Mashreq University
Faculty of Engineering
Dept. of Biomedical Engineering

A Proposed Program for B.Sc. (Honors) In:

Biomedical Engineering

مقترح برنامج بكالوريوس العلوم (شرف) في:

الهندسة الطبية الحيوية

Designed by:

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1 Introduction

Biomedical Engineering involves and incorporates life sciences, engineering sciences, design, and manufacturing, 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 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, 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.

2 Justifications:

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

5. Rapid changes and development, in Medical technology, healthcare and academia workplace.

3 Program Objectives:

3.1 General objective:

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

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.

4 Admission requirements

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

5 Registration Procedures

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

6 Duration of the study

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

7 Program Structure

The program consists, normally ten semesters (15 weeks each). A total academic-load of (186) credit hours are offered. In addition to the (65) taught courses, three training modules, and a final year project is undertaken. The number of contact hours is (4275),(1890) hours allocated to lectures, (630) hours for tutorials, and (1755) hours for practical work, as shown in the Academic Courses Structure Plate.

8 Language of Instruction

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

9 Academic Evaluation

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

10 Degree Awarded

The University senate awards the candidate "**B.Sc. in Biomedical Engineering"** after passing all courses and scoring a CGPA of 3.00 or more and successfully completing the requirements of the Program.

11 Coding System

$C_1C_2C_3C_4C_5C_6$ → EM1101

C_1C_2 Field of study
C_3 Year of study
C_4 Semester (1 or 2)

C_5C_6 The serial number of the course (01, 02, 03,…….)

Component		Code
Basic Sciences	Mathematics	EM
	Basic Sciences	PH, CH
	Computer System	CS
Engineering Science	Electrical And Electronics Eng.	EE
	Mechanical Eng	ME
	General Engineering	GE
Social and Human Sciences	Economics & Admin.	AD
	Studies & Languages	AR, IS, EN
Engineering Design and Applied	Project	PR
	Biomedical Engineering	BME

12 Plate of academic course structure

1st Year:

Semester one								
S/N	Course Code	Course Title	Hours/ Week			Contact Hrs.	Exam Hrs.	Cr.H
			L	TUT	PRA			
1	EM1101	Calculus -1 الحسبان 1	2	2	0	4	3	3
2	SD1102	Sudanese Studies الدراسات السودانية	2	0	0	2	2	2
3	PH1103	General Physics الفيزياء العامة	2	0	3	5	3	3
4	CH1104	General Chemistry الكيمياء العامة	2	0	3	5	3	3
5	CS1105	Introduction to Computer مبادئ الحاسوب	1	0	3	4	2	2
6	AR1106	Arabic Language -1 لغة عربية1	2	2	0	4	2	3
7	EN1107	English Language -1 لغة انجليزية1	2	2	0	4	2	3
8	IS1108	Islamic Culture-1 ثقافة سودانية1	2	2	0	4	2	3
Total			15	8	9	32		22

Semester Two								
S/N	Course Code	Course Title	Hours/ Week			Contact Hrs.	Exam Hrs.	Cr.H
			L	TUT	PRA			
1	EM1201	Calculus -2 حسبان 2	2	2	0	4	3	3
2	ME1202	Engineering Drawing رسم هندسي	1	0	3	4	3	2
3	CS1203	Computer Programming لغة برمجة	2	0	3	5	3	3
4	EM1204	Engineering Algebra هندسة الجبر	2	2	0	4	3	3
5	AR1205	Arabic Language -2 لغة عربية2	2	2	0	4	2	3
6	EN1206	English Language -2 لغة انجليزية 2	2	2	0	4	2	3
7	IS1207	Islamic Culture -2 ثقافة اسلامية2	2	2	0	4	2	3
Total			13	10	6	29		20

Basic Training (**Practical Duration→ 6 weeks)**					
WS1208	Basic Training التدريب الاساسي	-	-	-	**150**

2nd Year:

Semester Three								
S/N	Course Code	Course Title	Hours/ Week			Contact Hrs.	Exam Hrs.	Cr.H
			L	TUT	PRA			
1	EM2101	Differential Equations معادلات تفاضلية	2	2	0	4	3	3
2	EM2102	Complex Analysis تحليل مركب	2	2	0	4	3	3
3	CH2103	Principles of Biochemistry مبادئ الكيمياء الحيوية	2	0	3	5	3	3
4	ME2104	Principles of Mechanical Engineering مبادئ الهندسة الميكانيكة	2	0	0	2	2	2
5	BME2105	Anatomy and Physiology التشريح ووظائف الاعضاء	2	0	3	4	3	3
6	EE2106	Electrical Circuits Analysis – 1 تحليل الدوائر الكهربائية1	2	2	0	4	3	3
7	WS2107	Engineering Workshops ورش هندسية	0	0	6	6	2	2
Total			12	6	12	29		19

Semester Four								
S/N	Course Code	Course Title	Hours/ Week			Contact Hrs.	Exam Hrs.	Cr.H
			L	TUT	PRA			
1	EM2201	Mathematical Methods طرق رياضية	2	2	0	4	3	3
2	EM2202	Probability and Bio-Statistics الاحتمالات والاحصاء الحيوية	2	2	0	4	2	3
3	PH2203	Biophysics الفيزياء الحيوية	2	0	0	2	2	2
4	EE2204	Digital Circuits Design – 1 تصميم الدوائر الرقمية1	2	0	3	5	3	3
5	EE2205	Semiconductors and Electronics' Devices أشباه الموصلات والاجهزة الالكترونية	2	0	3	5	3	3
6	EE2206	Electrical Circuits Analysis -2 تحليل الدوائر الكهربائية2	2	2	0	4	3	3
7	PH2207	Nuclear Physics فيزياء نووية	2	0	0	2	2	2
8	BME2208	Biomaterials المواد الحيوية الطبية	2	0	0	2	2	2
Total			16	6	6	28		21

Advance Training (**Practical Duration→ 6 weeks)**						
WS2209	Advance Training	تدريب متقدم	3	-	-	150

3rd Year:

Semester Five								
S/N	Course Code	Course Title	Hours/ Week			Contact Hrs.	Exam Hrs.	Cr.H
			L	TUT	PRA			
1	CS3101	Advanced Computer Programming لغة برمجة متقدمة	2	0	3	5	3	3
2	EE3102	Measurements and Instrumentations القياسات والاجهزة	2	0	0	2	2	2
3	EE3103	Electromagnetic Theory نظرية المجالات الكهرومغناطيسية	2	2	0	4	3	3
4	EE3104	Digital Circuits Design -2 تصميم الدوائر الرقمية2	2	0	3	5	3	3
5	EE3105	Analog Circuits الدوائر الالكترونية	2	0	3	5	3	3
6	EE3106	Signals and Systems اشارات ونظم	2	2	0	4	3	3
7	BME3107	Biomechanics الميكانيكا الحيوية	2	0	0	2	2	2
Total			14	4	9	27		19

Semester Six								
S/N	Course Code	Course Title	Hours/ Week			Contact Hrs.	Exam Hrs.	Cr.H
			L	TUT	PRA			
1	EM3201	Numerical Analysis تحليل عددي	2	2	0	4	3	3
2	EE3202	Biosignal Processing معالجة الاشارة الحيوية	2	2	3	7	3	4
3	BME3203	Biosensors المتحسسات الحيوية	2	0	3	5	3	3
4	EE3204	Control Systems انظمة تحكم	2	2	0	4	3	3
5	EE3205	Power Electronics الكترونيات القدرة	2	0	3	5	3	3
6	EE3206	Microprocessors and Assembly Language المعالجات الدقيقة ولغة التجميع	2	0	3	5	3	3
7	BME3207	Medical Measurements and Monitoring Systems أنظمة القياسات وأنظمة المراقبة	2	0	3	5	3	3
Total			14	6	15	35		22

4th Year:

Semester Seven								
S/N	Course Code	Course Title	Hours/ Week			Contact Hrs.	Exam Hrs.	Cr.H
			L	TUT	PRA			
1	BME4101	Medical-Field Training -1 تدريب طبي-1	0	0	6	6	1	2
2	BME4102	Medical Laboratory Equipment اجهزة المعامل الطبية	2	0	3	5	3	3
3	BME4103	Medical Device Interfacing ربط الاجهزة الطبية	2	0	3	5	3	3
4	BME4104	Modeling of Physiological Systems نمذجة الانظمة البيلوجية	2	2	0	4	3	3
5	BME4105	Medical Safety and Environment Protection السلامة الطبية والحماية البيئية	2	0	0	2	2	2
6	BME4106	Rehabilitation and Artificial Organs الاعضاء الاصطناعية والتأهيل	2	0	0	2	2	2
7	BME4107	Medical Photonics الضوئيات الطبية	2	0	0	2	2	2
Total			12	2	12	26		17

Semester Eight								
S/N	Course Code	Course Title	Hours/ Week			Contact Hrs.	Exam Hrs.	Cr.H
			L	TUT	PRA			
1	BME4201	Ionizing Medical Imaging Systems انظمة التصوير المؤين	2	0	3	5	3	3
2	BME4202	Medical Image Processing معالجة الصورة الطبية	2	0	3	5	3	3
3	EE4203	PLDs and Microcontrollers الاجهزة القابلة للبرمجة والمتحكمات	2	0	3	5	3	3
4	BME4204	Selected Medical Equipment اجهزة طبية مختارة	2	0	3	5	2	3
5	GE4205	Research Methodology مناهج البحث	2	0	0	2	2	2
6	CS4206	Artificial Intelligence and Neural Networks الذكاء الاصطناعي والشبكات العصبية	2	0	3	5	3	3
Total			12	0	15	27		17

5th Year:

Semester Nine								
S/N	Course Code	Course Title	Hours/ Week			Contact Hrs.	Exam Hrs.	Cr.H
			L	TUT	PRA			
1	BME5101	Medical-Field Training -2 تدريب طبي-2	0	0	6	6	1	2
2	BME5102	Non-Ionizing Medical Imaging Systems انظمة التصوير المؤين	2	0	3	5	2	3
3	EE5103	Nano Technology and Engineering تكنولوجيا النانو والهندسة	2	0	0	2	2	2
4	BME5104	Bioinformatics المعلوماتية الحيوية	2	0	3	5	2	3
5	PR5205	Graduation Project -1 مشروع التخرج 1	0	0	6	6	1	2
6	AD5106	Industrial Management ادرأه صناعية	2	0	0	2	2	2
7	BME5107	Hospital Information Systems الانظمة التقنية بالمستشفيات	2	0	3	5	3	3
Total			10	0	21	31		17

Semester Ten								
S/N	Course Code	Course Title	Hours/ Week			Contact Hrs.	Exam Hrs.	Cr.H
			L	TUT	PRA			
1	AD5201	Engineering Economics اقتصاد هندسي	2	0	0	2	2	2
2	GE5202	Engineering Ethics اخلاقيات الهندسة	1	0	0	1	1	1
3	BME5203	Elective Course مقرر اختياري	2	0	0	2	2	2
4	PR5205	Graduation Project -2 مشروع التخرج2	0	0	12	12	2	4
5	BME5204	Clinical Engineering الهندسة السريرية	2	0	0	2	2	2
6	BME5205	Quality Assurance & Reliability ضمان الجودة والموثوقية	2	0	0	2	2	2
Total			9	0	12	21		13

Elective Courses:

1. Telemedicine
2. Real time Embedded Systems
3. Tissue Engineering
4. Biological Transport

13. Subjects Distribution:-

Semester	No. of Subjects	Lectures	Tutorials	Practical	Contacts Hrs.	Cr. Hrs.
One	**8**	**15**	**8**	**9**	**32**	**22**
Two	**7**	**13**	**10**	**6**	**29**	**20**
Three	**7**	**12**	**6**	**12**	**29**	**19**
Four	**8**	**16**	**6**	**6**	**28**	**21**
Five	**7**	**14**	**4**	**9**	**27**	**19**
Six	**7**	**14**	**6**	**15**	**35**	**22**
Seven	**7**	**12**	**2**	**12**	**26**	**17**
Eight	**6**	**12**	**0**	**15**	**27**	**17**
Nine	**7**	**10**	**0**	**21**	**31**	**17**
Ten	**6**	**9**	**0**	**12**	**21**	**13**
Total	**70**	**127**	**42**	**117**	**285**	**187**

14. Subjects Categories

Category	No. of Subjects	Cr. Hrs.	Percentage	Engineering Council
Humanities	9	24	13%	10% - 15%
Basic pure Sciences	16	46	25%	25% - 30%
Engineering Sciences	22	58	31%	25% - 35%
Specialization Sciences	23	59	31%	25% - 25%
	70	187	100%	

Category	No.	Subject
Humanities	1	*Arabic Language -1*
	2	*English Language -1*
	3	*Islamic Culture-1*
	4	*Sudanese Studies*
	5	*Arabic Language -2*
	6	*English Language -2*
	7	*Islamic Culture -2*
	8	*Industrial Management*
	9	*Engineering Economics*

Category	No.	Subject
Basic pure Sciences	**1**	*Introduction to Computer*
	2	*Calculus -1*
	3	*General Physics*
	4	*General Chemistry*
	5	*Calculus -2*
	6	*Engineering Algebra*
	7	*Computer Programming*
	8	*Complex Analysis*
	9	*Differential Equations*
	10	*Probability and Bio-Statistics*
	11	*Mathematical Methods*
	12	*Advanced Computer Programming*
	13	*Numerical Analysis*
	14	*Principles of Biochemistry*
	16	*Electromagnetic Theory*
	17	*Nuclear Physics*

Engineering Sciences	**1**	*Engineering Drawing*
	2	*Electrical Circuits Analysis - 1*
	3	*Principles of Mechanical Engineering*
	4	*Engineering Workshops*
	5	*Semiconductors and Electronics' Devices*
	6	*Digital Circuits - 1*
	7	*Electrical Circuits Analysis -2*
	8	*Signals and Systems*
	9	*Analog Circuits*
	10	*Digital Circuits -2*
	11	*Nano Technology and Engineering*
	12	*Measurements and Instrumentation*
	13	*Medical Device Interfacing*
	14	*Control Systems*
	15	*Power Electronics*
	16	*Microprocessors and Assembly Language*
	17	*PLDs and Microcontrollers*
	18	*Research Methodology*
	19	*Artificial Intelligence and Neural Networks*
	20	*Engineering Ethics*
	21	*Graduation Project -1*
	22	*Graduation Project -2*

Specialization (Application) Sciences	1	Anatomy and Physiology
	2	Biophysics
	3	Biosignal Processing
	4	Biomaterials
	5	Biosensors
	6	Biomechanics
	7	Medical-Field Training -1
	8	Medical Measurements and Monitoring Systems
	9	Medical Laboratory Equipment
	10	Modeling of Physiological Systems
	11	Medical Safety and Environment Protection
	12	Rehabilitation and Artificial Organs
	13	Medical Photonics
	14	Medical Image Processing
	15	Selected Medical Equipment
	16	Medical-Field Training -2
	17	Ionizing Medical Imaging Systems
	18	Non-Ionizing Medical Imaging Systems
	19	Bioinformatics
	20	Hospital Information Systems
	21	Elective Course
	22	Quality Assurance & Reliability

15. Courses Description

Course Title	**EM1101 Calculus 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 • 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	SD1102 Sudanese Studies
Level /Semester	1/1
Credit Hours	2
Pre-requisite(s)	لايوجد
Objective(s)	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.
Course Contents	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.
Teaching Method	المحاضرة(الكتروني)
Evaluation	بحث 10% اختبار فصلي 10% اختبار نهائي80% (الكتروني)
Reference(s)	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

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	Physics and Measurements ,Physical Quantity, Derived quantities, Dimensional Analysis, Vector and Scalar, Properties of Vectors, Vector addition and subtraction, ,Components of a vector, ,The scalar and vector product, Kinematics Description of Motion, The position and the displacement vector, The average and Instantaneous velocity, The average and Instantaneous acceleration, One-dimensional motion with constant acceleration and its Application, Free Fall, Motion in Uniform Circular Motion, The law of motion, The concept of force, Newton's laws of motion, Newton's first and second law, Newton's third law, Weight and tension, Work and Energy, heat.
Teaching Method	• 30 hours for lectures. • 15 hours for tutorial. • 30 Laboratory hours.
Evaluation	• Mid-Term Test (20%) • Final exam. (50%) • Lab. Practice (30%) Or As recommended by the Instructor
Reference(s)	1. **"Physics for Scientists and Engineers",** 9th Edition , by Raymond A. Serway, 2013

Course Title	CS1105 Introduction to Computer
Level /Semester	1/1
Credit Hours	3
Pre-requisite(s)	None
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	The course is organized into six modules. History of computing systems, modern computers, introduction to modern computer system. Introduction of how computer work: basic of computer architecture. Introduction to operating system. Introduction to problem solving, algorithm and programming. Introduction to network, internet and World Wide Web. Social aspect of computers and information technology
Teaching Method	This course has two parts, theory and practice. The theory could be taught in 30 contact hours making use of computer slides to assist in describing many topics. 30 hours as minimum of practice should be provided to cover the commands as DOS commands, and GUI. MS-office package should be practiced especially word processing and spreadsheets
Evaluation	• Homework and assignments (15%) • Lab Practice (25%) • Final Exam (60%) The percentages could be changed according to the instructor recommendation. **Computer Laboratory:** Two hours per week for subject CS1105
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	**AR1106 1- لغة عربية**
Level /Semester	1/1
Credit Hours	2
Pre-requisite(s)	لايوجد
Objective(s)	ان يتعرف المتعلم مسائل في اللغة وآدابها لتوظيفها في استعمالاته اللّغوية ، وتدريبه على بعض قواعد النحو الأساسية، وبعض قواعد الضبط الإملائي وتنمية مهارات الطلاب اللغوية من خلال (الاستماع،والكلام،والقراءة،والكتابة).
Course Contents	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 وأحكـامه (صياغته، وإعرابه) . 2. المعاجم العربية (التعريف، والأهمية، والأنواع، وطريقة الاستخدام) .
Teaching Method	المحاضرة (الكتروني)
Evaluation	بحث 10% اختبار فصلي 10% اختبار نهائي80% (الكتروني)
Reference(s)	1 - النحو الجامعي، محمـــد 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.

Course Title	**EN 1107 English Language I**
Level /Semester	1/1
Credit Hours	2
Pre-requisite(s)	None.
Objective(s)	This course aims to enable students to realize the basic skills of language.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.
Course Contents	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.
Teaching Method	- Lecture Exercises and drills
Evaluation	- Exercises and drills 10% - Mid-term test 20% - Final examination 70% (Electronic)
Reference(s)	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.

Course Title	IS1108: 1- الثقافة الاسلامية
Level /Semester	1/1
Credit Hours	2
Pre-requisite(s)	لا يوجد
Objective(s)	ان يتعرف المتعلم على مفهوم الثقافة الإسلامية ، مصادرها ، خصائصها. ،عناصر الثقافة الاسلامية وآثارها في الفرد والمجتمع، مفهوم العبادة في الإسلام.
Course Contents	– 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).
Teaching Method	المحاضرة (الكتروني)
Evaluation	بحث 10% اختبار فصلي 10% اختبار نهائي80% (الكتروني)
Reference(s)	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.

Course Title	**EM1201 Calculus II:**
Level /Semester	1/2
Credit Hours	3
Pre-requisite(s)	Calculus-I
Objective(s)	The objectives of this course as follow: - Study integration technique - Understanding partial derivative - Using vector caraculs
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. • 16 hours for tutorial. • 10 office hours available for revision.
Evaluation	• Class Assignments (20%) • Mid-Term Test (20%) • Final exam. (60%) • Or As recommended by the Lecturer.
Reference(s)	1. Advanced Engineering Mathematical, by alan Jeffrey, 1 edition (June 27, 2001) 2. Engineering Mathematical, by K.A. Stroud , 2007 3. Earl W. Swokowski, “Calculus”, 6 edition

Course Title	**ME1202 Engineering Drawing**
Level /Semester	2/4
Credit Hours	3
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	Engineering drawing introduction, types of lines, size of drawing papers, layouts of drawing sheets, graphics instruments, scales, geometrical construction, orthographic projection, sectioning, dimensioning, pictorial drawing, conventions. Descriptive geometry locus of a point, Mange's projection, straight line (particular positions), the plane, auxiliary planes, the positional problems, projection of circle, curved surfaces, intersection of surfaces of revolution, perspective projection.
Teaching Method	• Not less than 10 hours for the theory of descriptive geometry. • 5 hours drawing principles. • 15 hours for computer aided drawing practice. Not less than 15 hours in free hand drawing
Evaluation	As recommended by the instructor
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	CS1203 Computer Programming
Level /Semester	1/2
Credit Hours	3
Pre-requisite(s)	Introduction to Computer
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	Attendance of 30 contact hours should be a part of the student grade. Slides presentations are used to explain course materials
Evaluation	• Homework (5%) • Midterm Exam (10%) • Practice lab (25%) • Final Exam (60%) **Computer Laboratory:** Two hours per week for subject CS1203
Reference(s)	1. Object oriented programming using C++, Robett Lafore **,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	**EM1204 Engineering Algebra**
Level /Semester	1/2
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.
Teaching Method	• 30 hours for lectures. • 30 hours for tutorial. • 10 office hours available for revision.
Evaluation	• Class Assignments (20%) • Mid-Term Test (20%) • Final exam. (60%) Or As recommended by the Lecturer.
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

Course Title	AR1205 11 لغة عربية
Level /Semester	1/2
Credit Hours	2
Pre-requisite(s)	**لغة عربية 1**
Objective(s)	ان يطبق المتعلم مهارات اللغة العربية في شؤون حياته
Course Contents	أولاً: التحريـر العـربي: – ضوابط عـامة حول التحريـر والكتـابة العربيـة . – كتابة التلخيص (التعريف، والأهمية، والخطوات، والمبادئ، والتطبيق) . – كتابة التقـرير (التعريف، والأهمية، والأنواع " الإداري، والطبي، والهندسي "، والتطبيق). – كتابة الرسـالة (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.
Teaching Method	المحاضرة (الكتروني)
Evaluation	بحث 10% اختبار فصلي 10% اختبار نهائي80% (الكتروني)
Reference(s)	1 - محمد عيد ،النحو المصفى، مكتبة الشباب، مصر، 2000 م. 2 - عبد العليم إبراهيم، الإملاء و الترقيم في الكتابة العربية، مكتبة غريب، القاهرة، 1995م.

Course Title	**EN 1206 English Language II**
Level /Semester	1/2
Credit Hours	2
Pre-requisite(s)	English Language-I
Objective(s)	This course aims to enable students to realize the basic skills of language. 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.
Course Contents	1. Vocabulary, Word used in grammar.-parts of speech; Noun, verb, adverb .prepositions and yet. For and since +Practices. 2. Present Perfect; Definition and use Just 3. Past Perfect Tense; 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.
Teaching Method	- Lecture - Exercises and drills
Evaluation	- Exercises and drills 10% - Mid-term test 20% - Final examination 70% (Electronic)
Reference(s)	1. C-E- Eckersley ,J-M-Eckersley,(1985), comprehensive English 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.

Course Title	**الثقافة الاسلامية IS1207 11**
Level /Semester	1/2
Credit Hours	2
Pre-requisite(s)	**الثقافة الاسلامية 1**
Objective(s)	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.
Course Contents	**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
Teaching Method	المحاضرة (الكتروني)
Evaluation	بحث 10% اختبار فصلي 10% اختبار نهائي80% (الكتروني)
Reference(s)	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.

Course Title	**WS1208 Basic Training**
Level /Semester	1/2
Credit Hours	-
Pre-requisite(s)	**None.**
Objective(s)	To familiarize with 1. The basics of tools and equipment's 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	The process of teaching method depends on the trainer in the workshop.
Evaluation	-
Reference(s)	1. Gopal, T.V., Kumar, T., and Murali, G., "A first course on workshop practice – Theory, practice and work 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	**EM2101 Differential Equations**
Level /Semester	2/3
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 of lectures on differential equations, in which famous differential equations are modeled, especially the wave equations. • At least 16 hours of tutorials on solving differential equations
Evaluation	• Class Assignments (20%) • Mid-Term Test (20%) • Final exam. (60%) Or as recommended by the Lecturer
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, 7th edd.

Course Title	**EM 2102 Complex Analysis**
Level /Semester	2/3
Credit Hours	3
Pre-requisite(s)	Calculus I, II
Objective(s)	The aim of the course is to provide the student with a reliable grasp of the results and techniques of the properties of complex analytic functions, with some mathematics majors and joint majors
Course Contents	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. Complex differentiation and the Cauchy-Riemann equations. Infinite series. Convergence and uniform convergence. Line integral of a complex function Cauchy integral formula. Liouville's theorem. Taylor's and Laurent's expansions. Singular points. Residue, Cauchy's residue theorem
Teaching Method	• It is a lecture based course, so at least 30 hours should be covered. • Complex Variables course consists of a study of the properties of complex analytic functions, thus complex the properties should be clarified and wealth examples must be given. • 15 hours of tutorial must be set to cover the examples and exercises.
Evaluation	• Class Assignments (20%) • Mid-Term Test (20%) • Final exam. (60%) Or As recommended by the Lecturer.
Reference(s)	1- Complex variables and application 7th ed. By James word Brown/Ruel V.charchiodl 2- Advance Engineering mathematical by alan Jelfey.

Course Title	**CH2103 Principles of Biochemistry**
Level /Semester	2/3
Credit Hours	3
Pre-requisite(s)	**Biophysics, General Chemistry**
Objective(s)	To understand the basic cell structure, cell physiology & biochemistry of cell contents to apply this knowledge to the workings of tissues & organ-systems.
Course Contents	The cell and its components. The plasma membrane transport (diffusion Process active transport systems, ion channels and gates. Mitochondrial function (ATP generation, metabolism). The nervous system. The nerve cells-neurons, glia. Functions and geometry including myelinations, giant neurons, dendrites, synapses. Summary of brain anatomy and function. The resting potential-ionic, distribution, Na^+ K^+ pump. Generation of an action potential (Na^+, k^+ channels, hyper- polarization, depolarization,) threshold potential, signal transduction. Muscle structure and the mechanism of muscle contraction interaction between Ca^{2+} and actin/ myosin, Ca^{2+} pump.
Teaching Method	30 contact hours of lectures, and 15 tutorial hours are recommended.
Evaluation	• Attendance 5%, Assignments 10%, Laboratory 15%, Midterm 20%, and Final 50%.
Reference(s)	1.New Directions in Solid State Chemistry, J. Gopalakrishnan, 1989 2.Soil Chemistry & Its Applications, Ken Killham, 1993 3.Chemistry in the Modern World, Frank L. Wiseman,1985

Course Name	ME2104 Principles of Mechanical Engineering
Prerequisites	None
Level /semester	2/3
Course Objectives	- 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, **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 Efficiencies.
References	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	**BME 2105 Anatomy and Physiology**
Level /Semester	2/3
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	EE2106 Electrical Circuits Analysis I
Level /Semester	2/3
Credit Hours	3
Pre-requisite(s)	Complex Analysis
Objective(s)	• Ability to apply basic laws to resistive circuits. • Ability to perform mesh and nodal analysis. • Ability to apply circuit theorems • Ability to analyze first-order circuits.
Course Contents	Basic circuit laws, Ohm's Law, Nodes, Branches and Loops, Kirchoff's Laws, Series and Parallel Resistor Networks , Voltage and Current Dividers, Wye-Delta Transformations, Circuit Analysis: Linear Equations , Nodal Analysis, Super Nodes, Mesh Analysis, Super Meshes. Circuit Theorems: Linearity, Superposition , Source Transformations , Thevenin and Norton's Theorems, Maximum Power Transfer.
Teaching Method	• Lectures will be aided by slide shows. • Examples and problems will be solved at lectures and tutorial hours. • 30 contact hours and 15 tutorial hours are recommended
Evaluation	• Homework and assignments (15%) • Lab Practice (25%) • Final Exam (60%) The percentages could be changed according to the instructor recommendation
Reference(s)	1. Fundamentals Of Electrical Engineering, By Giorgio Rizzoni, 2009

Course Title	EM2201 Mathematical Methods
Level /Semester	2/4
Credit Hours	3
Pre-requisite(s)	None.
Objective(s)	• To study transforms used in many engineering topics.
Course Contents	Fourier Series, Even and odd functions, Convergence, Fourier transforms, Delta- Functions, Parseval's Theorem, Convolution theorem, Laplace transform, Applications of integral transforms: Wave Equation (Fourier Transform), LCR circuit (Laplace Transform), Bessel's Equation for n=0 (Laplace Transform).
Teaching Method	• The instructor should focus on depth of understanding rather than breadth of coverage, and subsequent courses will assume that students have seen induction, Boolean Algebra, and set theory in this course. • 30 hours for lectures. • 20 Tutorial hours.
Evaluation	• Class Assignments (20%) • Mid-Term Test (20%) • Final exam. (60%) Or As recommended by the
Reference(s)	1. Advanced Engineering Mathematical, by alan Jeffrey, 1 edition (June 27, 2001) 2. Engineering Mathematical, by K.A. Stroud , 2007

Course Title	**EM 3101 Probability & Bio-Statistics**
Level /Semester	3/5
Credit Hours	3
Pre-requisite(s)	Calculus-I, II
Objective(s)	• To understand standards of statistics in modern society. • To apply the rules of probability especially in engineering fields.
Course Contents	Measure of central tendency and measure of dispersion. **Correlation & regression:** Correlation between two variables (Pearson-spearman), Contingency tables (nominal variable), Simple linear regression, Time series analysis. **Probability theorems:** Fundamentals of the basic theory of probability, Sample spaces, events, basic axioms, Set theory and a set of axioms for probability, Condition probability. **Random variables:** Random variables (type-expected-variance), Probability density functions (pdf), Continuous distribution (normal distribution), Discrete distribution (binomial distribution-poisson distribution). **Estimation and hypothesis testing:** t-student distribution , f-distribution and Simple analysis of variance.
Teaching Method	• There are a wealth of examples in the text books, so the instructor has to present only some of them. • Tutorial hours must be held to solve different problems
Evaluation	• Homework • Mid-Term test • Final Exam As recommended by the Instructor
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	**Biophysics**
Level /Semester	2/4
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. B. Energy, Entropy, Free energy C. Activation energy & transition states D. Hydrophobic effect E. Statistical mechanics F. 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	EC2204 Digital Circuit Design I
Level /Semester	2/4
Credit Hours	3
Pre-requisite(s)	Discrete Mathematics.
Objective(s)	This course aims to study combinational logic circuits and their applications as a part of computer and other 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.
Teaching Method	• 15 Lectures to cover the topics. • 10 Lab sessions to practice different combinational circuits. • Slide show will be used in lectures. Digital simulators are used especially to check the circuit output.
Evaluation	• Practice 25%. • Midterm 15%, • and Final Exam 60%.
Reference(s)	1. Ramakant A.Gayakward, Op-amps and Linear Integrated Circuits, IV edition, Pearson Education, 2003 / PHI. 2. D.Roy Choudhary, 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	**EE2205 Semiconductors and Electronics' Devices**
Level /Semester	2/4
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	**EE2206 Electric Circuits Analysis II**
Level /Semester	2/4
Credit Hours	3
Pre-requisite(s)	Electric Circuits Analysis I
Objective(s)	Electric circuit II is a second course on electric circuits. It is intended both to enhance the knowledge of students with regard to electric circuits and to develop skills in analysis. Although the focus is electric circuits, the theory and skills learned are useful in other areas as well.
Course Contents	Frequency Response, Filters, and Resonance: Frequency response. High-pass and low-pass networks. Half-power frequencies. Frequency response from pole-zero locations and Bode plots. Band pass filters and resonance. Natural frequency and damping ratio. RLC series circuit; series resonance. Quality factor. RLC parallel circuit; parallel resonance. Practical LC parallel circuit. Series-parallel conversions. Locus diagrams. Mutual Inductance and Transformers. Mutual inductance. Coupling coefficient. Analysis of coupled coils. AC Power: Power in time domain. Power in sinusoidal steady state. Average or real power. Reactive power. Summary of AC power in R, L, and C. Exchange of energy between an inductor and a capacitor. Complex power, apparent power, and power triangle. Parallel-connected networks. Power factor improvement. Maximum power transfer.
Teaching Method	• 30 contact hours and 15 tutorial hours are recommended.
Evaluation	• Attendance 5%, Assignments 10%, Laboratory 15%, Midterm 20%, and Final 50%. Electrical Circuits II Lab for subject EE2206
Reference(s)	1. Fundamentals Of Electrical Engineering, By Giorgio Rizzoni, 2009

Course Title	**PH2207 Nuclear Physics**
Level /Semester	2/4
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, dosimetry 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, Radiation Measurements, and dosimeters 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	**BME2208 Biomaterials**
Level /Semester	2/4
Credit Hours	2
Pre-requisite(s)	None
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
Course Contents	*B*asic 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.
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.

Course Title	**CS3101 Advanced Computer Programming**
Level /Semester	3/5
Credit Hours	3
Pre-requisite(s)	**Computer Programming**
Objective(s)	The goal of this course is to introduce and study key concepts related to computer programming for scientific and engineering applications. The use of current operating and compilers (e.g. gcc) will also be presented. Object Oriented Programming will also be discussed. The differences and similarities between Java and C++ will also be discussed. Hands-on programming will be a key part of the course.

Course Contents	• Introduction
	  ○ Computers available for this course
	  ○ The History of Computing
	  ○ The Future of Computing
	  ○ Trends in Programming Languages
	• Linux, Windows
	• Utilities: vi, emacs, dbx, make, cvs, and IDE's
	• Brief Introduction to Software Engineering
	• C++ : Intro to C++ , Basics , Control and Arrays , Pointers Structures, Classes, and Objects , Operator Overloading , Input / Output , Templates
	  ○ File Operations , Opening a File, Reading a File, Closing a File, Text, Modes, Binary Modes, File Functions, and Command Line Arguments, C++ vs. Java
	• Brief Discussion of Java, C#, and Objective-C.
	• Parallel Computing :MPI , OpenMP , Threads
	• Python

Teaching Method	Consist of lectures: two hour per week, and practicle: 3 hour per week.
Evaluation	Class Assignments, Lab experiments, Mid-Term Test and Final exam.
Reference(s)	1. An Introduction To Programming With c+ +, Diane Zak, 1749. 2. Starting Out with C++ Early Objects, 7th Edition,Gaddis, Walters, Muganda, Addison Wesley, ISBN-13. 3. "C++ and Object-Oriented Numeric Computing", by D. Yang. 4. The C Programming Language," by Kernighan and Ritchie

Course Title	EC3102 Measurements & Instrumentation
Level /Semester	3/5
Credit Hours	2
Pre-requisite(s)	Electric Circuits Analysis I, Semiconductors and Electronics Devices
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
Course Contents	Measurement concept. SI units. Measurement statistics. Errors in measurement, causes and minimization. Accuracy and precision. Measurement of electrical quantities. Transducers types and applications. Measurement instruments. Galvanometer. Moving iron and coil instruments. Digital instruments. CRT theory and operation. Bridges: Whetstone's, Desauty's, Maxwell's, Anderson, Schering, HAY'S
Teaching Method	15 x 2 hours Lectures, in which multimedia projector is used in presenting many topics. 10 x 3 Lab hours to practice measurement experiments. Students attendance should be essential and not less than 75% of the total sessions time.
Evaluation	• Practice 25% • Midterm 15% • Final Exam 60%. Any other percentages recommended by the instructor could be taken
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 and Kenneth G. McConnell, 1993 3. Measurement and Instrumentation in Engineering: Principles and Basic Laboratory Experiments: Francis S. Tse and Ivan E. Morse, 1989

Course Title	**EE3103 Electromagnetic Theory**
Level /Semester	3/5
Credit Hours	3
Pre-requisite(s)	**Differential Equations**
Objective(s)	To provide a fundamental understanding of the concept of electromagnetic fields theory with emphasis on the application in biomedical fields.
Course Contents	Vector analysis, Coulomb's law and electric field intensity, Gauss's law and divergence, electric potential and potential gradient, Conductors, dielectrics and capacitance, electric dipoles Energy in electric field, method of images, steady electric current and its magnetic forces, materials and inductance, magnetic storage data, time changing electric and magnetic fields, Maxwell's equations, Poying vector and energy relations, wave motion in free space, dielectrics and conduction media, reflection and transmission of plane waves. Electromagnetic theory of transmission lines, guided waves, rectangular and circular wave guides. Electrostatic field, electric dipole, Multipoles, Magnetostatic field, magnetic dipole, EM waves – wave equations, EM waves – polarization, EM waves – eigenmodes, Geometrical optics, Physical optics, Radiation – dipole, Radiation – quadrupole, magnetic dipole, Radiation – damping, Radiation – scattering, Electrostatics of conductors, Dielectrics, Steady current, Magnetostatics, Ferromagnetism, Superconductivity, Magneto hydrodynamics, and Dispersion of EM waves.
Teaching Method	Consist of lectures: two hour per week, and tutorials: two hour per week.
Evaluation	Class Assignments, Mid-Term Test and Final exam.
Reference(s)	1. Staelin, David, Ann Morgenthaler, and Jin Au Kong. *Electromagnetic Waves.* Upper Saddle River, NJ: Prentice Hall, 1994. ISBN: 9780132258715. 2. Landau, Lifshitz, "Classical Theory of fields"

Course Title	**EE3104 Digital Circuits Design II**
Level /Semester	3/5
Credit Hours	3
Pre-requisite(s)	Digital Circuits Design I
Objective(s)	• To study and Design Sequential Logic circuits. • To link these designs with applicable electronic circuits.
Course Contents	Sequential and combinational circuits comparison. Multi-vibrators circuit operation. RS Flip Flop, T FF, D FF, and JK Flip Flop. Serial and parallel Shift Register. Counters, Asynch and Synch Counters, Decade counters, different Mod Counters.
Teaching Method	• Not less than 30 contact hours to explain the course topics. • Digital simulator slide show will be used to describe the operation of sequential digital devices. • Lab experiments will be set do practice the operation of different digital sequential circuits.
Evaluation	Preferably follow the same assessment of the previous course which includes: • Practice 25%. Midterm 15%, • Final Exam 60%. The instructor can suggest his own assessment which will considered if no big departure from recommended assessment occurs. **Digital II Lab for subject EC3104**
Reference(s)	1. Ramakant A.Gayakward, Op-amps and Linear Integrated Circuits, IV edition, Pearson Education, 2003 / PHI. 2. D.Roy Choudhary, 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	**EE3105 Analog Circuits**
Level /Semester	3/5
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 operational amplifiers (Op-Amps).
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 Op-amp operation modes. Op-amp characteristics, baising circuit, Op-amop Linear and Nonlinear characteristics, Op-amp Applications. Inverting ampilifiers, non-inverting ampilifiers, analog fillters, comparotars, summing circuits, precision rectifiers, precision peak detectors, oscillators and waveform generators. voltage and current regulators, analog-to-digital converters,
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	**EE3106 Signals and Systems**
Level /Semester	3/5
Credit Hours	3
Pre-requisite(s)	Mathematical Methods and Differential equation.
Objective(s)	This course aims to introduce the basic concepts and mathematical analysis for signals and system representations
Course Contents	Signals and system mathematical definition, the types, characteristics and properties of signals Time domain analysis, and convolution integral for LTI systems, properties and characteristics. Frequency domain representation of signals, aperiodic signals and Fourier transform, Fourier Transform properties, conversion tables, inverse Fourier transform. Frequency domain representation of continuous time systems, definition, properties, inverse Laplace transform. Z transform properties, duality properties, region of convergence, stability. Application: Analog filters, frequency separation, ideal filter, Butterworth filter, cross over frequency, bandwidth, design limitations.
Teaching Method	Suggested lecture/practice: • Lecture Hour: 30 hours • Matlab Practice Hour: 15 hours
Evaluation	• Matlab Practice 25% • Midterm 15% • Final Exam 60%. Subject to change according to the instructor advice
Reference(s)	1. Continuous and Discrete Time Signals and Systems by MrinalMandal, Amir Asif 2. Signals and Systems (2nd Edition) by Alan V. Oppenheim, Alan S. Willsky with S. Hamid 3. Signals and Systems using MATLAB (2nd Edition) by Luis Chaparro 4. Transforms in Signals and Systems by Peter Kraniauskas

Course Title	**BME 3107 Biomechanics**
Level /Semester	3/5
Credit Hours	2
Pre-requisite(s)	Principle of Mechanical Eng., Biometerials
Objective(s)	✚ 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	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, viscoelasticity, skin measurement of stress 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)	2. P. McGinnis. Biomechanics of sport and exercise: Human Kinetics. 2013. 3. Nihat Ozkaya & Margareta Nordin, Fundamental of biomechanics, second edition

Course Title	EM3201 Numerical Analysis
Level /Semester	3/6
Credit Hours	3
Pre-requisite(s)	Calculus I, II, Computer programming language.
Objective(s)	• The students completing this course will be able to apply standard numerical solution techniques to the solution of problems. • Using the computer programming to solve problems
Course Contents	Numerical methods for solving linear and nonlinear equations and systems of equations. Interpolation, numerical evaluation of definite integrals, and solution of ordinary differential equations, stability and convergence of methods and error estimates. Introduction to finite difference and finite element methods for solving partial differential equations. Techniques in matrix computation; elimination methods, matrix decomposition.
Teaching Method	This course is not lecture based. The course is an interactive, computer based laboratory course. The computer will lead you through the laboratory (like a set of lab notes) and you will answer problems most of which use the computer. The course consists of two parts: A set of interactive, computer based laboratory exercises, and two or more mini-projects
Evaluation	• Mini projects (25%) • Lab work (25%) • Final exam (50%) As directed by the instructor
Reference(s)	- Introduction to Numerical Analysis: Second Edition, by F. B. Hildebrand , 1987

Course Title	**EE3202 Biosignal Processing**
Level /Semester	3/6
Credit Hours	4
Pre-requisite(s)	Signals and Systems
Objective(s)	This course aims to expose This course will introduce the concepts and the advanced techniques for processing signals on a computer (DSP). , and explore the modern knowledge and techniques, and To develop skills for analyzing and synthesizing algorithms and systems that process discrete time signals, with emphasis on realization and implementation
Course Contents	1. Introduction to Digital Signal Processing. 2. Digital Signals and Systems, Signal Sampling and Quantization, 3. Fourier Transform, Z- Transform. 4. Basic Filtering Types, and Digital Filter Realizations. 5. Finite Impulse Response Filter Design. 6. Infinite Impulse Response Filter Design. 7. Integer filters. 8. Adaptive Filters. 9. Data Reduction Techniques 10. Multirate Signal processing 11. typical applications 12. Hardware and Software for Digital Signal Processors
Teaching Method	Lectures + tutorial + lab + office hours for revision.
Evaluation	Mid-term Exam. 15% Course project. 15% Course seminar (paper) .15% Lab 10% Final exam 55%
Reference(s)	1. Willis J. Tompkins, "Biomedical Digital Signal Processing", 1993. 2. Li Tan , " Digital Signal Processing Fundamentals and Applications", 2008. 3. JOHN L. SEMLOW. "Biosignal and Biomedical Image Processing MATLAB based Applications", 2004. 4. John G. Proakis and Dimitris C. Manolakis "Digital Signal Processing Principles, Algorithm and Application," Prentice Hall of India, Pvt. Limited, 1996. 5. Mitra, "Digital Signal Processing –A Computer Based Approach" , McGraw Hill, 1998.

Course Title	**EE3202 Biosensors**
Level /Semester	3/6
Credit Hours	3
Pre-requisite(s)	Measurements and Instrumentations
Objective(s)	1. To teach the fundamental concepts behind the operation of the most important classes of biosensors 2. To teach how biosensors are characterized, compared to each other, and designed to suit particular applications 3. To teach how biochemical functionality is coupled to a biosensor transducer 4. To describe the major applications of biosensor technology in diagnostic tests, life science research, and environmental testing 5. To expose students to several of the most important emerging biosensor technologies 6. 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	1) Introduction to the field of biosensors, applications, and the use of statistical information to analyze biosensor ourput 2) The design and capabilities of bioselective layers 3) Biomolecular structure and function 4) Mass transport and biosensing in a flow stream 5) Biosensor figures of merit for comparison of approaches 6) Homogeneous and heterogeneous assays: fluorescence polarization 7) Electrochemical biosensors 8) Acoustic biosensors 9) Optical biosensors 10) Fluorescence, Raman Spectroscopy, and Fluorescence Enhancement, 11) Nanoparticle and microparticle labels
Teaching Method	Lectures: 15 x 2 hours. practical: 15 x 3 hours
Evaluation	homework assignments (15% of grade in-class mini-exams (25% of grade) and one term paper project (25% of grade). Final exam (60%)
Reference(s)	1. "Biosensors: Theory and Applications", Donald G. Buerk. 2. "Bioinstrumentation and Biosensors" by Donald L Wise

Course Title	**EE3204 Control Systems**
Level /Semester	3/6
Credit Hours	3
Pre-requisite(s)	• Linear differential equations with constant coefficients. • Laplace transforms and transfer functions for linear systems. • Elementary matrix manipulations
Objective(s)	To build an introduction to classical and modern control theory. The course emphasizes essential concepts. These concepts are illustrated by using numerous graphics, block diagrams, and simple examples.
Course Contents	Introduction, control system, Open loop, Closed loop Mathematical Modeling representation, Differential equations (t-domain). Laplace transforms (s-domain). Transfer function, block diagram and state variable systems. Control System types and effects of feedback. Time Domain analysis: transient response, steady-state error, Stability of the control systems. Routh-Hurwitz Criterion. Frequency response analysis of linear systems, Poles and zeros, Root-locus Gain and phase margin. Methods of Nyquist and Bode. Trade-off between stability and performance, PID Control. Introduction to Digital Control systems: Discrete-time systems (z-domain). Mappings between t, s, and z domains. MATLAB/Simulink and its Control Toolbox.
Teaching Method	• 30 contact hours for 15 lectures. • Concepts will be illustrated with Matlab examples.
Evaluation	• Design oriented practica examples including extensive use of computer aided simulation & design techniques (25%). • Midterm Exam (15%), and final exam (60%), with mixed evaluation of underlying analytic techniques and design techniques.
Reference(s)	1. "I. J. Nagrath and M. Gopal", "Control Systems Engineering", New Age International (P) Limited, Publishers, 5th edition, 2009 2. "B. C. Kuo", "Automatic Control Systems", John wiley and sons, 8th edition, 2003. 3. "N. K. Sinha", "Control Systems", New Age International (P) Limited Publishers, 3rdEdition, 1998. 4. "NISE", "Control Systems Engineering", John wiley, 6th Edition, 2011. 5. "Katsuhiko Ogata", "Modern Control Engineering", Prentice Hall of India Pvt. Ltd., 3rd edition, 1998.

Course Title	**EE3205 Power Electronics**
Level /Semester	3/6
Credit Hours	3
Pre-requisite(s)	EE2106, EE2206
Objective(s)	Students of this courseware will gain intense knowledge and understanding of the field of Power Electronics, and also the student will learn to design and test these circuits through the software simulation package.
Course Contents	Fundamentals of DC/ DC, AC/DC power conversion. Switch mode power supply fundamentals. Basics and operation of power semi-conductor devices. Thyristors and controlled rectifiers .Power converters. SCR operation. Regulation circuits. DC choppers. Design and construct power converters and regulators to meet given objectives through homework, exams and a final project. Understand and analyze the concepts of soft switching of DC/DC converters. Uncontrolled Diode Rectifier Circuits, Phase controlled Converters, DC/AC Inverters.
Teaching Method	• 15 x 2 Hours Lectures. • 12 x 3 Hours Lab practice
Evaluation	• Attendance 5%. Practice 25%. • Midterm 10%, and Final Exam 60%. The instructor advice in assessment and grading will be considered. **Power Electronics Lab for subject EE4106**
Reference(s)	1. Bhimbra. Dr.P.S., Power Electronics Khanna Publishers, 2001 2. Muhammad H. Rashid, Power Electronics – Circuits, Devices & Applications, Prentice Hall of India, New Delhi, 1995

Course Title	ECE3206 Microprocessors and Assembly Language
Level /Semester	3/6
Credit Hours	3
Pre-requisite(s)	Non
Objective(s)	This course aims to introduce the organization of a microprocessor system and the assembly language for programming the microprocessor. Students will learn the programming techniques, design techniques of memory system and input/output system for a simple microprocessor system. Upon completion, students are equipped with fundamental knowledge to program a microprocessor system for specific application
Course Contents	Basic computer architecture: CPU, input/output, memory systems and buses; Structure of a CPU: ALU, accumulators, registers, stack, control unit and buses; Instruction execution, sequence and data flow, instruction cycle; Concept of address bus, data bus, control bus and bus arbitration; ASCII code; Instruction formats, operands, types and addressing modes; 8086 Assembly language programming, assembler directives and assembler operation
Teaching Method	Suggested lecture/tutorial/laboratory mix: • Lecture Hour: 30 hours • Tutorial Hour: 8 hours • Laboratory Hour: 15 hours
Evaluation	• Pracice 25% • Midterm 15% • Final Exam 60%. For a student to pass the course, at least 50% of the maximum mark must be obtained, and a laboratory attendance of at least 75% recorded
Reference(s)	1. Computer architecture and Organization ,William Stalling. 2. Microprocessor Fundamentals by K.John

Course Title	**BME3207 Medical Measurements and Monitoring Systems**
Level /Semester	3/6
Credit Hours	3
Pre-requisite(s)	Analog Circuits, Measurements and Instrumentations
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	**BME4101 Medical-Field Training -1**
Level /Semester	4/7
Credit Hours	2
Pre-requisite(s)	Medical Measurements and Monitoring Systems
Objective(s)	Introduce the student to the various types of medical equipments and systems through teaching, reviewing and explanation of: 1. Biomedical equipments and systems principles, applications and operations. 2. Basic block diagrams, basic schematic circuits, electrical circuit diagrams and components identification 3. Preventive maintenance, performance tests and electrical safety tests. 4. Examples for site planning and preparations for some typical equipments 5. Basic equipment troubleshooting techniques
Course Contents	Concerned equipment are Iintensive care units equipment.
Teaching Method	Explanation, hands-on activities
Evaluation	Reports, Discussion, and seminar
Reference(s)	Euipment Manuals

Course Title	**BME4102 Medical Laboratory Equipment**
Level /Semester	4/7
Credit Hours	3
Pre-requisite(s)	Medical Measurements and Monitoring Systems
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	BME4103 Medical Device Interfacing
Level /Semester	4/7
Credit Hours	3
Pre-requisite(s)	Microelectronics technology
Objective(s)	This course studies knowledge and skills required to interfacing supports and Techniques needs for biomedical Devices Connections in contacts with, human body, medical instruments and micro computer system. On completion of this module, students should be able to: - Understand interfacing Circuits concept. - Understand interface circuits functions and Services. - Understand biomedical devices interconnection Techniques
Course Contents	Interface circuits concepts; needs for interfacing; Bio sensors types and supports for human body interfaces ; actuators types ; signal conditions modules ;interface circuits classification; analogue interface models ; basics standard components for analogue interface; digital interface model and basics components; biomedical devices interface techniques and connections ; interfacing international standard and specification; interface protocols serial and parallel protocols.
Teaching Method	Power point slide show will be used to describe the topics. Lectures: 15 x 2 hours. practical: 15 x 3 hours
Evaluation	• Homework/practical 15% • Midterm 25% • Final Exam 60%. Students Lecture attendance is essential
Reference(s)	1. Microprocessor Based Design_ A Comprehensive Guide to Effective Hardware Design_ Michael Slater_ 2. Data-Acquisition-Handbook, Measurement Computing Corporation, 2012. 3. PC Interfacing Communications and windows Programming, William Buchanan, Addison, Wesley

Course Title	**BME4104 Modeling of Biological Systems**
Level /Semester	4/7
Credit Hours	3
Pre-requisite(s)	Anatomy and Physiology, Control Systems
Objective(s)	To use basic knowledge of models for applied and theoretical problems in biology system. And to formulate and construct a mathematical model, mathematicallly analyse and apply a model, and then interprete and evaluate the mathematical analysis
Course Contents	Modeling strategies in physiology: (introduction), Introduction to mathematical modeling in biological sciences, Scalar discrete-time Discrete-time deterministic matrix models, parameter estimation, Discrete-time stochastic models, Arterial dynamics, windkessel model, Transmission line model. Muscle contraction: lumped muscle strip models, cross bridge models, distributed description of the sarcomere. Cardiovascular modeling: an idealized segment of artery, An idealized segment of vein arterial and venous trees, models of the heart, models of combined heart and circulation. Respiratory Models: structure, chemoreflex models, models of respiratory central pattern generator, optimization of breathing pattern, optimization of ventilation. Control of Movements: modeling of human extremities. Eye movement control system; westheimer's saccadic eye movement model, saccade control mechanism. Modeling of neural function: Hodgkin-Huxley and cable theory, modeling with artificial neural networks, applications of non-linear dynamics concepts and algorithms.
Teaching Method	Lectures + tutorial + office hours for revision.
Evaluation	Mid-term Exam.15% Course project. 15% Course seminar (paper). 15% Lab10% Final exam 55%
Reference(s)	1. Ellner & Guckenheimer, Dynamic Models in Biology, 2. Bolker, Ecological Models and Data in R, *3.* Otto & Day, A Biologist's Guide to Mathematical Modeling in Ecology and Evolution,

Course Title	**BME4105 Medical Safety and Environment Protection**
Level /Semester	4/7
Credit Hours	2
Pre-requisite(s)	**None**
Objective(s)	1. Introduction to basic principles of environmental and occupational health and safety practices and creating awareness of public and occupational health and safety requirements associated with the environment. 2. Develop skills relevant in modern Safety, Health and Environment (SHE) practice
Course Contents	1. Introduction to environmental, health and safety management in an occupational environment. EHS management system. 2. General concept of risk, risk assessment and risk management 3. General safety – equipment, electrical, confined space, etc 4. Chemical safety Occupational Health: permissible exposure limits, solvents, metals, dusts, cancer causing agent, major occupational diseases in Singapore, Chemicals in the environment. major environmental disasters (Bhopal, Seveso) 5. Biosafety: epidemic and pandemic, WHO Biosafety Manual, Management of Biosafety in Laboratories and Biomedical Facilities 6. Noise at the workplace and environmental noise issues 7. Flammable materials, fire and explosion. 8. Air pollution - sources, impacts and control. Trans-boundary movement of air pollutants (haze) 9. Water management – sources, impacts and control hazardous waste - sources, impacts and control 10. Standard radiological safety checks Real & X-ray equipment X-ray tube 11. Electrical safety issues: important susceptibility parameters, micro-shock Hazards, basic approaches to protection against shock, distribution of electric power, Cables, short circuit analysis, protection principles and circuit Breaker.
Teaching Method	Teaching is delivered through lectures, tutorials and case studies, and simulated projects are utilized to develop practical, observational and analytical skills.
Evaluation	Mid-term Exam 25%, Course seminar (paper) 15%, Final exam 60%
Reference(s)	1. The Workplace Safety and Health Act and its subsidiary legislations. 2. The Environmental Protection and Management Act and its subsidiary legislations. 3. Brauer R L (2005), Safety and Health for Engineers, 2nd Edition, Wiley. 4. Woodside G and Kocurek D (1997), Environmental, Safety, and Health Engineering, John Wiley & Sons, Inc.

Course Title	**BME4107 Medical Photonics**
Level /Semester	4/7
Credit Hours	2
Pre-requisite(s)	General Physics
Objective(s)	This course provides students with a working knowledge of optical physics, including diffraction and physical optics, atomic physics and optical spectroscopy, laser physics and photonics. It also provides a basis for further study in optics and photonics. Laser engineering, designing and implentation.
Course Contents	• Interference of light, optical interferometry, Fraunhofer and Fresnel scalar diffraction, diffraction gratings, temporal coherence, spatial coherence, and partial coherence. • Optical propagation of light waves as applied to isotropic, anisotropic, and inhomogeneous media, guided waves and Gaussian beams. • Principles of laser amplification and oscillations; design of lasers; general characteristics of excitation systems. • Photonic devices and systems including liquid crystal displays, fiber-optic sensors, laser diodes, electro optic modulation, acousto-optic modulation, light wave detection, optical communications, and photonic signal processing. • Designing and device implementation of diode pumped solid-state lasers, nonlinear frequency conversion, Q-switching, mode locking, and pulse second harmonic generation. • Design and micro-fabrication of semiconductor and optoelectronics devices including passive waveguides, light emitting diodes (LEDs), laser diodes (LDs), photo detectors and electro-optic modulators.
Teaching Method	Lectures, tutorials, observational and analytical skills.
Evaluation	Mid-term Exam.....25% Course seminar (paper).....15% Final exam ……..…60%
Reference(s)	1. Lasers and Electro-optics: Fundamentals and Engineering, by Christopher C. Davis. 2. Photonics and Laser Engineering: Principles, Devices, and Applications 1st Edition, by Alphan Sennaroglu 3. Introduction to Optics and Lasers in Engineering, by Gabriel Laufer

Course Title	**BME4201 Ionizing Medical Imaging Systems**
Level /Semester	4/8
Credit Hours	3
Pre-requisite(s)	Nuclear Physics
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	**BME4202 Medical Image Processing**
Level /Semester	4/8
Credit Hours	3
Pre-requisite(s)	Digital Biosignal Processing
Objective(s)	Understanding the basics concepts of images perception for monochromic vision and color image presentation and digital image presentation and some important techniques for image processing and applications on medical imaging.
Course Contents	▪ Overview, Computer imaging systems, ▪ Image perception ▪ The mammalian visual system ▪ Simple monochrome vision model. ▪ Image representation, Image features. ▪ Digital images, Image transform, ▪ enhancement, detection, filters ▪ Image Segmentation, Representation and Description ▪ Morphological Image Processing, o Dilation and Erosion o Opening and Closing o Some basic morphological algorithms o Extensions to gray level images
Teaching Method	Lectures + Labs + office hours for revision.
Evaluation	- Class Assignments, Mid-Term Test and Final exam.
Reference(s)	1. Biosignal and Biomedical Image Processing: MATLAB-Based Applications, by John L Semmlow, Semmlow L. 2. *Computer Vision and Image Processing*, by Scott Umbaugh, Prentice-Hall, Inc., Upper Saddle River, New Jersey, 1998. 3. Digital Image Processing - R.C.Gonzalez&P.Wintz 4. Computer Vision - D.H.Ballard&C.M.Brown

Course Title	**BME4204 Selected Medical Equipment**
Level /Semester	4/8
Credit Hours	3
Pre-requisite(s)	Medical Measurements and Monitoring Systems
Objective(s)	The course objective is to prepare student to understand the knowledge of ICU, Patient Monitors, …etc.
Course Contents	Fact sheet for intensive care unit ICU, types of equipment used in ICU Fundamentals of Patient Monitors. Bedside monitor, patient monitor, central monitoring, and monitoring alarms. Operating suite environment, operating room instrumentation, Sterilization Cardiac pacemakers and other electric stimulation Defibrillators and cardio-vectors Hemodialysis machines principles', structure and troubleshooting Ventilators machines principles', structure and troubleshooting Anesthesia machines principles', structure and troubleshooting Drug Delivery Devices. Surgical Instruments. Surgical Instruments. Therapeutic Application of the Laser Arrhythmias Analyzer , Dental Machines
Teaching Method	Lectures + Labs + office hours for revision.
Evaluation	- Class Assignments, Lab sessions, Mid-Term Test and Final exam.
Reference(s)	1. Medical instrumentation, Application, and Design, J. Webster.4th edition 2. Biomedical Instrumentation and Measurements 3. The *Biomedical Engineering Handbook* 4. *Medical Instrumentation Systems*

Course Title	GE 4205 Research Methods
Level /Semester	4/8
Credit Hours	2
Pre-requisite(s)	No
Objective(s)	The course objective is to prepare student for research work, practice and knowledge about research methods, statistical analyses of data within environmental science, a way of thinking and solving problems. Also focus on papers and proposal writing styles.
Course Contents	Communication skills, The Nature of Communication, Barriers to Effective Communication, Informative presentations, Persuasive presentations, Organizing Presentations, Types of Deliveries. Making an effective PowerPoint Slides. Objective of research, Research Motivations, Outcomes of Research. Stages of Research, Research Problem, Meaning of research problem, Sources of research problem, Criteria / Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Literature survey Overview: What is literature survey, Functions of literature survey. Developing a Research Proposal, Format of research proposal, Individual research proposal, Institutional proposal and presentation. Research Design, Actual Investigation, Research Report, Research ethics, Legal issues, copyright, plagiarism General advice about writing technical papers in English, Tips for writing correct English
Teaching Method	• 15 x 2 Classroom Lectures with whiteboard or chalkboard. • 10 x 2 Practical laboratory
Evaluation	Homework and management research 15% Midterm 15% Final Exam 70%. The instructor may change the percentages
Reference(s)	1. Ranjit kumar (2014).Research Methodology: A Step-by-Step Guide for Beginners.4th edition 2. Heidi A, Danille (2007).Digital Writing Research: Technologies Methodologies and Ethical Issues. 3. Stuart Melville, Wayne(2004). Research methodology: an introduction.2nd edition

Course Title	**CS4206 Artificial Intelligence and Neural Networks**
Level /Semester	4/8
Credit Hours	3
Pre-requisite(s)	None
Objective(s)	• To introduce the Artificial Intelligence, Machine Learning, and neural networks; • To give design methodologies for artificial neural networks; • To provide knowledge for network tuning and over fitting avoidance; • To offer neural network implementations in Matlab; • To demonstrate neural network applications on real-world tasks.
Course Contents	1. Introduction to Artifical inelegance, and Machine Learning Algorithms 2. Introduction and Role of Artificial Neural Networks. 3. Fundamentals of Biological Neural Networks. 4. Basic Structures of ANNs. 5. Principles of ANN Design 6. The ANN Input-Output Principles. 7. Adaline Neural Networks. 8. The Madaline Neural Networks. 9. Perceptron Neural Networks. 10. Back Propagation Neural Networks. 11. Hopfield Neural Networks. 12. Selected Applications of ANN.
Teaching Method	Lectures + Labs + office hours for revision.
Evaluation	Mid-term Exam. 15% Asignment and Homwork 10% Lab 15% Final exam 60%
Reference(s)	1. Fausett, L. (1994), "**Fundamentals of Neural Networks: Architectures, Algorithms, and Applications**", Englewood Cliffs, NJ: Prentice Hall, ISBN 2. Daniel Graupe, "**Principles of Artificial and Neural Networks**", 2nd edition, 2007.

Course Title	**BME5101 Medical-Field Training -2**
Level /Semester	5/9
Credit Hours	2
Pre-requisite(s)	**Ionizing Medical Imaging Systems**
Objective(s)	Introduce the student to the various types of medical equipments and systems through teaching, reviewing and explanation of: 1) Biomedical equipments and systems principles, applications and operations. 2) Basic block diagrams, basic schematic circuits, electrical circuit diagrams and components identification. 3) Preventive maintenance, performance tests and electrical safety tests. 4) Examples for site planning and preparations for some typical equipments. 5) Basic equipment troubleshooting techniques
Course Contents	Concerned equipment are Laboratory, and ionizing imaging systems
Teaching Method	Explanation, hands-on activities, discussion, and seminars
Evaluation	Report and Seminar
Reference(s)	Equipment Manuals

Course Title	**BME5102 Non-Ionizing Medical Imaging Systems**
Level /Semester	5/9
Credit Hours	3
Pre-requisite(s)	Nuclear Physics
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	EE5203 Nano Technology and Engineering
Level /Semester	5/9
Credit Hours	2
Pre-requisite(s)	None
Objective(s)	The course is focused on the operational principles and circuit applications of nanoelectronic devices, especially those based on electron tunneling, i.e. tunnel diodes, resonant tunnel diodes, and single electron transistors. Carbon nanotube will also be considered.
Course Contents	• Intro: Nanotechnology & CMOS • Electron tunneling Tunnel diode & RTD • TD & RTD circuits • TF deposition, nucleation, growth • Single electron transistor (SET) • SET circuits • Carbon nanotubes (CNT) • Spintronics • Molecular Electronics
Teaching Method	Assessment will be continuous relying on report writing, presentations and demonstrations of practical work during the development
Evaluation	• Student group presentations. (20%) • Mid-term Exam (20%) • Final Exam (60%) Percentages are subject to change
Reference(s)	Nanotechnology: An Introduction, By Jeremy Ramsden, 2011

Course Title	**BME5104 Bioinformatics**
Level /Semester	5/9
Credit Hours	3
Pre-requisite(s)	**Mathematical Methods**
Objective(s)	The aim of this course is: • To introduce the students to bioinformatics. • To familiarize the students with different types of databases. • To make the students be able to read and understand scientific review articles. • To Work with Sequences. • To Make the student be able compare sequences and search for similarity. • To Explain the Protein and RNA structures. • To Introduce the students to existing softwares for data manipulation and presentation.
Course Contents	1. Introduction to bioinformatics. 2. Bioinformatics online resources. 3. Sequence alignments and database search. 4. Phylogenic tree & multiple sequence alignments. 5. Protein structure alignments. 6. Protein secondary structure predictions. 7. Introduction to Monte Carlo Simulation. 8. Protein folding and protein structure modeling. 9. Protein function and structure-based function annotation
Teaching Method	Lectures, lab work, and mini project.
Evaluation	Final Written Examination: 50% Midterm Examination: 20% Laboratory Work, Tests (1 & 2) 30%
Reference(s)	1. Westhead, D.R., J.H. Parish and R.M. Twyman, Instant Notes: Bioinformatics, 2002, BIOS Scientific Publishers Ltd. 2. Xiong, Jin, Essential Bioinformatics, 2006, Cambridge University Press, Baxevanis, Andreas D. and B.F. Francis Ouellette (editors), 3. Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins, 3rd edition, 2005, Wiley.

Course Title	**PR5105 Graduation Project-I** **PR5205 Graduation Project-II**
Level /Semester	5/9 – 5/10
Credit Hours	2 - 4 (6)
Pre-requisite(s)	All courses.
Objective(s)	2. Enable students to implement the knowledge & skills gathered through various theoretical and laboratory courses 3. Introduce students to conduct independent literature survey for contemporary problems and issues related to implementation of the allotted project. 4. 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:*** Any filed related to Biomedical Engineering
Teaching Method	Weekly meeting with supervisor
Evaluation	- Supervisor :40 mark and committee: 60
Reference(s)	The students should select recent references depend on the project area

Course Title	AD5106 Industrial Management
Level /Semester	5/9
Credit Hours	2
Pre-requisite(s)	None
Objective(s)	• This course aims to provide the student with the basic requirements of engineering organization's management • To develop the skills of the student to solve administrative problems that may encounter during his supervision of engineering projects.
Course Contents	**UNITI:** HISTORICAL: Definition of Management–Science or Art–Management and Administration– Development of Management Thought–Contribution of Taylor and Fayol– Functions of Management– Types of Business Organization. **UNIT II:** Nature & Purpose – Steps involved in Planning – Objectives – Setting Objectives – Process of Managing by Objectives – Strategies, Policies & Planning Premises- Forecasting – Decision-making. **UNIT III:** Nature and Purpose–Formal and informal organization–Organization Chart–Structure and Process– Departmentation by difference strategies–Line and Staff authority–Benefits and Limitations–De-Centralization and Delegation of Authority–Staffing–Selection Process - Techniques – HRD – Managerial Effectiveness. **UNIT IV:**Scope–HumanFactors–CreativityandInnovation–HarmonizingObjectives–Leadership – TypesofLeadershipMotivation–Hierarchyofneeds–Motivationtheories–Motivational Techniques – Job Enrichment – Communication – Process of Communication – Barriers and Breakdown-Effective Communication – Electronic media in Communication. **UNIT V:** System and process of Controlling– Requirements for effective control–The Budget as Control Technique–Information Technology in Controlling– Use of computers in handling the information–Productivity–Problems and Management– Control of Overall Performance –Direct and Preventive Control– Reporting– The Global Environment– Globalization and Liberalization– International Management and Global theory of Management.
Teaching Method	This course is lecture based course, but group assignments will be delivered regarding management topics.
Evaluation	Lecturers from industry will have at least two seminars in industrial management issues. 30 contact hours will be set to cover 15 Lectures. Homework and management research, 15% Midterm 15% and Final Exam 70%.
Reference(s)	1. Ernest Dale, Management Theory and Practice, International Student edition, McGraw Hill blushing 2. Murphy W.R. and Mc Kay. G., Energy Management Butterworths, London. 3. Chandran. J.S., Organizational Beheviours, Vikas Publishing House Pvt. Ltd., New Delhi, 1994. 4. Industrial engineering and management by O.P Khanna

Course Title	**AD5201 Engineering Economics**
Level /Semester	5/10
Credit Hours	2
Pre-requisite(s)	Calculus-I, II
Objective(s)	To improve the students skills in financing topics to have the confidence to take decisions in his organization and analyze different options.
Course Contents	**ENGINEERING ECONOMICS:** Introduction - Economics – Scope and Definition – Importance of Economics in Engineering - Economic optimization- Demand and Revenue Analysis – Law of Demand - Demand Forecasting –Methods of Demand Forecasting - Demand curves – Factors affecting Demand – Demand Elasticity - Production Analysis - simple problems. **SUPPLY, COST AND OUTPUT:** Supply – Supply schedule – Law of Supply – Elasticity of Supply - Cost and Supply Analysis – Types of Costs - Price and output Determination – Price Fixation – Pricing methods - Pricing Policies – Factors governing Pricing Policies – Break-Even analysis – Estimation of Break-Even Point - Usefulness of BEP – Limitations – simple problems
Teaching Method	30 contact hours for 15 lectures. Wealthy examples will be covered. Student homework regarding economics problems will be set.
Evaluation	• Homework and economic research 15% • Midterm 15% • Final Exam 70%. The instructor may change the percentages
Reference(s)	**1.** Chandran. J.S., Organizational Beheviours, Vikas Publishing House Pvt. Ltd., New Delhi, 1994. **2.** Ernest Dale, Management Theory and Practice, International Student edition, McGraw Hill Publishing Co.,

Course Title	**GE5202 Engineering Ethics**
Level /Semester	5/10
Credit Hours	1
Pre-requisite(s)	None
Objective(s)	The course aims at providing basic knowledge of ethics for engineers in different types of work roles and prepare the engineer for potential ethical dilemmas in their future profession. Special emphasis is placed on ethics in technology-intensive activities.
Course Contents	The course consists of three integrated components: moral philosophy, case studies and industry perspectives, as well as the code of conduct for engineers. Moral Philosophy: basic ethical theories such as utilitarianism, deontology, and virtue ethics, but also more modern theories such as discourse ethics and feminist ethics. Case Study: Analysis of examples of situations which engineers may encounter in their professional life with the help of the studied ethical theory. Industry Perspective: discussion with professionally active engineers on ethical issues they have encountered during their career.
Teaching Method	15 hours for lectures. 15 hours for seminars and discussions. 10 office hours for revision.
Evaluation	- Class Assignments, Mid-Term Test and Final exam.
Reference(s)	1. *Davis, M., ed. Engineering Ethics. Burlington, VT: Ashgate Publishing Co., 2005. ISBN: 0754625249.* 2. *Harris, C. E., et al. Engineering Ethics. 2nd ed. Belmont, CA: Wadsworth, 1999. ISBN: 0534533973.* 3. *Koen, B. V.* Discussion of the Method: Conducting the Engineer's Approach to Problem Solving. *New York, NY: Oxford University Press, 2003. ISBN: 0195155998.*

Course Title	**BME5204 Clinical Engineering**
Level /Semester	5/10
Credit Hours	2
Pre-requisite(s)	None
Objective(s)	Introduce the Hospital based clinical engineering: Hospital organization and the role of clinical engineering,
Course Contents	- Hospital Technology Management - Management of Complex Clinical System - Decision Support Systems in Healthcare - Early Stage Healthcare Technology Assessment - Integrated Risk and Quality Management in Hospital Systems - Management of New Technologies: Software and Integrated Systems. - 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. - Clinical Engineering and Disaster Preparedness - Human Factors Engineering in Healthcare - Clinical Engineering Education and Careers - Certification of Clinical Engineers
Teaching Method	30 hours for lectures. Office hours for revision. and discussions
Evaluation	• Homework and assailments 15% • Midterm 25% • Final Exam 60%. The instructor may change the percentages
Reference(s)	1. Clinical Engineering, From Devices to Systems, 1st Edition. 2. Clinical Engineering, a Handbook for Clinical and Biomedical Engineers.

Course Title	**BME5205 Quality Assurance & Reliability**
Level /Semester	5/10
Credit Hours	2
Pre-requisite(s)	None
Objective(s)	Introduce the **Quality Assurance** (**QA**), which includes **quality control** (QC) tests, helps to ensure that high **quality** diagnostic systems, the course covers the entire **Medical- Devices** from machine, to processor, to view box.. Experimental design and case studies for quality improvement. Acceptance sampling. Reliability.
Course Contents	Description and discussion of the rationale for components and persons involved in a QA program. Description of the various types of test, performed and their a frequency, plus record–keeping procedures in a QA program; Description of the purpose and function of various QA tests, tools and instrumentation and performance of quality control testing of all biomedical equipments; Analysis interpretation, and reporting the various results and, identification of the causes of inconsistency, malfunction, or total damage. Performance evaluation and commissioning. Reliability and its relationship with QA. Types of Failure. Analysis of Reliability data. Reliability modeling and availability. Case studies an Computer Applications.
Teaching Method	30 hours for lectures.
Evaluation	office hours for revision. and discussions
Reference(s)	1. Statistical Quality Control: A Modern Introduction, Douglas C. Montgomery, 2013 / Seventh Edition, John Wiley & Sons> 2. Blanchard & Lowery, “Maintainability”, McGraw-Hill, 1969. 3. Costin, H. “Readings in Total Quality Management”, Harcourt Brace College Publishers, 1994. 4. Juran & Gryna, “Quality Planning and Analysis”, McGraw-Hill, 1980. 5. O’Connor, P. “Practical Reliability Engineering”, Wiley, 1985.

Course Title	BME5203 Tissue Engineering
Level /Semester	Elective
Credit Hours	2
Pre-requisite(s)	None.
Objective(s)	This course will use student-directed learning as the teaching tool to introduce students to the concepts, principles, and applications of tissue engineering.
Course Contents	Principles of materials science and cell biology underlying the design of medical implants, artificial organs, and matrices for tissue engineering. Methods for biomaterials surface characterization and analysis of protein adsorption on biomaterials. Molecular and cellular interactions with biomaterials are analyzed in terms of unit cell processes, such as matrix synthesis, degradation, and contraction. Mechanisms underlying wound healing and tissue remodeling following implantation in various organs. Tissue and organ regeneration. Design of implants and prostheses based on control of biomaterials-tissue interactions. Comparative analysis of intact, biodegradable, and bioreplaceable implants by reference to case studies. Criteria for restoration of physiological function for tissues and organs.
Teaching Method	- 15 Lectures + discussion + study cases
Evaluation	- Exercises, Quiz and H/Ws 15% - Mid-term test 25% - Final examination 60%
Reference(s)	1. Principles of Tissue Engineering Ed. (Lanza, Langer, Vacanti) 2. Class notes: "Survey of Clinical Cases of Biomaterials-Tissue Interactions: The Paradigm."

Course Title	BME5203 Biological Transport
Level /Semester	Elective
Credit Hours	2
Pre-requisite(s)	None
Objective(s)	This is an elective course. The aim of the course is to introduce the basic principles and concepts of fluid flow, heat and mass transfer relevant to physiological and biological systems, as well as more advanced mathematical models. The course is designed to place an emphasis on developing a quantitative understanding of the underlying physical, chemical and biological phenomena. Practical problems and case studies will be included.
Course Contents	- Introduction, revision of the basic principles of fluid mechanics, heat and mass transfer. - Physiological properties of biological fluids and tissues; Non-Newtonian fluid flow. - Fluid flow in the circulation. - Fluid flow in tissues, hand out Problem Sheet 1. - Mass transport in biological systems – part 1, Problem Class. - Mass transport in biological systems – part 2. - Heat transfer in biological systems. - Case study 1 - Numerical modeling of blood flow and mass transport in the circulation. - Case study 2 – Numerical modeling of drug delivery to solid tumor.
Teaching Method	- 15 Lectures + tutorials + study cases
Evaluation	- Exercises, Quiz and H/Ws 15% - Mid-term test 25% - Final examination 60%
Reference(s)	1. Basic Transport Phenomena in Biomedical EngineeringFournier, Ronald L. 2. Datta, A.K. 2017. Heat and Mass Transfer: A Biological Context. CRC Press. 3. Truskey, G. A., F. Yuan, and D. F. Katz. *Transport Phenomena in Biological Systems*. East Rutherford, NJ: Prentice Hall, 2003.

Course Title	BME5203 Real Time Embedded Systems
Level /Semester	Elective
Credit Hours	2
Pre-requisite(s)	None.
Objective(s)	The objective of the course is for students to develop the ability to design real-time systems. This class allows students to combine principles of microcomputer interfacing, software development, digital logic and analog circuits into the design of microcomputer-based systems: implementation of multitasking, synchronization, protection, and paging; operating systems for embedded microcomputers; design, optimization, evaluation, and simulation of digital and analog interfaces; real-time microcomputer software; and applications, including data acquisition and robotics.
Course Contents	- General structure and principal implementation of embedded systems. Fundamental characteristics and associated design challenges of real-time systems. - Central computer architecture concepts from the perspective of the real-time systems designer - Different memory technologies, input/output techniques, and peripherals for embedded systems. - Design embedded control hardware at the block diagram level for a specific application. - Specialized programmable interfaces are implemented in VHDL to help with these measurements. - A real time kernels, - An acquisition system is implemented and the gathered data is transmitted by a Web server. - QA,and QC, of the real time acquisition and reading by a multiprocessor system. - Embedded systems management models through polling, interrupts and using a real time kernel with its task management and synchronization primitives. - Programing and evaluating a real-time embedded systems for certain application.
Teaching Method	- 15 Lectures + discussion + study cases
Evaluation	- Exercises, Practice, and H/Ws 15% - Mid-term test 25% - Final examination 60%
Reference(s)	1. *Jonathan W. Valvano,* Embedded Systems: Real-Time Operating Systems for ARM® Cortex™-M Microcontrollers , *Volume 3, Third edition, September 2014, ISBN: 978-1466468863*