.
Teaching Method	30 hours for lectures. 45 hours for Lab. 10 office hours for revision.
Evaluation	- Class Assignments, Mid-Term Test and Final exam.
Reference(s)	1. Glenn Brookshear, computer Science an overview, 11ed ISBN:0132569035 2. Peter Norton's, "Introduction to Computers", McGraw-Hill/Irwin; 6th edition, 2004

Course Title	**MA1102Calculus- I**
Level /Semester	1/1
Credit Hours	3
Pre-requisite(s)	None.
Objective(s)	After the completion of this course, the student should be able to: - Understand limits, and continuous functions - Plot the graphs of the elementary function. - Find Derivatives. - Integrate by part and substitution. - Apply improper integrals. -
Course Contents	Functions: graphs of elementary functions, limits, continuous functions. Derivatives of algebraic, logarithmic, exponential inverse trigonometric. High order derivatives, mean value theorem. Taylor theorem. Indefinite integral, integration by part, and by substitution. Solid volumes, Arc length and coordinates. Unbounded functions. Geometric and physical application of improper integrals.
Teaching Method	30 hours for lectures. 30 hours for tutorial. 10 office hours for revision.
Evaluation	- Class Assignments, Mid-Term Test and Final exam
Reference(s)	1. Advanced Engineering Mathematical, by alan Jeffrey, 1 edition (June 27, 2001) 2. Engineering Mathematical, by K.A. Stroud , 2007 3. Calculus, by Earl W. Swokowski, 6 edition

Course Title	**PH1103 General Physics**
Level /Semester	1/1
Credit Hours	3
Pre-requisite(s)	**None**
Objective(s)	• At the end of this course the student will build a good base for further heat and mechanics theorems and topics. • The course aims to provide the student with the elementary laws of mechanics and heat theorem. • To ensure the basic laws of mechanics and heat practically.
Course Contents	Reflection and refraction of light lens systems. Light and electromagnetic waves. Electric charge and current. Electric and magnetic fields. Capacitance, inductance and resistance. Maxwell's equations. Electromagnetic oscillation and wave.
Teaching Method	30 hours for Lectures. 30hours for Tutorial. 45hours for Lab. 10 office hours for revision.
Evaluation	- Class Assignments, Mid-Term Test and Final exam.
Reference(s)	1. **"Physics for Scientists and Engineers",** 9th Edition , by Raymond A. Serway, 2013

Course Title	**CH1107 General Chemistry**
Level /Semester	1/1
Credit Hours	3
Pre-requisite(s)	None.
Objective(s)	• The main goal of this course is to clarify the relation between elements and the electronic structure of these elements. • This will improve the student's perception when studying basic and advanced electronic courses. • Microelectronics devices strongly need the chemical properties of some elements especially ceramic and solution because these elements are used in fabrication process of microelectronics devices.
Course Contents	Atomic Law. Quantum mechanics and Bohr hydrogenation. Wave mechanics atomic model. Periodic table, periodic properties of elements and its relation to electronic structure. Chemical and physical bonding, types and properties. Electronic bonding and particles structure. Bonding forces. Crystal structure. Doping effect of some elements. Ideal gas, Boil law. Types of solutions, and common properties. Surfaces tension.
Teaching Method	30 hours for Lectures. 30hours for Tutorial. 45hours for Lab. 10 office hours for revision.
Evaluation	- Class Assignments, Mid-Term Test and Final exam
Reference(s)	1. "General chemistry", by davidclark, 2004

Course Title	**EL1108 Electric Circuits**
Level /Semester	1/1
Credit Hours	3
Pre-requisite(s)	None.
Objective(s)	On completion of this course, students should be able to: • Explain the relations between charge, current, voltage, energy, power and the properties of ideal circuit elements, including resistors and voltage and current sources, and show understanding of how these differ from real elements. • Perform simple power calculations and find the maximum power available from a source. • Describe the behavior of ideal energy storage elements (inductor, capacitor). •
Course Contents	Units, atom, charge, Coulomb law. Current .voltage, power, Ohm's law, resistance measuring, resistance connection; series, parallel, delta, star. Kirchhoff's laws. Coils; Magnetic Circuits, Magnetic Fields, flux, flux density, magnetization curve, hysteresis loop, eddy current. Capacitor: Capacitance connection , electric field , charging and discharging, energy
Teaching Method	30 hours for lectures. 45 hours for Lab. 10 office hours for revision.
Evaluation	- Class Assignments, Mid-Term Test and Final exam.
Reference(s)	1. Fundamentals Of Electrical Engineering, By Giorgio Rizzoni, 2009

Course Title	**MA1201Calculus- II**
Level /Semester	1/2
Credit Hours	3
Pre-requisite(s)	None.
Objective(s)	The objectives of this course as follow: - Study integration technique - Understanding partial derivative - Using vector caraculs
Course Contents	**Course Contents:** The length along a curve if it were straightened out. **Convergent Series**: A series for which partial sums become arbitrarily close to some fixed number. **Exponential Growth**: The increase in a quantity according to an exponential function. **Harmonic Series**: The sum of the reciprocals of the positive integers. The series diverges. A Taylor series expansion of a function around zero. **Power Series**: A sum of powers of a variable. A power series is essentially an infinite polynomial. **Radius of Convergence**: Half the width of the interval inside which a power series converges absolutely. **Surface of Revolution**: A surface generated by rotating a two-dimensional curve about an axis. **Taylor Series**: The power series of a function around a given point.
Teaching Method	30 hours for lectures. 30 hours for tutorial. 10 office hours for revision.
Evaluation	- Class Assignments, Mid-Term Test and Final exam.
Reference(s)	1. Advanced Engineering Mathematical, by alan Jeffrey, 1 edition (June 27, 2001) 2. Engineering Mathematical, by K.A. Stroud , 2007 3. Calculus, by Earl W. Swokowski, 6 edition

Course Title	**MA2104 Algebra and Complex Numbers**
Level /Semester	2/1
Credit Hours	3
Pre-requisite(s)	None
Objective(s)	• To study Vectors and matrices • Solution of Linear equation. • Using Gauss method for linear systems.
Course Contents	Vectors Introduction, Space Vector. Matrices, Algebra of matrices, determinants, matrix and inverse of matrix. Crammer rule and Gauss elimination method for solution of linear systems, and solution of linear equations by inverse matrix. Eigen Value and Eigen Vectors. Complex number system. Geometry of the complex plane,General functions of a complex variable. Limits and continuity of a function of a complex variable and related theorems.
Teaching Method	30 hours for lectures. 30 hours for tutorial. 10 office hours for revision.
Evaluation	- Class Assignments, Mid-Term Test and Final exam.
Reference(s)	1. Advanced Engineering Mathematical, by alan Jeffrey, 1 edition (June 27, 2001) 2. Engineering Mathematical, by K.A. Stroud , 2007 3. Linear Algebra and it's application, 4th ed, by G.strong, 2006 4. Advance Engineering mathematical by alanJelfey.

Course Title	**ES1205 Engineering Drawing**
Level /Semester	1/2
Credit Hours	2
Pre-requisite(s)	None.
Objective(s)	To provide the student with the required skills in dimension determination, descriptive modeling of an object, and drawing skills using standard drawing tools and equipment
Course Contents	Introduction of descriptive geometry, lines, points, curves, and use of equipment. Principal orthographic views, isometric view and surfaces. Technical sketching with précised dimensions, real examples of enclosures, and machine components. Detail and assembly drawing. Lay out and manufacturing drawing. Pipes and electric print structural elements.
Teaching Method	30 hours for lectures. 45 hours for Lab. 10 office hours for revision.
Evaluation	- Class Assignments, Mid-Term Test and Final exam.
Reference(s)	1. Thomas, E.E., Charls, J.V., and Robert J.F., Engineering Drawing and Graphic Technology, 14th edition, McGraw-Hill, 1993. 2. Colin H., Simmons and Dennis E. Maguire, Manual of Engineering Drawing, 2nd edition, 2004, Elsevier Newnes, Linacre House, Jordan Hill, Oxford OX2 8DP, 200 Wheel Road, Burlington MA 01803.

Course Title	**EE1206 Semiconductors and Electronics Devices**
Level /Semester	1/2
Credit Hours	3
Pre-requisite(s)	None.
Objective(s)	• This course is designed to help the student to learn about origin of electronics starting from the atomic level in solid state theory, components, circuits, and the use of electronics.
Course Contents	Solid state principal, atomic theory. Charge and conduction. Covalent bonding. Diodes: types of diodes, Zener diode, tunnel diode, light emitting diode (LED), operation curve, breakdown and other characteristics. Diodes applications, LED indicators, half and full wave rectifiers. Transistor: types of transistors, bipolar junction transistor, PNP and NPN transistors, field effect transistors (FET), metal oxide transistors (MOS), operation and regions. Q-point and characteristics, saturation, cut off regions. Comparison between bipolar and field effect transistors in power consumption, speed and cost.
Teaching Method	30 hours for lectures. 45 hours for Lab. 10 office hours for revision.
Evaluation	- Class Assignments, Mid-Term Test and Final exam.
Reference(s)	1. Electronic devices edition 9 , Floyd 2. Microelectronic Circuits by Sedra Smith,5th edition

Course Title	**EE1207 Mechanics**
Level /Semester	1/2
Credit Hours	3
Pre-requisite(s)	
Objective(s)	- The course gives the students knowledge about the fundamental laws of nature for time, space, matter, and motion and how these are applied in the solution of practical problems. Together with the course Physics with experimental methods it should give the students reasonable insight into the most basic methods and results of science. - Define the basic concepts in mechanics for a system of particles and for a rigid body and to explain the connections between them.
Course Contents	- Statics: Quantities, units, and dimension, vector algebra and vector geometry, geometry of force systems including resultant force, couples etc. Necessary conditions for equilibrium, force and torque in a beam, centre of mass. - Particle dynamics: Kinematics of a particle in Cartesian coordinates, cylindrical (polar) coordinates, natural components. - Inertial systems, forces, and Newton's laws. - Work, power, energy, conservative forces, kinetic and potential energy. - Motion in central force fields. - Linear oscillations, harmonic, damped, and forced. - Systems of particles: The basic principles of linear and angular momentum. - The laws of mechanics for a system of particles. - The concepts here are for example constraints, degrees of freedom, centre of mass, velocity, acceleration, angular velocity, angular acceleration, force, mass, moment of inertia, and moment of force. - Definition of a number of mechanical quantities such as momentum, angular momentum, impulse, moment of impulse, work, kinetic and potential energy for systems of particles and rigid bodies. - The laws of mechanics for a system of particles. - Rigid body two dimensional kinematics - Moments of inertia and products of inertia. Rigid body two dimensional dynamics. The laws of mechanics in accelerated reference frames.
Teaching Method	Lectures + Lab + office hours for revision.
Evaluation	- Class Assignments, Mid-Term Test and Final exam.
Reference(s)	1. Engineering Mechanics, Statics & Dynamics, W. G. Mclan, 1978 2. Mechanics for Engineers, Statics, Ferdenand P. Beer, 1976 3. Handbook of Mechanics Experiment, J. Jimenz, 1963

Course Title	**WS1208 Engineering Workshop**
Level /Semester	1/2
Credit Hours	2
Pre-requisite(s)	
Objective(s)	To familiarize with: 1. The basics of tools and equipment are used in fitting, carpentry, sheet metal, welding and smithy. 2. The production of simple models in the above trades.
Course Contents	**FITTING** Tools &Equipment's – Practice in Filing and Drilling. Making Vee Joints, Square, dovetail joints, Key Making. **CARPENTARY** Tools and equipment's- Planning practice. Making Half Lap, dovetail, Mortise &Tenon joints, a mini model of a single door window frame. **SHEET METAL** Tools and equipment's - Fabrication of a small cabinet, Rectangular Hopper, etc. **WELDING** Tools and equipment's - Arc welding of butt joint, Lap Joint, Tee Fillet. Demonstration of Gas welding, TIG & MIG. **SMITHY** Tools and equipment's –Making simple parts like hexagonal headed bolt, chisel.
Teaching Method	30 hours for lectures. 45 hours for Lab. 10 office hours for revision.
Evaluation	- Class Assignments, Mid-Term Test and Final exam.
Reference(s)	1. Gopal, T.V., Kumar, T., and Murali, G., "A first course on workshop practice – Theory, practice andwork book", Suma Publications, 2005. 2. Kannaiah,P. &Narayanan,K.C. Manual on Workshop Practice, Scitech Publications, Chennai, 1999. 3. Venkatachalapathy, V.S. First year Engineering Workshop Practice, Ramalinga Publications, Madurai,1999.

Course Title	**MA2101 Probability and Bio-statistics**
Level /Semester	2/1
Credit Hours	2
Pre-requisite(s)	**MA1201 Mathematics II**
Objective(s)	• To understand standards of statistics in modern society. • To apply the rules of probability especially in engineering fields.
Course Contents	Statistic concepts in modern society. Frequency distribution, the normal distribution, elements of statistical inference. Estimation and hypothesis testing. Contingency tables. Linear regression and correlation. Simple analysis of variance. Fundamentals of the basic theory of probability. Sample spaces, events, basic axioms and theorems of probability, finite sample spaces with equally likely probabilities. Random variables and their distribution functions. Principles of set theory and a set of axioms for probability are used to derive some probability density and/or distribution functions.
Teaching Method	30 hours for lectures. 30 hours for tutorial. 10 office hours for revision.
Evaluation	- Class Assignments, Mid-Term Test and Final exam.
Reference(s)	1. Walpole, Myers, Myers & Ye, Probability & Statistics for Engineers and Scientists; Pearson; 9th edition, 2011. 2. Engineering mathematical by K.A stword 2007

Course Title	**EL2206 Bio-Sensor and Measurement**
Level /Semester	2/2
Credit Hours	3
Pre-requisite(s)	Analog Electronic
Objective(s)	• This course aims to provide the student with the SI, the modern metric system of measurement. • Also to study different measuring instruments, their use and operation. • To expose students to several of the most important emerging biosensor technologies. • To encourage the practice of critical thinking when considering a new detection technology and to develop the ability to communicate well-researched opinions to others.
Course Contents	• Fundamental concepts behind the operation of the most important classes of biosensors. • Biosensors characterization, compared to each other, and haw can be designed to suit particular applications. • Biochemical functionality coupling to a biosensor transducer. • Biosensor figures of merit • Measurement concept. • SI units. • Errors in measurement,measurement of electrical quantities. • Types and applications. Galvanometers. • Moving iron and coil instruments. • BridgesandDigital instruments. • CRT theory and operation.
Teaching Method	30 hours for lectures. 30 hours for tutorial. 10 office hours for revision.
Evaluation	- Class Assignments, Mid-Term Test and Final exam.
Reference(s)	**1.** Measurement and Instrumentation: Theory and Application: Alan S Morris and Reza Langari, 2011 **2.** Instrumentation for Engineering Measurements: James W. Dally, William F. Riley andKenneth G. McConnell, 1993 **3.** Measurement and Instrumentation in Engineering: Principles and Basic LaboratoryExperiments: Francis S. Tse and Ivan E. Morse, 1989

Course Title	**EE2103 Digital Electronics**
Level /Semester	2/1
Credit Hours	3
Pre-requisite(s)	**EE1107 Principle of Electronics**
Objective(s)	• This course aims to study combinational logic circuits and their applications as a part of computer and other electronic circuits. • To study and Design Sequential Logic circuits. • To link these designs with applicable electronic circuits
Course Contents	Basic notions: Characteristics of digital systems, basic gates AND, OR, NOT, XOR symbols, operation and truth table revision. Combinational logic circuits, simplification techniques, Algebra and Karnaugh map simplifications, parity checker and complement circuits, half and full binary adders. Multiplexers and de-multiplexers, coders and decoders. Memory, PAL, Sequential and combinational circuit's comparison. Multi-vibrators circuit operation. RS Flip Flop, T FF, D FF, and JK Flip Flop. Serial and parallel Shift Register. Counters, a Synch and Synch Counters, Decade counters, different Mod Counters.
Teaching Method	30 hours for lectures. 30 hours for tutorial. 10 office hours for revision.
Evaluation	- Class Assignments, Mid-Term Test and Final exam.
Reference(s)	1. RamakantA.Gayakward, Op-amps and Linear Integrated Circuits, IV edition, Pearson Education, 2003 / PHI. 2. D.RoyChoudhary, SheilB.Jani, Linear Integrated Circuits, II edition, New Age, 2003. 3. M. Morris Mano, Digital Logic and Computer Design, Prentice Hall of India, 2008

Course Title	**EE2104 Principle of Mechanical Engineering**
Level /Semester	2/1
Credit Hours	2
Pre-requisite(s)	None
Objective(s)	Understanding of basic principles of Mechanical Engineering is required in various field of engineering.
Course Contents	**UNIT – 0** Centroids and centre of mass; Centroids of lines and areas; Rectangular, circular, triangular areas by integration, T section, I section, - Angle section, Hollow section by using standard formula , **UNIT – I** Introduction: Prime movers and its types, Concept of Force, Pressure, Energy, Work, Power, System, Heat, Temperature, Specific heat capacity. **UNIT – II** Heat Engines: Heat Engine cycle and Heat Engine, working substances, Classification of heat engines, Description and thermal efficiency;Combustion Engines: Introduction, Classification, Engine details, four- stroke/ two-stroke cycle Petrol/Diesel engines, Indicated power, Brake Power, Efficiencies. **UNIT – III** Pumps: Types and operation of Reciprocating, Rotary and Centrifugal pumps, Priming Air Compressors: Types and operation of Reciprocating and Rotary air compressors, significance of Multistage. **UNIT – IV** Couplings, Clutches and Brakes: Construction and applications of Couplings (Box; Flange; Pin type flexible; Universal and Oldham), Clutches (Disc and Centrifugal), and Brakes (Block; Shoe; Band and Disc). Transmission of Motion and Power: Shaft and axle, Belt drive, Chain drive, Friction drive, Gear drive. Engineering Materials: Types and applications of Ferrous & Nonferrous metals
Teaching Method	30 hours for lectures. 30 hours for tutorial. 10 office hours for revision.
Evaluation	- Class Assignments, Mid-Term Test and Final exam.
Reference(s)	1. Basic Mechanical Engineering / Pravin Kumar/ Pearson 2. Introduction to Engineering Materials / B.K. Agrawal/ Mc Graw Hill 3. Fundamental of Mechanical Engineering/ G.S. Sawhney/PHI 4. Thermal Science and Engineering / Dr. D.S. Kumar/ Kataria

Course Title	**MA2105 Differential Equations**
Level /Semester	2/1
Credit Hours	3
Pre-requisite(s)	Calculus I, II.
Objective(s)	• To study of differential equations as a wide field in pure, applied mathematics, and engineering. • To study the properties of solutions of a given differential equation. • To show that differential equations are used to model the behavior of complex systems.
Course Contents	Degree and order of ordinary differential equations. Formation of differential equations. Solutions of first order differential equations by various methods. Solutions of general linear equations of second and higher orders with constant coefficients. Solution of homogeneous linear equations. Solution of differential equation of the higher order when the dependent or independent variable is absent. Solution of differential equation by the method based on the factorization of the operators. Frobenius method. Partial differential equations: Wave equations. Particular solutions with boundary and initial conditions.
Teaching Method	30 hours for lectures. 30 hours for tutorial. 10 office hours for revision.
Evaluation	- Class Assignments, Mid-Term Test and Final exam.
Reference(s)	1. Advanced Engineering Mathematical, by alan Jeffrey, 1 edition (June 27, 2001) 2. Engineering Mathematical, by K.A. Stroud , 2007 3. Differential equation with BU, Dennis G.Zill, 7thedd.

Course Title	**BME2106 Anatomy and Physiology**
Level /Semester	2/1
Credit Hours	2
Pre-requisite(s)	None
Objective(s)	This course is an introduction to human anatomy and physiology from an integrative perspective. Students learn the structure and function of the tissues, the skeletal system, the nervous system, the endocrine system, and muscle function from the level of the cell to the level of the organism.
Course Contents	The systems are overviewed by identifying the various components organization and function, which make up the system and outlining their most basic functions. The general appearance and structure and functions of the major organs will be briefly covered as well as relative positions and relationships of each one, within each body cavity.. **Locomotors system:** types of Bone: a typical long bone, the bony skeleton, types of joint: a typical synovial joint, the major articulations. **Cardiovascular system:** organization and functions of the CV system: systemic and pulmonary circulation: the heart and the blood vessels. **Respiratory system:** general organization and function of upper airways, the lungs, the pleura. **Lymphatic system:** general organization and functions: the spleen, lymph nodes and lymph vessels. **Digestive system:** general organization: the tube and its expansions, the side parts: liver, gall bladder and pancreas. **Urinary system:** general organization and function: the kidneys, the urethra. **Nervous system and organs of special sense**: general organization and function: the central nervous system, the peripheral nervous system, the autonomic nervous system, the eye, the ear. **Endocrine system:** general organization and function: the major endocrine glands: the pituitary, the thyroid, the parathyroid, the adrenals, the ovaries/testes, the pancreas. **Reproductive system:** general organization and function: the major features of male and female systems.
Teaching Method	30 hours for lectures. 30 hours for tutorial. 10 office hours for revision.
Evaluation	- Class Assignments, Mid-Term Test and Final exam.
Reference(s)	1. “Essentials of Human Anatomy & Physiology” (7th Edition) Marieb

Course Title	**EE2107 Analog Electronics**
Level /Semester	2/1
Credit Hours	3
Pre-requisite(s)	Semiconductors and Electronics Devices
Objective(s)	The goal of this course is to introduce electronic circuit analysis and design techniques with special consideration given to the operation and use of bipolar junction transistors including the analysis and design of important circuits that utilize these devices. In particular, this course will focus on practical analog circuits and more specifically on amplifiers.
Course Contents	Introduction to amplifier circuits, class A, class B, and class C circuits. Common Emitter circuit, analysis and design, circuit gain, alpha and beta calculations, common collector circuit and analysis, common base circuit. FET amplifiers, common source circuit analysis and design
Teaching Method	30 hours for lectures. 30 hours for tutorial. 10 office hours for revision.
Evaluation	- Class Assignments, Mid-Term Test and Final exam.
Reference(s)	1. Electronic devices edition 9 , Floyd 2. Microelectronic Circuits by Sedra Smith,5th edition

Course Title	**EE2201 Electrical Machine**
Level /Semester	2/2
Credit Hours	3
Pre-requisite(s)	Electric Circuits
Objective(s)	This course provides an overall guide to modern theory and practice of controlling electrical motors; these are often used as the prime movers in industrial machines. To introduce to the student the range of mathematical techniques that can be used to analyze the static and dynamic characteristics of electrical machines. The course will deal with the application of various motors in real engineering situations. Industrial machines will come in different guises such as robots, gantries, x-y tables, conveyors and packaging mechanisms.
Course Contents	1. All motors are the same! The concept 'Primitive machine' will be analyzed and this generalized approach will permit steady state and transient solution for the analysis of machines. 2. Static and rotating electrical machines. 3. Voltage Equation. 4. Transformation and connection matrices. 5. Symmetrical components. 6. Invariance of power. 7. Primitive machine. 8. Transformer and rotational EMFs. 9. Fundamental torque equation. 10. Matrix expressions. 11. DC machines. 12. Interconnected machines. 13. Synchronous machine.
Teaching Method	Lectures + tutorials + office hours for revision.
Evaluation	- Class Assignments, Mid-Term Test and Final exam.
Reference(s)	1. Electrical Machines, Slemon G R &Straughen , Addison Wesley 2. Electrical Machines and Applications, Hindmarch John, Pergamon Press 3. Matrix Analysis of Electrical Machinery, Handcock N N, Pergamon Press

Course Title	**CS2203 Computer Programming**
Level /Semester	2/2
Credit Hours	3
Pre-requisite(s)	**CS1101 Introduction to Computer Science**
Objective(s)	Because programming languages are at the core of writing software, students should have a thorough understanding of how languages are designed, implemented, and manipulated. This course concerns itself specifically with the implementation and translation of computer languages, leaving an in-depth study of language design to further course. Students will learn the formalisms behind computer languages. C++ language will be taken as a programming language example
Course Contents	Introduction to Computers and Programming. The C Language, Compilers, Numbers Systems. Program Structure, Comments and Printing. Formatting Output, Escape Sequences, Program Debugging. Variables, Constants, Arithmetic Operators and Expressions. Reading Data, Writing to Files, Single Character Data. IF Statements, Logical Operators and Expressions. Switch and IF-ELSE-IF Control Structures, Applications and Review. WHILE and FOR Loops, Applications. Function Prototypes, Definitions, and Call. Address and Pointer Variables, Applications. One Dimensional Arrays, Array I/O. Multidimensional Arrays, Arrays and Functions, Applications and Review. Strings and Pointers. Applications and Review.
Teaching Method	30 hours for lectures. 30 hours for tutorial. 10 office hours for revision.
Evaluation	- Class Assignments, Mid-Term Test and Final exam.
Reference(s)	1. Object oriented programming using C++, RobettLafore **,2001** 2. H.H. Tan and T.B. D'Orazio, "C Programming for Engineering & Computer Science", McGraw-Hill Science/Engineering/Math; 1st edition (September 17, 1998) 3. B.W. Kernighan and D.M. Ritchie, "The C Programming Language", 2nd edition, Prentice-Hall, 1988. 4. P.J. Plauger, "The Standard C Library", Prentice-Hall, 1992. 5. A.I. Holub, "The C Companion", Prentice-Hall, 1987.

Course Title	**BME2204 Medical Recording and Monitroing Instrument**
Level /Semester	2/2
Credit Hours	3
Pre-requisite(s)	Analog Electronics, Measurement and Instrumentation
Objective(s)	Students will be able to apply the principles of electronic circuits and devices to the use and design of instrumentation in the biomedical area. They will have gained a basic knowledge of the operating principles of electrical and other transducers, analog and digital instrumentation, applied signal acquisition and processing, electrical safety in the medical environment, electrical properties of nerve and muscle physiology; and instrumentation used in cardiopulmonary, neurological, surgical, and rehabilitation areas of medicine.
Course Contents	1. Basics of Medical Measurement & Instrumentation. 2. Biomedical Sensors & transducers. 3. Bio-potentials and amplifiers characteristics. 4. Signals conditioning requirement. 5. Electrocardiogram Measurement system (ECG), 6. ElectroMyoGram Measurement system (EMG) 7. Electroencephagram Measurement system (EEG) 8. Electrooculogram Measurement system (EOG) 9. Action potential and biopotential electrodes, electrode-skin interface 10. Blood Pressure Measurement Fundamentals. 11. Cardiac Catheterization 12. Concepts of Blood flow and blood volume. 13. Electromagnetic, and ultrasonic flowmeters. 14. Respiration, Mechanical Ventilation, and Types of respiratory equipment, pulmonary function test. 15. Respiratory Rate Measurement System 16. Bioimpedance measurements of human body 17. Photoplethysmography and its application in clinical 18. Body temperature measurement system
Teaching Method	Lectures + tutorial + office hours for revision.
Evaluation	- Class Assignments, Mid-Term Test and Final exam.
Reference(s)	1. Medical Instrumentation Application and Design 2. Introduction To Biomedical Equipment Technology 3. Biomedical Instrumentation and Measurements 4. The Biomedical Engineering Handbook 5. Medical Instrumentation Systems

Course Title	**BME2205 Nuclear Physics and Radiotherapy**
Level /Semester	2/2
Credit Hours	2
Pre-requisite(s)	General Physics
Objective(s)	Students first receive an introduction to the concepts of nuclear physics including; nuclear systematics, nuclear models, radioactivity, nuclear models, nuclear reactions and applications of nuclear physics. The course then deals with theoretical and applied radiation physics including; interactions of charged particles, interactions of photons, generation of X-rays, attenuation and energy transfer, dosimetric quantities, radiation measurement, and applications in medical physics astrophysics and atmospheric physics.
Course Contents	1. Introduction Terminology 2. Review: Atomic & Nuclear Structure 3. Radioactive Decay 4. The Radioactive Decay Law 5. Units of Radiation Measurement 6. Interaction of Radiation with Matter 7. Attenuation of Gamma-Rays 8. Gas-Filled Radiation Detectors 9. Scintillation Detectors 10. Nuclear Medicine Imaging Systems 11.Gamma camera. 12.PET (Positron Emission Tomography) 13. Linear Accelerator 14. Cobalt-60 15. Radiation Protection and safety.
Teaching Method	30 hours for lectures. 30 hours for tutorial. 10 office hours for revision.
Evaluation	- Class Assignments, Mid-Term Test and Final exam.
Reference(s)	1. Basic Physics of Nuclear Medicine. 2. IAEA Materials on Nuclear Medicine, Radiation Protection& safety. 3. K. Kleinknecht - Detectors for Particle Radiation, C.U.P. 1990 R.K. Bock & A. Vasilescu - The Particle Detector BriefBook, Springer 1998

Course Title	**BME2206 Biophysics**
Level /Semester	2/2
Credit Hours	2
Pre-requisite(s)	Anatomy and Physiology
Objective(s)	Objectives of the course are to study selected biological phenomena using physical principles. This course provides a thorough grounding in the theory and major experimental methods of biophysics.
Course Contents	1. Life and Its Physical Basis: 2. Forces and energies at nanometer scales. 3. Thermodynamic basis of life. 4. Macromolecular Structure a) Primary Through Quaternary Structure b) Covalent stereochemistry & Force fields c) Non-bonded interactions & Force fields 5. Thermodynamics & Kinetics • Illustrated with applications to Membrane Transport. A. Energy, Entropy, Free energy B. Activation energy & transition states C. Hydrophobic effect D. Statistical mechanics E. Equilibria (Reactions, Binding, Conformation, Calorimetry) 6. Membrane proteins, ion channels&pumps 7. Transport & Diffusion 8. Action potentials / measurement / synapses 9. Chemical composition of living systems. 10. Proteins: Structure and Function. 11. Nucleic Acid and Genetic Information: Deciphering the genetic code. 12. The Cell: A Survey. The Cell Membrane. 13. Molecular machines: Motility. 9. The Neuron: We all have to talk to each other.
Teaching Method	Lectures. + tutorial.+ office hours for revision.
Evaluation	- Class Assignments, Mid-Term Test and Final exam.
Reference(s)	1. Introductory Biophysics, M. Cerdonio and R. W. Noble, 1998. 2. Rob Phillips, Jane Kondev, and Julie Theriot, "Physical Biology of the Cell" Garland Science, 1st edition, 2008, ISBN-10: 0815341636,

Course Title	**BME3101 Biomaterial and Biomechanics**
Level /Semester	3/1
Credit Hours	2
Pre-requisite(s)	General Physics, Mechanics
Objective(s)	✓ To introduce student to biomaterials. Emphasis will be on the understanding of what is a biomaterial, how it is processed, how it behaves under loadings and usage in design for broken or failured parts of the human body ✓ To quantify human movement. ✓ To link your physics and mathematics background to applied biomechanical questions. ✓ To apply the mathematical tools and physics principles to problem solving. ✓ To predict performance outcome from given biomechanical variables.
Course Contents	Basic concepts introduction to major considerations for **Biomaterials**, Biocompatibility examples of applications. Structure of solids, types of Bonds, crystalline and non – crystalline materials, crystal structure of solids, Defects in crystals. Structure property relationships of Biological Materials. **Properties of materials:** Metals, Polymers, ceramics, compositions, fluids, continuum analysis, the relation-ship between atomic or molecular structure and physical properties, strength and stiffness, bonding and theoretical strength. Alloying, phase diagram. Biodegradable polymeric biomaterials ,Structure and properties of Collagen, Hard tissue replacements ,Hip joint prosthesis and possible solutions , Soft tissue replacements ,Applications of biomaterials, Techniques of material testing. Properties of tissues **mechanical** properties in relation to molecular structure. The collagen family and their elastic properties, Elating, ageing, micro fibrils, fibril in etc. proteoglycan family. Deformation of soft tissues, nonlinear elasticity, viscoelalasticity, skin measurement of stress and strain in tissues. **Bone:** compact bone. Organization of trabeculae, ligaments and tendons, growth and remodeling, deformation of cartilage, lubrication, intervertebral disc. Cell mechanics, membrane and cytoskeleton properties, deformability, adhesion. **Muscle mechanics:** active and resting stresses, integration of skeleton – muscular mechanics: posture, gait, forces during waking, running jumping. Methods of gait analysis. Introductory to robotics
Teaching Method	Lectures. + Tutorial + office hours for revision.
Evaluation	- Class Assignments, Mid-Term Test and Final exam.
Reference(s)	1. L. Hench and J. Jones. Biomaterials, artificial organs and tissue engineering: Elsevier. 2005. 2. P. McGinnis. Biomechanics of sport and exercise: Human Kinetics. 2013. 3. NihatOzkaya& Margareta Nordin, Fundamental of biomechanics, second edition

Course Title	**BME3102 Rehabilitation and artificial Organs**
Level /Semester	3/1
Credit Hours	2
Pre-requisite(s)	
Objective(s)	1. to familiarize students with the musculoskeletal anatomy of the upper and lower extremities; 2. to familiarize students with muscle mechanics and the electromyogram; 3. to familiarize students with human locomotion in terms of terminology and characterization of normal versus pathologic function; 4. to familiarize students with biologic soft tissue and interface mechanics related to seating, positioning, prostheses, and load transfer; 5. to familiarize students with amputation surgery techniques and factors influencing amputation level selection; 6. Introducing existing artificial organs, prostheses, and rehabilitation systems, focusing on their goals, working principles, and limitations. 7. It further stimulates the student's innovation skills through the deep understanding of the global problem of interfacing a human with such a device.
Course Contents	Engineering concepts in sensory rehabilitation engineering concepts in communication disorder. **Orthopedic prosthetics and orthotics in rehabilitation**: fundamentals, applications, design examples such as intelligent prosthetic knee, hand. **Wheeled mobility**: wheel chairs and personal transportation; introduction, categories of wheel chairs, wheel chairs structure and component design, Power wheelchair electrical systems; user interface, integrated controls, power system, electromagnetic compatibility. Restoration of hand functions, restoration of standing and walking. Active above – knee prostheses, myoelechic hand and arm prostheses. **Visual system:** introduction about visual systems, visual substitution. **Auditory systems:** introduction about auditory system, auditory substitution. Coclear implants **Introduction** to the medical treatments that resort to the substitution of artificial systems to failing organs or physiological systems. The basic anatomy and physiology notions of organs to be replaced. **Presenting** the artificial organs (composition, functioning mode, organism adaptation) along with the therapeutic effects and the limitations to such substitution (side effects and complications). **Applications**: vital organ substitution (blood flow, cardiac pump, lung, kidney, etc.), passive and active implants, and rehabilitation and assistive robots. **Machine** organs in medical applications (pumps, actuators, transmission and tightness organs, micro-mechanisms, etc.). Overview the prostheses and external sensorial devices. The cardiac pacemaker and defibrillators should be exhaustively studied.
Teaching Method	Lectures + tutorial. + office hours for revision.
Evaluation	- Class Assignments, Mid-Term Test and Final exam.
Reference(s)	1. D. Hobson and E. Trefler, “Chapter 142 - Rehabilitation engineering technologies: Principles of application,” in The Biomedical Engineering Handbook, J. D. Bronzino, Ed. Boca Raton, FL: CRC, 1995, pp. 2135–2151 2. Artificial Organs, Nadey Hakim (Ed) 3. L. Hench and Jones, Biomaterials, artificial organs and tissue engineering: Elsevier, 4. G. Sawhney, Fundamental of biomedical engineering: New Age International, 2007.

Course Title	BME3103 Medical Laboratory Equipment
Level /Semester	3/1
Credit Hours	3
Pre-requisite(s)	
Objective(s)	✚ Learn the concepts, and operation of the laboratory devices. ✚ Providing skills to design, build, and test biomedical laboratory equipment
Course Contents	Introduction Laboratory Instrumentation Technology, Basics of physical chemistry, with emphasis on biological applications. Basics of thermodynamics & mechanics with emphasis on biological applications. Medical laboratory environment, instrumentation, and Sterilization. Basic electronic troubleshooting. Heating instrument (oven, incubator, water bath, distiller & autoclave). Microscope, Centrifuge, Analytical balance, Rotor , shaker & vortex, Osmometry. Refractometer, Physician's office Laboratory Instrumentation Colorimeter, Spectrophotometer, Flame photometer, Ion selective electrode, Auto Chemistry analyzer, Liquid Chromatography, Electrochemical methods of Analysis, Photon Counters, Liquid Chromatography. Nephelometry and Turbidimetry, Hematology analyzer, Electrophoresis, Hemoglobin meter (Spectrophotometer), PCV centrifuge, ISR meter, Elisa reader, Elisa washer, Real time PCR, Mass spectrometry , Flow Cytometry.
Teaching Method	30 hours for lectures. 30 hours for tutorial. 10 office hours for revision.
Evaluation	- Class Assignments, Mid-Term Test and Final exam.
Reference(s)	1. Laboratory Instrumentation, fourth edition, Mary C. Haven

Course Title	**BME3104 Ionizing Imaging Systems**
Level /Semester	3/1
Credit Hours	3
Pre-requisite(s)	Nuclear Physics and Radiotherapy
Objective(s)	The course treats the physical, mathematical and technological aspects of medical imaging systems. Modalities (imaging types) covered include x-ray imaging, computed tomography (CT). Special emphasis is given to the principles of radiation detection and the associated instrumentation. Numerical methods to quantify the performance of medical imaging systems are presented. The design of medical imaging systems usually involves a number of tradeoffs involving parameters such as contrast, spatial resolution, noise, image acquisition time, size and cost. It is a major goal of the course to provide an understanding of these relations.
Course Contents	- **X-ray physics** Generation of x-ray, radiation interaction with matter, and the components of x-ray imaging systems (Diagnostic, fluoroscopy, and mammography systems) of different types and describe their respective functions. - **Radiation detectors** Explain the physical and technological principles behind various types of radiation detectors and imaging modalities. - **CT imaging system.** Describe the principle of CT imaging system, Projection Slice Theorem and CT Reconstruction Methods, the generations of CT scanners, and contrast mechanism and system spatial resolution.
Teaching Method	Lectures + tutorials + office hours for revision.
Evaluation	- Class Assignments, Mid-Term Test and Final exam.
Reference(s)	1. S. Webb “The physics of medical imaging”. Institute of physics publishing, 1998 2. J. Bushberg et al, “The essential physics of medical imaging”, 2nd Ed., 2001. 3. A. Oppelt (Ed.), “Imaging systems for medical diagnostics”, 2005. 4. G. Knoll, “Radiation detection and measurement” 3rd Ed., 2000.

Course Title	**EE3105 Microcontroller**
Level /Semester	3/1
Credit Hours	3
Pre-requisite(s)	Computer Programming
Objective(s)	Digital Circuits
Course Contents	Introduction to microcontroller , types of microcontrollers , input and output ports description, comparison between microcontroller and microprocessor, applications of microcontroller, main units of microcontroller, internal architecture (CISC vs RISC) architecture, clock instruction cycle, pipelining process, interrupt request , interfacing of microcontroller, types of oscillators, MCLR and its function, analog to digital conversion, pulse width modulation (PWM).
Teaching Method	30 hours for lectures. 30 hours for tutorial. 10 office hours for revision.
Evaluation	- Class Assignments, Mid-Term Test and Final exam.
Reference(s)	1. Analog and Digital Circuits for Electronic Control System Applications. By: Jerry Luecke. 2. Interfacing PIC Microcontrollers Embedded Design by Interactive Simulation. By : Martin Bates.

Course Title	**BME3201 Non-Ionizing Imaging Systems**
Level /Semester	3/2
Credit Hours	3
Pre-requisite(s)	Nuclear Physics and Radiotherapy
Objective(s)	The course treats the physical, mathematical and technological aspects of non-ionizing imaging systems. Modalities (imaging types) covered include MRI imaging system, Ultrasound system, and some other non-ionizing imaging modalities. Special emphasis is given to signal detection, image formation, and the associated instrumentation.
Course Contents	• Physics of non-ionizing radiation • Explain the fundamental concepts of non-ionizing radiation including lasers, microwaves, UV light, IR Light and radio frequency • MRI imaging system • Describe the principle of MR imaging system, detected signal and Relaxation, Magnetic Resonance and Reference Frame, and MR contrast mechanism • Ultrasound system Physics of Ultrasound Waves, Fundamental acoustics, Interactions of ultrasound with tissue and image formation, describe the various components of ultrasound system and their functions, and type of ultrasound scanning techniques.
Teaching Method	30 hours for lectures. 30 hours for tutorial. 10 office hours for revision.
Evaluation	- Class Assignments, Mid-Term Test and Final exam.
Reference(s)	1. S. Webb "The physics of medical imaging". Institute of physics publishing, 1998 2. J. Bushberg et al, "The essential physics of medical imaging", 2nd Ed., 2001. 3. A. Oppelt (Ed.), "Imaging systems for medical diagnostics", 2005. 4. Edelman SK. Woodlands, "Understanding Ultrasound Physics" TX: ESP, Inc., 2004.

Course Title	**BME3202 Radiation Protection and Safety**
Level /Semester	3/2
Credit Hours	2
Pre-requisite(s)	Nuclear Physics and Radiotherapy, Ionizing Imaging Systems
Objective(s)	To introduce to students the basics concepts in quality control related to medical imaging, to introduce to students the basics concepts related to medical radiation protection. The course focuses on issues related to these technologies and applications, namely development, standardization, and implementation and user acceptance
Course Contents	▪ Basic **principles of Quality** management ▪ Tools and **methods for quality** improvement ▪ **Elements of Radiation Protection**, Dosimeters, and Safety, Exposure, Kerma, absorbed dose, equivalent dose, effective dose, units, Personal protection; Film badges; TLD; leakage and contamination surveys; Shielding; Record keeping; Roles of Radiation Protection Advisor, Radiation safety officer and Laser Safety Officer; Disposal of radioactivity. Personal and environmental monitoring patient dosimetry in diagnostic imaging. Exposure to natural and man made background radiation. Assessment of risk for diagnostic examinations, acceptability and comparison of risks. ▪ **Acquisition of equipment**: technical assessment and data analysis, inspection and test of medical instruments and system. Inventory control: manufacturer, model and serial number, purchase date and price, warranty, guarantee. ▪ **Preventive maintenance** and inspection: prolong the useful life of equipment, reduce failure, and reduce operating costs, calibration, Safety and management of medical
Teaching Method	30 hours for lectures. 30 hours for tutorial. 10 office hours for revision.
Evaluation	- Class Assignments, Mid-Term Test and Final exam.
Reference(s)	• Ethics and Radiological Protection, Gilbert Eggermont and Bernard Feltz (eds) Bruylant Academia, 2008, ISBN 978-2-87209-894-1 • Any reference As suggested by the lecturer

Course Title	**PR 3204 Graduation Project**
Level /Semester	3/2
Credit Hours	3
Pre-requisite(s)	None
Objective(s)	1. Enable students to implement the knowledge & skills gathered through various theoretical and laboratory courses 2. Introduce students to conduct independent literature survey for contemporary problems and issues related to implementation of the allotted project. 3. Encourage the students to acquire a comprehensive understanding about design, operation, simulation, data collection and analysis on the important areas of the project.
Course Contents	Choose a project that makes usage of the acquired knowledge& skills and in line with current needs of prospective employers. Projects shall incorporate the technological advancements while applying Information Communication Technology (ICT) extensively. **Suggested Fields:** •
Teaching Method	30 hours for lectures. 30 hours for tutorial. 10 office hours for revision.
Evaluation	- Class Assignments, Mid-Term Test and Final exam.
Reference(s)	The students should select recent references depend on the project area

Languages & Studies (HL)

		عدد ساعات الاتصال		
اسم المقرر	رمز المقرر	نظري	تطبيقات	المعتمدة
الثقافة الاسلامية 1	HL1105	2	-	2

الهدف العام :-

ان يتعرف المتعلم على مفهوم الثقافة الإسلامية ، مصادرها ، خصائصها . ،عناصر الثقافة الاسلامية وآثارها في الفرد والمجتمع، مفهوم العبادة في الإسلام.

مخرجات التعلم (ما يتوقع من المتعلم اكتسابه بعد دراسة المقرر)

ان يطبق المتعلم ثقافته الاسلامية في شؤون حياته

مفردات المقرر (المحتوى – الموضوعات)

- الوحدة الأولى : مقدمات في الثقافة الإسلامية:

تعريف الثقافة الإسلامية – مصادرها– خصائصها – موقف المسلم من الثقافات الأخرى.

- الوحدة الثانية : العقيدة الإسلامية:

مفهوم العقيدة الإسلامية – أهميتها – أركان الإسلام الخمسة – أثر هذه العقيدة على الفرد والمجتمع .

عقيدة أهل السنة والجماعة في السمع والطاعة لولاة الأمر – خطورة الخروج عليهم وعقوبة ذلك – أهمية الجماعة ووجوب لزومها.

- الوحدة الثالثة : العبادة في الإسلام:
  - حقيقة العبادة في الإسلام – خصائصها – أنواعها – حكم ومقاصد أركان الإسلام الخمسة.
  - الغلو – مفهومه –أنواعه – حكمه – و خطره – المنهج النبوي في معالجة الغلو – مصير الغلاة – نماذج من الغلاة (الخوارج).

توصيف المهام والتكاليف:

المهمة	الوصف	الاسبوع
بحث	موضوع في مفردات المقرر	الرابع
اختبار فصلي		السابع
اختبار نهائي		نهاية الفصل

استراتيجيات تدريس المقرر

المحاضرة

استراتيجيات (طرق) التقييم

بحث 10%

اختبار فصلي 10%

اختبار نهائي80%

المراجع :-

1 –الثقافة الإسلامية – الشيخ عبدالمجيد بن عزيز الزنداني– إدارة المطلوبات جامعة الخرطوم،

2 –الوسطية والاعتدال وأثرها على حياة المسلمين للشيخ صالح بن عبد العزيز آل الشيخ.

3 – الموافقات للإمام الشاطبي.

4 –مقاصد الشريعة للشيخ الطاهر بن عاشور.

اسم المقرر	رمز المقرر	عدد ساعات الاتصال		
		نظري	تطبيقات	المعتمدة
لغة عربية 1	HL1204	2	–	2

الهدف العام :-

ان يتعرف المتعلم مسائل في اللغة وآدابها لتوظيفها في استعمالاته اللُغوية، وتدريبه على بعض قواعد النحو الأساسية،وبعض قواعد الضبط الإملائي وتنمية مهارات الطلاب اللغوية من خلال (الاستماع،والكلام،والقراءة،والكتابة) .

مخرجات التعلم (ما يتوقع من المتعلم اكتسابه بعد دراسة المقرر)

ان يطبق المتعلم مهارات اللغة العربية في شؤون حياته

مفردات المقرر (المحتوى – الموضوعات)

المسائل النحوية:

1. مراجعة لبعض القواعد النحوية التالية:
   - الإعراب والبناء (الأسماء، والأفعال، والحروف) .
   - الجملة الاسمية (المبتدأ والخبر، والأفعال الناسخة، والحروف الناسخة) .
   - الجملة الفعلية (الفاعل ونائبه، وبناء الفعل للمجهول،والأفعال اللازمة والمتعدية، والمفاعيل) .
   - العدد وأحكامه (صياغته، وإعرابه) .
2. المعاجم العربية (التعريف، والأهمية، والأنواع، وطريقة الاستخدام) .

توصيف المهام والتكاليف:

المهمة	الوصف	الاسبوع
بحث	موضوع في مفردات المقرر	الرابع
اختبار فصلي		السابع
اختبار نهائي		نهاية الفصل

استراتيجيات تدريس المقرر

المحاضرة (الكتروني)

استراتيجيات (طرق) التقييم

الكتروني

المراجع :

1 –النحو الجامعي، محمد شريف أبو الفتوح، مكتبة الشباب، مصر، 1974 م.

2 –فن التحرير العربي، محمد صالح الشنطي، دار النفائس، بيروت، 2004 م.

3 –المنجد في اللغة والاعلام – المكتبة الشرقية، بيروت.

اسم المقرر	رمز المقرر	عدد ساعات الاتصال		
		نظري	تطبيقات	المعتمدة
الثقافة الاسلامية 11	HL2202	2	–	2

الهدف العام :-

ان يتعرف المتعلم على العقيدة السليمه ضد انحرافات وشبهات المذاهب الفكرية والاجتماعية المعاصرة للقيام بواجبه الديني في بناء ذاته وأسرته ووطنه المشاركة في النهضة المعاصرة للأمة في مختلف مجالات الحياة.

مخرجات التعلم (ما يتوقع من المتعلم اكتسابه بعد دراسة المقرر)

ان يطبق المتعلم ثقافته الاسلامية في شؤون حياته

مفردات المقرر (المحتوى – الموضوعات)

مسائل و قضايا معاصرة:

أولا: الجهاد:تعريفه – حكمه – أنواعه – الرد على الجماعات الجهادية المعاصرة – بيان ما جنته هذه الجماعات على الأمة الإسلامية من الشرور.

ثانيا: محاسن الإسلام و أبرز مزاياه:

التمام و الكمال – الاتساع والشمول – الصلاحية لكل زمان و مكان – الوسطية والاعتدال – اليسر والسعة ورفع الحرج – العدل – الرحمة – المحبة – الوفاء بالعهود و المواثيق – الأمر بالصلاح والإصلاح والنهي عن الفساد والإفساد – حسن الخلق – الحكمة والبصيرة في الدعوة

توصيف المهام والتكاليف:

المهمة	الوصف	الاسبوع
بحث	موضوع في مفردات المقرر	الرابع
اختبار فصلي		السابع
اختبار نهائي		نهاية الفصل

استراتيجيات تدريس المقرر

المحاضرة

استراتيجيات (طرق) التقييم

بحث 10%

اختبار فصلي 10%

اختبار نهائي80%

المراجع :-

1 –الثقافة الإسلامية – الشيخ عبدالمجيد بن عزيز الزنداني– إدارة المطلوبات، جامعة الخرطوم

2 –الوسطية والاعتدال وأثرها على حياة المسلمين للشيخ صالح بن عبد العزيز آل الشيخ.

3 –الموافقات للإمام الشاطبي.

4 –مقاصد الشريعة للشيخ الطاهر بن عاشور.

اسم المقرر	رمز المقرر	عدد ساعات الاتصال		
		نظري	تطبيقات	المعتمدة
لغة عربية 11	HL1202	2	–	2

الهدف العام :-

ان يتعرف المتعلم مسائل في اللغة وآدابها لتوظيفها في استعمالاته اللُغوية، وتدريبه على بعض قواعد النحو الأساسية،وبعض قواعد الضبط الإملائي وتنمية مهارات الطلاب اللغوية من خلال (الاستماع،والكلام،والقراءة،والكتابة)

مخرجات التعلم (ما يتوقع من المتعلم اكتسابه بعد دراسة المقرر)

ان يطبق المتعلم مهارات اللغة العربية في شؤون حياته

مفردات المقرر (المحتوى – الموضوعات)

أولاً: التحرير العربي:

- ضوابط عامة حول التحرير والكتابة العربية .
- كتابة التلخيص (التعريف، والأهمية، والخطوات، والمبادئ، والتطبيق) .
- كتابة التقرير (التعريف، والأهمية، والأنواع " الإداري، والطبي، والهندسي "، والتطبيق).
- كتابة الرسالة (التعريف، والمقومات، والأنواع " الأدبية، والرسمية "، والتطبيق) .

ثانياً : التدريبات اللغوية :

- تدريبات على مهارات اللغة (السماع، والحديث، والقراءة، والكتابة) .
- تدريبات على استعمال قواعد اللغة، والمعاجم اللغوية .
- تدريبات على استعمال الهمزات وعلامات الترقيم .
- تدريبات على الأخطاءاللغوية الشائعة، وكيفية معالجتها.

توصيف المهام والتكاليف:

المهمة	الوصف	الاسبوع
بحثاختبار	موضوع في مفردات المقرر	الرابع
فصلي		السابع
اختبار نهائي		نهاية الفصل

استراتيجيات تدريس المقرر

المحاضرة (الكتروني)

استراتيجيات (طرق) التقييم

الكتروني

المراجع :-

1 –محمد عيد ،النحو المصفى، مكتبة الشباب، مصر، 2000 م.

2 –عبد العليم إبراهيم، الإملاء و الترقيم في الكتابة العربية، مكتبة غريب، القاهرة، 1995م.

اسم المقرر	رمز المقرر	عدد ساعات الاتصال		
		نظري	تطبيقات	المعتمدة
الدراسات السودانية	HL3107	2	-	2

الهدف العام :-

ان يتعرف المتعلم على القضايا الاجتماعية والسياسية والاقتصادية للمجتمع السوداني. . وتعميق الإحساس بالسودانية عند الطالب. وتقديم رؤية فكرية عن السودان بوصفه جزء من العالم العربي والأفريقي والإسلامي.

مخرجات التعلم (ما يتوقع من المتعلم اكتسابه بعد دراسة المقرر)

ان يناقش المتعلم في مكونات الثقافة السودانية.

مفردات المقرر (المحتوى – الموضوعات)

يشتمل المقرر علي الآتي:

البلاد وسكانها وعصورها التاريخية وتشمل الجغرافية الطبيعية والبشرية والحضارات السودانية (النوبة – المسيحية – الإسلام) العلاقات الدولية – المهدية والقومية السودانية – السودان والحكم الثنائي – الحركة الوطنية والاستقلال . الآداب والفنون – جمعيات القراءة والمناقشة – المجلات – أشهر الأدباء والفنانين – الفنون التشكيلية – الثقافة الشعبية السودانية والفلكلور السوداني (الأغاني – الأمثال الشعبية – الأحاجي). التعليم الأهلي (فلسفته – مؤسساته – بنيانه).

يستعان ببعض الشخصيات لمناقشة القضايا مع زيارة المعالم الوطنية والمتاحف ، كتابة بحوث ومقالات قصيرة بواسطة الطلاب.

توصيف المهام والتكاليف

المهمة	الوصف	الاسبوع
بحثاختبار	موضوع في مفردات المقرر	الرابع
فصلي		السابع
اختبار نهائي		نهاية الفصل

استراتيجيات تدريس المقرر

المحاضرة(الكتروني)

استراتيجيات (طرق) التقييم

الكتروني

المراجع :

1 –بروفيسور محمد عمر بشير ، دراسات سودانية معاصرة،

2 –معتصم محمد الحاج ،دراسات سودانية معاصرة ،

3 –زينب الزبير الطيب، الدراسات السودانية ،جامعة الخرطوم ،2010م

4 –أماني الطويل : مستقبل السودان : واقع التجزئة وفرص الحرب –المركز العربي للأبحاث ودراسة السياسات2011م

عدد ساعات الاتصال				
المعتمدة	تطبيقات	نظري	رمز المقرر	اسم المقرر
2	-	2	HL1104	English Language I

الهدف العام :-

This course aims to enable students to realize the basic skills of language.

مخرجات التعلم (ما يتوقع من المتعلم اكتسابه بعد دراسة المقرر)

After this course the student may able to read some simplified book or benefit the media the student also can practice speaking English to his /her teacher classmates or other English speakers.

مفردات المقرر (المحتوى– الموضوعات)

1. Family and family tree , vocabulary +exercise
2. Simple present +form and use +exercises
3. Vocabulary concern job and career +speaking (talking about your job and occupation).
4. Application letter writing +Drill
5. Exercise +5-Future simple tense
6. Conditional 0,1,2, and 3
7. Vocabulary of Nationalities , languages, countries and rigors
8. Simple past g) present continues.

متطلبات المقرر

Suitable classroom, microphone,chalk or marker

توصيف المهام والتكاليف

المهمة	الوصف	الاسبوع
تطبيقات	موضوع في مفردات المقرر	الرابع
ورقة بحثية		السابع
اختبار نهائي		نهاية الفصل

استراتيجيات تدريس المقرر

- Lecture
- Exercises and drills

استراتيجيات (طرق) التقييم

- Exercises and drills 10%
- Mid-term test 20%
- Final examination 70%

المراجع :-

1. C-E- Eckersley ,J-M-Eckersley,(1985), comprehensive English Grammar , Longman ,Hong Kong .
2. A-J-Thomson , A-V-Martinet, (1982) A practical English Grammar ,third edition ,Oxford University press ,Oxford.
3. Romand Murphy , Ronan Altman ,(1998) , Grammar in use- Reference and practice for intermediate students of English ,Cambridge University press, Cambridge.
4. Michael McCarthy,Felicity O'Dell ,(1998) , English Vocabulary in use, Cambridge university press ,Cambridge.
5. www. E now-com.
6. https //web-Facebook-com-Daily English Grammar.
7. www.Vdyautube.com.

اسم المقرر	رمز المقرر	عدد ساعات الاتصال		
		نظري	تطبيقات	المعتمدة
English Language II	HL1203	2	-	2

الهدف العام :-

This course aims to enable students to realize the basic skills of language.

مخرجات التعلم (ما يتوقع من المتعلم اكتسابه بعد دراسة المقرر)

After this course the student may able to read some simplified book or benefit the media the student also can practice speaking English to his /her teacher classmates or other English speakers.

مفردات المقرر (المحتوى – الموضوعات)

1. Vocabulary, Word used in grammar.-parts of speech; Noun, verb, adverb .prepositions and yet. For and since+Practices.
2. Present Perfect; Definition and useJust
3. Past PerfectTense; form and use +past participle form-Reported speech –direct and indirect speech +conditional3.
4. How to use preposition correctly; some tips in preposition in place expression and in time expression +Exercises.

متطلبات المقرر

Suitable classroom,microphone, chalk or marker

توصيف المهام والتكاليف

المهمة	الوصف	الاسبوع
سمنار	موضوع في مفردات المقرر	الرابع
ورقة بحثية		السابع
اختبار نهائي		نهاية الفصل

استراتيجيات تدريس المقرر

- Lecture
- Exercises and drills

استراتيجيات (طرق) التقييم

- Exercises and drills 10%
- Mid-term test 20%
- Final examination 70%

المراجع :-

1. C-E- Eckersley ,J-M-Eckersley,(1985), comprehensive English Grammar , Longman ,Hong Kong .
2. A-J-Thomson , A-V-Martinet, (1982) A practical English Grammar ,third edition ,Oxford University press ,Oxford.
3. Romand Murphy , Ronan Altman ,(1998) , Grammar in use- Reference and practice for intermediate students of English ,Cambridge University press, Cambridge.
4. Michael McCarthy ,Felicity O'Dell ,(1998) , English Vocabulary in use, Cambridge university press ,Cambridge.
5. www. E now-com
6. 6-https//web-Facebook-com-Daily English Grammarcom.
7. www.Vdyautube.com.