Republic of Iraq
Ministry of Higher Education & Scientific Research
Supervision and Scientific Evaluation Directorate
Quality Assurance and Academic Accreditation
International Accreditation *Dept.*

Academic Program Specification Form
For the Academic Year 2020-2021

University: University of Technology
College: Biomedical Engineering Department
Branch of Bio-Mechanics
Date of Form Completion: June 2021

Dean's Name:Prof.Dr. Wisam Ali K. Hamdan
Date: 26 / 6 /2021
Signature:

Dean's Assistant for Scientific Affairs:
Assist. Prof. Dr. Saad M. Ali
Date: 26 / 6 / 2021
Signature:

The College Quality Assurance and University Performance Manager:Dr.Taqwa O. Fahad
Date: 26 / 6 / 2021
Signature:

TEMPLATE FOR PROGRAMME SPECIFICATION

HIGHER EDUCATION PERFORMANCE REVIEW: PROGRAMME REVIEW

PROGRAMME SPECIFICATION

This Programme Specification provides a concise summary of the main features of the programme and the learning outcomes that a typical student might reasonably be expected to achieve and demonstrate if he/she takes full advantage of the learning opportunities that are provided. It is supported by a specification for each course that contributes to the programme.

1. Teaching Institution	University of Technology
2. University Department/Centre	Biomedical Engineering Department
3. Programme Title	Biomedical Engineering Department/Bio-Mechanics Branch
4. Title of Final Award	BSc in Biomedical Engineering
5. Modes of Attendance offered	Courses
6. Accreditation	National Accreditation of Iraqi Universities
7. Other external influences	Summer training- Industrial visits
8. Date of production/revision of this specification	June 2021
9. Aims of the Programme	
The objectives of the academic program lie in achieving scientific integration in the field of engineering and medical specialization. This program gives the integrated engineering background version for medical device engineers and biomechanical engineers, as well as supplying the health institutions with experienced engineers with scientific expertise in order to improve medical treatment for hospitals health.	

10. Learning Outcomes, Teaching, Learning and Assessment Methods

A. Knowledge and Understanding

The department aims to the integration sate between medical and engineering specialties, so that the department exits Engineering disciplines supporting the medical specialization in the fields of medical technologies and biomechanics from By providing the appropriate knowledge base for both specializations in the five academic years. It also provides the scientific base for study and analysis problems through a group of laboratories specialized in these areas, whether they deal with Equipment or engineering tests for biological materials.

B. Subject-specific skills

B1: Perform engineering duties required by medical care units in hospitals.

B2: Work as experts and specialists in centers for the design and manufacture of medical devices and equipment.

B3: Experts and specialists in physiotherapy centers and prosthetic units production and medical devices centers

B4: Work in medical research centers, such as universities that work on developing medical devices and Solving biological and health problems.

Teaching and Learning Methods

1. Lecture presentation
2. Tutorials
3. Scientific tour
4. Student center
5. Team project
6. Lab and Experimental learning
7. Technical Application

Assessment methods

1. Quiz, report, assignments
2. Mid-term exam and Final term exam

C. Thinking Skills

C1: Engineering problems solving skills in a scientific way.

C2: Ability to analyzing, designing, verification, and testing bio-medical engineering issues.

C3: The capability of performing the required tests, in addition to conduct, compare and analyze the results.

C4: Bio-medical engineering devices development.

D. General and Transferable Skills (other skills relevant to employability and personal development)

1. Verbal communication
2. Team Work
3. Analyzing & Investigating
4. Initiative / self-motivation
5. Written communication
6. Planning & Organizing
7. Flexibility
8. Time management

11. Programme Structure

Level/Year	Course or Module Code	Course or Module Title	Credit hours
First Year/Course 1	WRKS101	WROKSHOP - I	2
	ENGL103	ENGLISH LANGUAGE - I	2
	COMP105	COMPUTER PRINCIPLES	3
	BMED107	ANATOMY AND PHYSIOLOGY I	2
	BMED109	CALCULUS - I	2
	BMED111	ENGINEERING MECHANICS - STATICS	2
	BMED113	ENGINEERING DRAWING	2
First Year/Course 2	WRKS102	WORKSHOP - II	2
	UOT102	HUMAN RIGHTS & Democracy	2
	BMED106	BIOMEDICAL COMPUTER APPLICATIONS	3
	BMED108	ANATOMY AND PHYSIOLOGY II	2
	BMED110	CALCULUS - II	2
	BMED112	ENGINEERING MECHANICS - DYNAMICS	2
	BMED114	Computer Aided Drafting	2
Second Year/ Course 1	BMED201	MECHANICS OF MATERIALS I	3
	BMED203	MATERIALS SCIENCE	3
	BMED205	MATHEMATICS - I	2
	BMED207	INTRODUCTION TO BME I	2
	BMED209	Medical Physics	2
	BMED211	Thermodynamics Principles	3
	BMED213	ELECTRICAL ENGINEERING - DC	3

Second Year/ Course 2	BMED202	MECHANICS OF MATERIALS II	3
	BMED204	BIOMATERIALS AND BIOCOMPATIBILITY	3
	BMED206	MATHEMATICS - II	2
	BMED208	INTRODUCTION TO BME II	2
	BMED210	Biochemistry	3
	BMED212	Bio fluid	3
	BMED214	ELECTRICAL ENGINEERING - AC	3
Third Year/ Course 1	BM311	Anatomy and physiology III	3
	BIC312	Biomechanics I	3
	BIC313	Engineering analysis	2
	BIC314	Human rights	2
	BM315	Mechanical design	3
	BIC316	Medical instrumentations	2
	BM317	Electronics	3
	BM318	design and application of biomaterial	2
Third Year/ Course 2	BM321	Anatomy and physiology IV	3
	BIC322	Biomechanics II	3
	BIC323	Numerical analysis	2
	BIC324	Democracy and Freedom	2
	BIC325	Biomedical signal processes	2
	BIC326	CAD/ CAM	2
	BM327	Advance electronics	3
	BM328	Advanced biomaterials	3
Fourth Year/ Course 1	BM411	Histology	3
	BM412	Microsystem and Nanotechnology	2
	BM413	Medical Electronics	2
	BIC414	Design of medical device	3
	BIC415	Engineering statistics	2
	BIC416	Image process	3
	BM417	Artificial limbs I	3
	BIC418	Project	2
Fourth Year/ Course 2	BM421	Diseases of bones and joints	2
	BM422	Biotribology	3
	BIC423	Nuclear medicine techniques	2
	BIC424	Fabrication of medical devices	2
	BM425	Biostatistics	2
	BIC426	Bioimaging system	2
	BM427	Artificial limbs II	3
	BIC428	Project	2
Fifth Year/ Course 1	BIC511	Project	3
	BIC512	Medical Informatics	2
	BM513	Biocompatibility	3
	BIC514	Biomedical sensors	3

	BM515	Drug delivery	2
	BIC516	Writing skills	2
	BM517	Cell biotechnology	2
	BIC518	Neurobiology engineering	2
	BIC519	Advanced English language I	2
Fifth Year/ Course 2	BIC521	Project	3
	BIC522	Medical radiography	2
	BM523	Nutrition	2
	BM524	Tissue engineering	3
	BM525	Transport phenomena	2
	BM526	Fiber Optics	2
	BIC527	Hospital engineering	2
	BM528	Bioelectromagnetic	3
	BIC529	Advanced English language II	2

13. Personal Development Planning

Urging the student to realize the importance of continuing self-learning and acquiring new techniques and skills in the field of specialization

14. Admission criteria .

Students are admitted to the college according to:

- Their average grades on the Baccalaureate.
- Student desire.
- The capacity of the department.

15. Key sources of information about the programme

- The official website of the university
- The college's official website
- The university's guidelines booklet
- Vocabulary and curricula of scientific lessons for the college

Curriculum Skills Map																															
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				Knowledge and understanding							Subject-specific skills					Thinking Skills						General and Transferable Skills (or) Other skills relevant to employability and personal development								
				A1	A2	A3	A4	A5	A6	A7	B1	B2	B3	B4	B5	C1	C2	C3	C4	C5	C6	D1	D 2	D3	D4	D5	D6	D7	D8		
First Year/ Course 1	**WRKS101**	WROKSHOP - I	C	*	*	*	*	*	*	*	*	*	*	*		*	*	*	*	*		*	*	*	*	*	*	*	*		
	ENGL103	ENGLISH LANGUAGE - I	C	*	*	*	*	*	*	*	*	*	*	*		*		*	*	*		*	*	*	*	*	*	*	*		
	COMP105	COMPUTER PRINCIPLES	C	*	*	*	*	*	*	*	*	*	*	*		*	*	*	*	*		*	*	*	*	*	*	*	*		
	BMED107	ANATOMY AND PHYSIOLOGY I	C	*	*	*	*	*	*	*	*	*	*	*		*	*	*	*	*		*	*	*	*	*	*	*	*		
	BMED109	CALCULUS - I	C	*	*	*	*	*	*	*	*	*	*	*		*	*	*	*	*		*		*	*	*	*	*	*		
	BMED111	ENGINEERING MECHANICS - STATICS	C	*	*	*	*	*	*	*	*	*	*	*		*	*	*	*	*		*		*	*	*	*	*	*		
	BMED113	ENGINEERING DRAWING	C	*	*	*	*	*	*	*	*	*	*	*		*	*	*	*	*		*	*	*	*	*	*	*	*		
First Year/ Course 2	**WRKS102**	WORKSHOP - II	C	*	*	*	*	*	*	*	*	*	*	*		*	*	*	*	*		*	*	*	*	*	*	*	*		
	UOT102	HUMAN RIGHTS & Democracy	C	*	*	*	*	*	*	*	*	*	*	*		*		*	*	*		*	*	*	*	*	*	*	*		
	BMED106	BIOMEDICAL COMPUTER APPLICATIONS	C	*	*	*	*	*	*	*	*	*	*	*		*	*	*	*	*		*	*	*	*	*	*	*	*		
	BMED108	ANATOMY AND PHYSIOLOGY II	C	*	*	*	*	*	*	*	*	*	*	*		*	*	*	*	*		*	*	*	*	*	*	*	*		
	BMED110	CALCULUS - II	C	*	*	*	*	*	*	*	*	*	*	*		*	*	*	*	*		*		*	*	*	*	*	*		
	BMED112	ENGINEERING MECHANICS - DYNAMICS	C	*	*	*	*	*	*	*	*	*	*	*		*	*	*	*	*		*		*	*	*	*	*	*		

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				A1	A2	A3	A4	A5	A6	A7	B1	B2	B3	B4	B5	C1	C2	C3	C4	C5	C6	D1	D 2	D3	D4	D5	D6	D7	D8
	BMED114	Computer Aided Drafting	C	*	*	*	*	*	*	*	*	*	*	*		*	*	*	*	*		*	*	*	*	*	*	*	*
Second Year/ Course 1	**BMED201**	MECHANICS OF MATERIALS I	C	*	*	*	*	*	*	*	*	*	*	*		*	*	*	*	*		*	*	*	*	*	*	*	*
	BMED203	MATERIALS SCIENCE	C	*	*	*	*	*	*	*	*	*	*	*		*		*	*	*		*	*	*	*	*	*	*	*
	BMED205	MATHEMATICS - I	C	*	*	*	*	*	*	*	*	*	*	*		*	*	*	*	*		*		*	*	*	*	*	*
	BMED207	INTRODUCTION TO BME I	C	*	*	*	*	*	*	*	*	*	*	*		*	*	*	*	*		*	*	*	*	*	*	*	*
	BMED209	Medical Physics	C	*	*	*	*	*	*	*	*	*	*	*		*	*	*	*	*		*		*	*	*	*	*	*
	BMED211	Thermodynamics Principles	C	*	*	*	*	*	*	*	*	*	*	*		*	*	*	*	*		*		*	*	*	*	*	*
	BMED213	ELECTRICAL ENGINEERING - DC	C	*	*	*	*	*	*	*	*	*	*	*		*	*	*	*	*		*	*	*	*	*	*	*	*
Second Year/ Course 2	**BMED202**	MECHANICS OF MATERIALS II	C	*	*	*	*	*	*	*	*	*	*	*		*	*	*	*	*		*	*	*	*	*	*	*	*
	BMED204	BIOMATERIALS AND BIOCOMPATIBILITY	C	*	*	*	*	*	*	*	*	*	*	*		*		*	*	*		*		*	*	*	*	*	*
	BMED206	MATHEMATICS - II	C	*	*	*	*	*	*	*	*	*	*	*		*	*	*	*	*		*		*	*	*	*	*	*
	BMED208	INTRODUCTION TO BME II	C	*	*	*	*	*	*	*	*	*	*	*		*	*	*	*	*		*		*	*	*	*	*	*
	BMED210	Biochemistry	C	*	*	*	*	*	*	*	*	*	*	*		*	*	*	*	*		*	*	*	*	*	*	*	*
	BMED212	Bio fluid	C	*	*	*	*	*	*	*	*	*	*	*		*	*	*	*	*		*	*	*	*	*	*	*	*
	BMED214	ELECTRICAL ENGINEERING -	C	*	*	*	*	*	*	*	*	*	*	*		*	*	*	*	*		*	*	*	*	*	*	*	*

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				A1	A2	A3	A4	A5	A6	A7	B1	B2	B3	B4	B5	C1	C2	C3	C4	C5	C6	D1	D 2	D3	D4	D5	D6	D7	D8		
		AC																													
Third Year/ Course 1	**BI311**	MEMS Design	C	*	*	*	*	*	*	*	*	*	*	*		*	*	*	*	*		*	*	*	*	*	*	*	*		
	BIC312	Biomechanics I	C	*	*	*	*	*	*	*	*	*	*	*		*		*	*	*		*	*	*	*	*	*	*	*		
	BIC313	Engineering analysis	C	*	*	*	*	*	*	*	*	*	*	*		*	*	*	*	*		*		*	*	*	*	*	*		
	BIC314	Human rights	C	*	*	*	*	*	*	*						*	*	*	*	*		*		*	*	*	*	*	*		
	BI315	Biosignals and Biosystems	C	*	*	*	*	*	*	*	*	*	*	*		*	*	*	*	*		*	*	*	*	*	*	*	*		
	BIC316	Medical instrumentations	C	*	*	*	*	*	*	*	*	*	*	*		*	*	*	*	*		*	*	*	*	*	*	*	*		
	BI317	Medical Electronics I	C	*	*	*	*	*	*	*	*	*	*	*		*	*	*	*	*		*	*	*	*	*	*	*	*		
Third Year/ Course 2	**BI321**	MEMS Evlaution	C	*	*	*	*	*	*	*	*	*	*	*		*	*	*	*	*		*	*	*	*	*	*	*	*		
	BIC322	Biomechanic П	C	*	*	*	*	*	*	*	*	*	*	*		*		*	*	*		*	*	*	*	*	*	*	*		
	BIC323	Numerical analysis	C	*	*	*	*	*	*	*	*	*	*	*		*	*	*	*	*		*		*	*	*	*	*	*		
	BIC324	Democracy and Freedom	C	*	*	*	*	*	*	*						*	*	*	*	*		*		*	*	*	*	*	*		
	BIC325	Biomedical signal process	C	*	*	*	*	*	*	*	*	*	*	*		*	*	*	*	*		*	*	*	*	*	*	*	*		
	BIC326	CAD/ CAM	C	*	*	*	*	*	*	*	*	*	*	*		*	*	*	*	*		*	*	*	*	*	*	*	*		

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				A1	A2	A3	A4	A5	A6	A7	B1	B2	B3	B4	B5	C1	C2	C3	C4	C5	C6	D1	D2	D3	D4	D5	D6	D7	D8
	BI327	Medical Electronics II	C	*	*	*	*	*	*	*	*	*	*	*		*	*	*	*	*		*	*	*	*	*	*	*	*
	BI328	Biomaterials inspection.	C	*	*	*	*	*	*	*	*	*	*	*		*	*	*	*	*		*	*	*	*	*	*	*	*
Fourth Year/ Course 1	**BI411**	Introduction to Nanotechnology	C	*	*	*	*	*	*	*	*	*	*	*		*	*	*	*	*		*	*	*	*	*	*	*	*
	BI412	Mechatronic systems	C	*	*	*	*	*	*	*	*	*	*	*		*		*	*	*		*		*	*	*	*	*	*
	BI413	Nuclear medicine	C	*	*	*	*	*	*	*	*	*	*	*		*	*	*	*	*		*		*	*	*	*	*	*
	BIC414	Design of medical device	C	*	*	*	*	*	*	*	*	*	*	*		*	*	*	*	*		*	*	*	*	*	*	*	*
	BIC415	Engineering statistics	C	*	*	*	*	*	*	*	*	*	*	*		*	*	*	*	*		*		*	*	*	*	*	*
	BIC416	Image processing	C	*	*	*	*	*	*	*	*	*	*	*		*	*	*	*	*		*	*	*	*	*	*	*	*
	BIC417	Project	C	*	*	*	*	*	*	*	*	*	*	*		*	*	*	*	*		*	*	*	*	*	*	*	*
Fourth Year/ Course 2	**BI421**	NEMS	C	*	*	*	*	*	*	*	*	*	*	*		*	*	*	*	*		*	*	*	*	*	*	*	*
	BI422	Genetic devices	C	*	*	*	*	*	*	*	*	*	*	*		*		*	*	*		*		*	*	*	*	*	*
	BIC423	Nuclear medicine techniques	C	*	*	*	*	*	*	*	*	*	*	*		*	*	*	*	*		*		*	*	*	*	*	*
	BIC424	Fabrication of medical devices	C	*	*	*	*	*	*	*	*	*	*	*		*	*	*	*	*		*		*	*	*	*	*	*
	BI425	Introduction to robotics	C	*	*	*	*	*	*	*	*	*	*	*		*	*	*	*	*		*	*	*	*	*	*	*	*
	BIC426	Bioimaging system	C	*	*	*	*	*	*	*	*	*	*	*		*	*	*	*	*		*		*	*	*	*	*	*
	BIC427	Project	C	*	*	*	*	*	*	*	*	*	*	*		*	*	*	*	*		*	*	*	*	*	*	*	*

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				A1	A2	A3	A4	A5	A6	A7	B1	B2	B3	B4	B5	C1	C2	C3	C4	C5	C6	D1	D 2	D3	D4	D5	D6	D7	D8		
Fifth Year/ Course 1	**BIC511**	Project	C	*	*	*	*	*	*	*	*	*	*	*		*	*	*	*	*		*	*	*	*	*	*	*	*		
	BIC512	Medical informatics	C	*	*	*	*	*	*	*	*	*	*	*		*		*	*	*		*	*	*	*	*	*	*	*		
	BI513	Biocompatiablity and toxicity	C	*	*	*	*	*	*	*	*	*	*	*		*	*	*	*	*		*	*	*	*	*	*	*	*		
	BIC514	Biomedical sensors	C	*	*	*	*	*	*	*	*	*	*	*		*	*	*	*	*		*	*	*	*	*	*	*	*		
	BI515	Biomedical acoustics	C	*	*	*	*	*	*	*	*	*	*	*		*	*	*	*	*		*		*	*	*	*	*	*		
	BIC516	Writing skills	C	*	*	*	*	*	*	*	*	*	*	*		*	*	*	*	*		*		*	*	*	*	*	*		
	BI517	Sugary for engineering	C	*	*	*	*	*	*	*	*	*	*	*		*	*	*	*	*		*	*	*	*	*	*	*	*		
	BIC518	Neurobiology engineering	C	*	*	*	*	*	*	*	*	*	*	*		*	*	*	*	*		*		*	*	*	*	*	*		
	BIC519	Advanced English language I	C	*	*	*	*	*	*	*	*	*	*	*		*	*	*	*	*		*		*	*	*	*	*	*		
Fifth Year/ Course 2	**BIC521**	Project	C	*	*	*	*	*	*	*	*	*	*	*		*	*	*	*	*		*	*	*	*	*	*	*	*		
	BIC522	Medical radiography	C	*	*	*	*	*	*	*	*	*	*	*		*		*	*	*		*		*	*	*	*	*	*		
	BI523	Engineering biomedical physiology	C	*	*	*	*	*	*	*	*	*	*	*		*	*	*	*	*		*		*	*	*	*	*	*		
	BI524	Catheter and netareisurgy tools	C	*	*	*	*	*	*	*	*	*	*	*		*	*	*	*	*		*	*	*	*	*	*	*	*		
	BI525	Advanced medical devices	C	*	*	*	*	*	*	*	*	*	*	*		*	*	*	*	*		*	*	*	*	*	*	*	*		
	BI526	Cardiology	C	*	*	*	*	*	*	*	*	*	*	*		*	*	*	*	*		*		*	*	*	*	*	*		
	BIC527	Hospital engineering	C	*	*	*	*	*	*	*	*	*	*	*		*	*	*	*	*		*		*	*	*	*	*	*		
	BI528	Nanomechanics	C	*	*	*	*	*	*	*	*	*	*	*		*	*	*	*	*		*	*	*	*	*	*	*	*		

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				Knowledge and understanding							Subject-specific skills					Thinking Skills						General and Transferable Skills (or) Other skills relevant to employability and personal development								
				A1	**A2**	**A3**	**A4**	**A5**	**A6**	**A7**	**B1**	**B2**	**B3**	**B4**	**B5**	**C1**	**C2**	**C3**	**C4**	**C5**	**C6**	**D1**	**D 2**	**D3**	**D4**	**D5**	**D6**	**D7**	**D8**
	BIC529	Advanced English language II	C	*	*	*	*	*	*	*	*	*	*	*		*		*	*	*		*		*	*	*	*	*	*

TEMPLATE FOR COURSE SPECIFICATION

HIGHER EDUCATION PERFORMANCE REVIEW: PROGRAMME REVIEW

COURSE SPECIFICATION

Study of biotribology aim to gather information about friction, adhesion, lubrication and wear of systems, surface contact area. Friction theories, wear theories, wear in practical. Experimental methods Also The thermal and hydrolytic sensitivities of biological materials limit their applicability in many important synthetic materials applications. lubrication theories, tribology in biological systems and instruments.

1. Teaching Institution	Ministry of Higher Education & Scientific Research
2. University Department/Centre	University of Technology/ Biomedical Engineering Department
3. Course title/code	biotribology/ BME
4. Programme(s) to which it contributes	BM
5. Modes of Attendance offered	Virtual Attendance
6. Semester/Year	II semester/ 4th year
7. Number of hours tuition (total)	60 hours semester
8. Date of production/revision of this Specification	6/12/2020
9. Aims of the Course	
1. Understand the fundamental mechanisms of friction, laws and simple theories.	
2. Describe the laws and simple theories of wear, the basic mechanisms and phenomena of wear, and theories of lubrication.	
3. Appreciate the consequences of friction and wear on different types of biomaterials of implants	

10· Learning Outcomes, Teaching ,Learning and Assessment Method

A- Knowledge and Understanding

A1. Revision the Basic Concepts in biotribology and Study the surface science.
A2. Apply lubrication methods to human joints
A3. Apply and analysis of human joints.
A4. Analyze the artificial joints and their biomaterials.

B. Subject-specific skills

B1. Explain the different models of friction
B2. Apply types of friction and materials used in joints.
B3. Introduce the different human joints.

Teaching and Learning Methods

The teaching method that will be used in this course will be composed of a series of mini lectures interrupted with frequent discussions and brainstorming exercises. Using white board and Data show

Assessment methods

For the purpose of evaluation is used

1. Method of rapid test and snap
2. Identify some homework
3. Quarterly exams

C. Thinking Skills

C1. Analyze problems involving friction and surface nature.
C2. Study the joint types
C3. Study the types of materials and implants

Teaching and Learning Methods

1. Explain the required term
2. To discuss ideas and share knowledge
3. Methodology and use the text books

Assessment methods

D. General and Transferable Skills (other skills relevant to employability and personal development).

D1. Experimental test in laboratory.
D2. Reports set related to the theoretical objects

11. Course Structure					
Week	Hours	ILOs	Unit/Module or Topic Title	Teaching Method	Assessment Method
2nd semester					
1	4	Introduction to Bio-Tribology: Friction, Surface Roughness and Finishing, Lubrication ,Synovial Membrane, theories of lubrication	Introduction to Bio-Tribology:,	Explain of theoretical subjects	Quiz. H.W exam and Ex. Reports
2	4	Wear, mechanisms of wear Adhesive, Abrasive, Fatigue, Linear wear, Volumetric wear, Wear testing, Wear rate, Laws of wear, Corrosion,	Wear, mechanisms, , , Corrosion Types	Explain of theoretical subjects with examples	Quiz. H.W exam and Ex. Reports
3	4	The structure, friction and wear of natural joints, types of implants, (cemented and cementless), biomaterials of joint replacements,	The structure, friction and wear of natural joints, materials.	Explain of theoretical subjects with examples	Quiz. H.W exam and Ex. Reports
4	4	Implant geometry, Manufacturing methods and metallurgy, Tribology of metal-on-metal bearings, Effects of material and design on the	Implant geometry, Manufacturing methods and metallurgy, Tribology	Explain and derive the related eqs.	Quiz. H.W exam and Ex. Reports
5	4	Metal alloys in joint replacements, stainless steel, cobalt, nickel,	Metal alloys in joint replacements,	Explain and derive the	Quiz. H.W exam and Ex.
6	4	Titanium (Ti) Alloys, Biotribological properties of	Titanium (Ti) Alloys, Biotribological	Explain and derive the	Quiz. H.W exam and Ex.
7	4	Ceramic evolution and internal/surface treatments to use in	Ceramic evolution and internal/surface	Explain and derive the	Quiz. H.W exam and Ex.
8	4	Diamond, bioglass, Bioactive ceramics and glasses as coatings to improve bone bonding,	Diamond, bioglass, Bioactive ceramics and glasses as	Explain and derive the related eqs.	Quiz. H.W exam and Ex. Reports
9	4	Polymer evolution and internal/surface treatments,	Polymer evolution and internal/surface	Explain and derive the	Quiz. H.W exam and Ex.
10	4	Effects of temperature on performance of artificial joints,	Effects of temperature on	Explain and derive the	Quiz. H.W exam and Ex.
11	4	Experimental Wear Studies of Total Joint Replacements, Methods	Experimental Wear Studies of Total Joint	Explain and derive the	Quiz. H.W exam and Ex.
12	4	Design of Artificial Joints: Shoulder joints and its	Design of Artificial Joints	Explain and derive the	Quiz. H.W exam and Ex.
13	4	Wrist joints and its replacements, Finger joint and its replacements	Design of Artificial Joints	Explain and derive the	Quiz. H.W exam and Ex.
14	4	Hip joints and its replacements, Knee joint and its replacements,	Design of Artificial Joints	Explain and derive the	Quiz. H.W exam and Ex.
15	4	Revision	Revision	Explain and derive the	Quiz. H.W exam and Ex.

12. Infrastructure	
Required reading: · CORE TEXTS · COURSE MATERIALS · OTHER	1. J. Paulo Davim, Biotribology, John Wiley & Sons, 2013 2. JOHN H. DUMBLETON, Tribology of Natural and Artificial Joints, ELSEVI ER, 1981
Special requirements (include for example workshops, periodicals, IT software, websites)	Experimental apparatus in biotribology laboratory for perform experimental test
Community-based facilities (include for example, guest Lectures , internship , field studies)	www.elsevier.com/locate/biotri

13. Admissions	
Pre-requisites	Fundamental basic concepts and applications of biomaterial and mechanics.

TEMPLATE FOR COURSE SPECIFICATION

HIGHER EDUCATION PERFORMANCE REVIEW: PROGRAMME REVIEW

COURSE SPECIFICATION

Basic properties and concepts of fluid and solid mechanics are introduced in static and flow with problems and applied to the analysis of blood flow in the macro and microcirculation, and to other physiological flows. The viscosity, surface tension capillary action and its applications. Analysis of mathematical models is combined with discussions of physiological mechanisms. Energy equations, Bernolles equation, viscous flow analyses and pulsate flow.

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1. Teaching Institution	Ministry of Higher Education & Scientific Research
2. University Department/Centre	University of Technology/ Biomedical Engineering Department
3. Course title/code	Bio-fluid mechanics/ BME
4. Programme(s) to which it contributes	general
5. Modes of Attendance offered	Virtual Attendance
6. Semester/Year	II semester /2nd year
7. Number of hours tuition (total)	60 hours semester
8. Date of production/revision of this Specification	6/12/2020
9. Aims of the Course	
1. understand the role of physiological fluid mechanics in Biomedical Engineering	
2. Introduce fluid concepts essential to the understanding of biofluid mechanics and physiological fluid mechanics	
3. Apply basic concepts in fluid mechanics to clinical fluid dynamic measurements	

10· Learning Outcomes, Teaching ,Learning and Assessment Method

A- Knowledge and Understanding

A1. Revisit Basic Concepts in Fluid Mechanics and Study the kinematics of Fluid Flow
A2. Apply hydrostatics equations to clinical applications
A3. Apply conservation relations to fluid flow and Difference between viscid and inviscid flow
A4. Analyze the flow properties of blood, and blood vessel structure

B. Subject-specific skills

B1. Explain the different models of Biofluid and blood flow
B2. Apply Poiseuilli's Law to the study of Blood Flow
B3. Introduce the different classes of Non-Newtonian fluids
B4. Study the operation of heart valves and its relation to blood flow in arteries

Teaching and Learning Methods

The teaching method that will be used in this course will be composed of a series of mini lectures interrupted with frequent discussions and brainstorming exercises. Using white board and virtual meeting.

Assessment methods

For the purpose of evaluation is used

1. Method of rapid test and snap
2. Identify some homework
3. Quarterly exams

C. Thinking Skills

C1. Analyze problems involving circulatory biofluid mechanics and blood rheology
C2. Study the flow properties of blood and their relation to blood vessel structure
C3. Apply different mathematical models to describe the behavior of viscous fluids flow

Teaching and Learning Methods

1. Explain the required term
2. To discuss ideas and share knowledge
3. Methodology and use the text books

Assessment methods

D. General and Transferable Skills (other skills relevant to employability and personal development).

D1. Experimental test in laboratory.
D2. Reports set related to the theoretical objects

11. Course Structure					
Week	Hours	ILOs	Unit/Module or Topic Title	Teaching Method	Assessment Method
2nd semester					
1	4	- Introduction to Physiological Fluid Mechanics	Introduction &Basic concepts	Explain of theoretical subjects	Quiz. H.W exam and Ex. Reports
2	4	Kinematics of Fluid Flow, Hydrostatics - Conservation Relations	Fluid kinematics	Explain of theoretical subjects with examples	Quiz. H.W exam and Ex. Reports
3	4	Viscous Flow	Viscous Flow	Explain of theoretical subjects with examples	Quiz. H.W exam and Ex. Reports
4	4	- Unsteady Flow	Unsteady Flow	Explain and derive the related eqs.	Quiz. H.W exam and Ex. Reports
5	4	- Analysis of Total Peripheral Flow	Peripheral Flow	Explain and derive the related eqs.	Quiz. H.W exam and Ex. Reports
6	4	- Circulatory Biofluid Mechanics	Biofluid Circulatory	Explain and derive the related eqs.	Quiz. H.W exam and Ex. Reports
7	4	- Flow Properties of Blood	Blood flow	Explain and derive the related eqs.	Quiz. H.W exam and Ex. Reports
8	4	-Clinical Fluid Dynamic Measurements	Measurements	Explain and derive the related eqs.	Quiz. H.W exam and Ex. Reports
9	4	- Blood Vessel Structure	Blood Vessel Structure	Explain and derive the related eqs.	Quiz. H.W exam and Ex. Reports
10	4	- Applications of Poiseuilli's Law	Poiseuilli's Law	Explain and derive the related eqs	Quiz. H.W exam and Ex. Reports
11	4	Introduction to Non-Newtonian Fluids	Non-Newtonian Fluids	Explain and derive the related eqs	Quiz. H.W exam and Ex. Reports
12	4	- Operation of Heart Valves	Heart Valves	Explain and derive the related eqs	Quiz. H.W exam and Ex. Reports
13	4	- Shear Stress on Vessel Wall	Vessel Wall	Explain and derive the related eqs	Quiz. H.W exam and Ex. Reports
14	4	- Blood Vessel Bifurcation	- Blood Vessel Bifurcation	Explain and derive the related eqs	Quiz. H.W exam and Ex. Reports
15	4	Respiration and lungs function	Respiration	Explain and derive the related eqs	Quiz. H.W exam and Ex. Reports

12. Infrastructure	
Required reading: · CORE TEXTS · COURSE MATERIALS · OTHER	Lighthill, J. "Physiological Fluid Mechanics." Springer-Verlag. Hellums, J. and Brown, C. "Cardiovascular Fluid Dynamics." University Press Fung, Y.C. (1996). "Biomechanics: Properties of Living Tissues." Springer-Verlag Fung, Y.C. (1993). "First Course in Continuum Mechanics of Physical and Biological Engineers and Scientists." 3rd Ed. Prentice-Hall.
Special requirements (include for example workshops, periodicals, IT software, websites)	Experimental apparatus in fluid mechanics laboratory for perform experimental test
Community-based facilities (include for example, guest Lectures , internship , field studies)	

13. Admissions	
Pre-requisites	Fundamental basic concepts and applications of physics and Engineering mathematics.
Minimum number of students	95
Maximum number of students	101

TEMPLATE FOR COURSE SPECIFICATION

HIGHER EDUCATION PERFORMANCE REVIEW: PROGRAMME REVIEW

COURSE SPECIFICATION

This Course Specification provides a concise summary of the main features of the course and the learning outcomes that a typical student might reasonably be expected to achieve and demonstrate if he/she takes full advantage of the learning opportunities that are provided. It should be cross-referenced with the programme specification.

1. Teaching Institution	Ministry of Higher Education & Scientific Research
2. University Department/Centre	Technology Department
3. Course title/code	**Medical physics**
4. Programme(s) to which it contributes	Google meet + Canvas+ Google classroom
5. Modes of Attendance offered	Theoretical material
6. Semester/Year	2022/2021 - first semester
7. Number of tuition hours (total)	30 Hours In Year
8. Date of production/revision of this specification	2021/7/10
9. Aims of the Course	
Introducing the student to the subject of medical physics and the necessity of learning it because it is an essential part closely related to the physics of parts The body and its importance in preparing for how to design medical devices and knowing their physical principle or parts to be implanted inside the body And how to deal with it in a physical way, which helps in the success of work in a way that suits the physical nature of the human body	

10· Learning Outcomes, Teaching, Learning and Assessment Methods

A- Knowledge and Understanding

A1: Cognitive goals
A1: Cognitive objectives
A2 :At the end of the semester, the student should be able to define
A3: The physical principle of the work of the parts of the body
A4:The physical principle of operation of medical devices

Subject-specific skills

Course specific objectives
1-The learner should have the ability to analyze and interpret issues related to medical physics
2-The ability to determine the physical characteristics of all parts of the human being
3-The ability to self-evaluation and independent in the field of medical physics and draw lessons for the future through observation
Logical linking, abstraction, judgment about knowledge, working to solve problems, and choosing the best and most appropriate solutions
4-The ability to adopt appropriate physical methods to design new medical devices
5- Inventing new treatments for problems related to the physical principle of medical devices

Teaching and Learning Methods

1-Theoretical lectures, brainstorming

2-Group discussion and dialogue

3- Comparison between applied reality and theoretical study and examples about the experiences of peoples and countries at the present and past times

Assessment Methods

1-Regular and quarterly exams

2-duties

3-Short reports and research

4 short exams

C- Thinking Skills

C1: Consolidate these rights and freedoms for the university student and inform him that these rights are not absolute and are exercised without restrictions
but hey
Constrained by the rights of others and not to be violated, in addition to his duty towards the society in order to grow in a free and complete growth that suits him achieve that
rights. Therefore, every right is accompanied by an obligation or a duty to implement .it
A:2: To establish for the university student that enjoying the exercise of rights and :freedoms is under the national legislation that
control and regulate
Practicing these rights in order to be in harmony with the culture of human rights, promoting them with realistic examples and spreading a spirit of hope and optimism with a future
brightening our country, moving away from sectarian and ethnic characterization and its repercussions, promoting the spirit of citizenship and spreading the values of tolerance
and discard all
Forms of racial discrimination and division and building a state of law magnifies human beings

Teaching and Learning Methods

1. Employing the faculty's ability and experience in communicating the scientific material to the student

2- Motivating the student to discuss, debate and draw conclusions

Assessment Methods

‹Periodic and final exams (documented), oral questions during lectures

Reports and Research

D- General and Transferable Skills (other skills relevant to employability and personal development)

D1:

D2:

D3:

D4:

D5:

D6:

11· Course Structure

Week	Hours	ILOs	Unit/Module or Topic title	Teaching Method	Assessment Method
1	**2**	**Understanding the student**	**Introduction of medical physics**	**Theoretic**	**Lecture and discuss and dialogue and examples used to achieve Objectives**
2	**2**		***Forces On and In the Body***	**Theoretic**	
3	**2**		**Energy, work, and power of Body**	**Theoretic**	
4	**2**		**Pressure**	**Theoretic**	
5	**2**		**Physics of the lung and Breathing**	**Theoretic**	
6	**2**		**Physics of Cardiovascular System**	**Theoretic**	
7	**2**		**Physics of eye**	**Theoretic**	
8	**2**		**Physics of vision**	**Theoretic**	
9	**2**		**Physics of diagnostic X-Rays**	**Theoretic**	
10	**2**		**Physics of nuclear medicine**	**Theoretic**	
11	**2**		**Friction force**	**Theoretic**	
12	**2**		**Physics of laser**	**Theoretic**	
13	**2**		**Skelton**	**Theoretic**	

14	**2**		**viscosity**	**Theoretic**	
15	**2**		**Electricity**	**Theoretic**	

12· Infrastructure	
Required readings: - Core Texts - Course Materials - Other	**A b h f li d h i i A branc h o f appli e d p hysics concerning the** **application of physics to medicine or, in other words The app p** **y q lication of p h ysics techni ques to the human health Marco** **Silari CERN**
Special requirements (include for example workshops, periodicals, IT software, websites)	**There is no**
Community-based facilities (include for example, guest lectures, internship, field studies)	**There is no**

13· Admissions	
Pre-requisites	**success from middle school**
Minimum number of students	**There is no**
Maximum number of students	**There is no**

TEMPLATE FOR COURSE SPECIFICATION

HIGHER EDUCATION PERFORMANCE REVIEW: PROGRAMME REVIEW

COURSE SPECIFICATION

This Course Specification provides a concise summary of the main features of the course and the learning outcomes that a typical student might reasonably be expected to achieve and demonstrate if he/she takes full advantage of the learning opportunities that are provided. It should be cross-referenced with the programme specification.

1. Teaching Institution	Ministry of Higher Education & Scientific Research
2. University Department/Centre	University of Technology/ Biomedical Engineering Department
3. Course title/code	Numerical Analysis / BME
4. Programme(s) to which it contributes	BM & MI
5. Modes of Attendance offered	Virtual Attendance
6. Semester/Year	II semester /3rd year
7. Number of tuition hours (total)	45 hours semester
8. Date of production/revision of this specification	6/12/2020
9. Aims of the Course	
1. Enable students to understand, develop, analyze approximate solutions to algebraic and transcendental engineering problems	
2. Enable students to understand the concepts of error and approximate solutions in engineering application	
3. Apply the numerical solution to solve differential equations, derivatives, integral, and hard problems.	
4. Code various numerical methods in a modern computer language using Matlab, for example.	

10· Learning Outcomes, Teaching, Learning and Assessment Methods

A- Knowledge and Understanding

Al: Understand the basic error analysis techniques.
A2: Understand the basic methods for root approximation.
A3: Understand the basic methods for solving linear systems.
A4: Understand the basic numerical techniques for approximating differentiation.
A5: Understand the basic numerical techniques for approximating integration
A6: Understand the basic numerical techniques for interpolation

B- Subject-specific skills

B1: Compute the absolute, relative, rounding, truncation, and propagation errors.
B2: Solve an algebraic or transcendental equation using an appropriate numerical method.
B3: Solve differential equations using an appropriate numerical method.
B4: Calculate a definite integral using an appropriate numerical method.
B5: Solve real world problems numerically using Matlab.

Teaching and Learning Methods

1. Explain the required term
2. To discuss ideas and share knowledge
3. Methodology and use the text books

Assessment Methods

For the purpose of evaluation is used
1. Method of rapid test and snap
2. Identify some homework
3. Quarterly exams

C- Thinking Skills

C1: Analyze and compare the significance of the different techniques for root approximation.
C2: Analyze and compare the different techniques for solving linear systems
C3: analyze and compare the different techniques for numerical differentiation.
C4: analyze and compare the different techniques for numerical integration.
C5: Prove results for numerical root finding methods.
C6: Understand the basic numerical techniques for interpolation.

Teaching and Learning Methods

1. The teaching method that will be used in this course will be composed of a series of mini lectures interrupted with frequent discussions and brainstorming exercises. Using white board and virtual meeting.

Assessment Methods

For the purpose of evaluation is used
1. Method of rapid test and snap
2. Identify some homework
3. Quarterly exams

D- General and Transferable Skills (other skills relevant to employability and personal development)

Dl: Perform an error analysis for a given numerical method

D2: Discuss and work in a group in order to solve numerical approximation problems.

D3: Discuss and work in a group in order to program numerical solutions using Matlab

D4: Demonstrate developed solutions using programming language.

11· Course Structure

Week	Hours	ILOs	Unit/Module or Topic title	Teaching Method	Assessment Method
1	3	Absolute & relative error	Error analysis	Lectures and discussions	Quizzes, H.W., and exams
2	3	Solving Nonlinear Function f(X)=0: Iteration for Solving f(X)=0 (fixed point iteration), Bracketing Methods for Locating Roots	Finding of roots	Lectures and discussions	Quizzes, H.W., and exams
3	3	Secant, Newton-Raphson and its modified Methods	Finding of roots	Lectures and discussions	Quizzes, H.W., and exams
4	3	Lagrange interpolation, and Newton polynomial	Interpolation	Lectures and discussions	Quizzes, H.W., and exams
5	3	Curve Fitting: Least Squares method	Curve Fitting	Lectures and discussions	Quizzes, H.W., and exams
6	3	Least Squares method in Multiple Linear Regression	Curve Fitting	Lectures and discussions	Quizzes, H.W., and exams
7	3	Numerical Differentiation: Approximating the Derivative, Numerical Differentiation Formulas	Numerical Differentiation	Lectures and discussions	Quizzes, H.W., and exams
8	3	Numerical Integration: Introduction, Composite	Numerical	Lectures and	Quizzes, H.W., and

		Trapezoidal and Simpson's Rule	Integration	discussions	exams
9	3	Modified Trapezoidal and modified Simpson's Rule	Numerical Integration	Lectures and discussions	Quizzes, H.W., and exams
10	3	Solution of Linear Systems AX=B: Introduction, Properties of Vectors and Matrices	Linear System Solutions	Lectures and discussions	Quizzes, H.W., and exams
11	3	Upper-Triangular Linear Systems, Gaussian Elimination and Pivoting, Triangular Factorization	Linear System Solutions	Lectures and discussions	Quizzes, H.W., and exams
12	3	Iterative Methods for Linear System (Jacobi & Gauss Seidel).	Linear System Solutions	Lectures and discussions	Quizzes, H.W., and exams
13	3	Introduction to numerical solution of Diff. Eqs., Euler & modified Euler methods	Numerical solution of Diff. Eqs.	Lectures and discussions	Quizzes, H.W., and exams
14	3	The Runge-Kutta Method for ordinary 1st order Diff. Eqs.	Numerical solution of Diff. Eqs.	Lectures and discussions	Quizzes, H.W., and exams
15	3	Second Order Diff. Eqs: Euler & Runge-Kutta methods for Second Order	Numerical solution of Diff. Eqs.	Lectures and discussions	Quizzes, H.W., and exams

12· Infrastructure	
Required readings: - Core Texts - Course Materials - Other	Advanced Engineering Mathematics By: E. Kreyszig Numerical Methods for Engineers, Education, Graw Hill 2015, by Steven C. Chapra and Raymond P. Cale
Special requirements (include for example workshops, periodicals, IT software, websites)	Matlab tutorials and assigned reading and audio-visual lectures.
Community-based facilities (include for example, guest lectures, internship, field studies)	

13· Admissions	
Pre-requisites	Engineering mathematics and calculus
Minimum number of students	
Maximum number of students	

TEMPLATE FOR COURSE SPECIFICATION

HIGHER EDUCATION PERFORMANCE REVIEW: PROGRAMME REVIEW

COURSE SPECIFICATION

Design synthesis, fundamental principles of standard design elements, mechanical and fluid power elements, formal mechanical design drawing requirements, component specification and optimization.

1. Teaching Institution	Ministry of Higher Education & Scientific Research
2. University Department/Centre	University of Technology /Biomedical Engineering Department
3. Course title/code	**Mechanical Design (ME.G. 144)**
4. Programme (s) to which it contributes	(Biomechanical Branch)
5. Modes of Attendance offered	Google meet + Google classroom full time + online
6. Semester/Year	Third year / Second term – 2020/2021
7. Number of tuition hours (total)	2 theoretical hours + 2 Laboratory hours/ week (total number of hours 60 hours)
8. Date of production/revision of this specification	5/7/2021
9. Aims of the Course	

The main goals of this course are:

1- To understand the design process and to apply the scientific principles and techniques for analyze and solving open-ended design problems of various mechanical components commonly, such as screws, bearings, gears, etc .
2- Apply modeling and design principles to the analysis of an engineering problem.
3- To evaluate the student's ability to work by teams.
4- To grade the student's ability to plan, organize and distribute tasks. Student participation on the design project will be graded according to the fulfillment of the goals above .
5- Each student must have a thorough understanding of the design concepts.

10· Learning Outcomes, Teaching, Learning and Assessment Methods
A- Knowledge and Understanding

Students Upon successful completion of the course, the student will be able:

A1: The student is expected to analyze mechanical systems and select the proper machine elements (bearings, gears, pulleys, screws,…) from commercial catalogs for a required application .

A2: The student is expected to be able to analyze proposed design solutions and suggest modifications and improvements .

A3: The student should be able to execute original designs of machine elements .

B- Subject-specific skills

At the end of the semester, the student should be able to define:

B1: The student should be able to produce design sketches and integrate the designed or selected elements into a working mechanical system.

B2: The student will be able to implement design procedures to perform complete design projects individually and in teams.

B3: The student is expected to communicate the implemented design ideas by performing production drawings, writing technical reports and making oral presentations.

Teaching and Learning Methods

Prepared lectures, Date show, direct explanations on blackboard and bio-medical related video you-tubes.

Assessment Methods

Assessment:

Coursework and quizzes exams (2 written) and homework	10%
Mid Examinations (2hr written exams)	15%
Student Attendances	5%
Coursework reports and Labaratory quizzes exams	25%
Final Examination (3hr written exam)	50%

C- Thinking Skills

C1: A1: Develop an attitude of discovery/innovation/creativity, as demonstrated by students possessing a strong sense of curiosity, asking questions actively, challenging assumptions or engaging in inquiry together with teachers.

C2: Develop the ability/skill needed to discover/innovate/create, as demonstrated by students possessing critical thinking skills to assess ideas, acquiring research skills, synthesizing knowledge across disciplines or applying academic knowledge to self-life problems.

C3: Demonstrate accomplishment of discovery/innovation/creativity through producing /constructing creative works/new artefacts, effective solutions to real-life problems or new processes.

Teaching and Learning Methods

1-Employing the faculty's ability and experience in communicating the scientific material to the student

2- Encouraging the student to discuss, debate and draw conclusions

Assessment Methods
Periodic and final exams (oral questions during lectures, reports and research)

D- General and Transferable Skills (other skills relevant to employability and personal development)

D1: The learner's use of information in real life situations in medical institutions after graduation

D2: Using modern knowledge to develop examination devices within health institutions

D3: Using modern knowledge in preparing national standards for the acceptability of medical devices and biological materials, methods of examination and biological acceptability

D4: Improving writing skills, dialogue skills, and problem solving, using teamwork in all aspects of life.

11· Course Structure

Week	Hours	ILOs	Unit/Module or Topic title	Teaching Method	Assessment Method
(1-2)	2Hrs Theory+ 2Hrs. ANSYS Laboratory	Student understanding of the lecture and achieving its objective	Review in Strength of Materials	Theoretical Lecture	As mentioned above
(3-4)	2Hrs Theory+ 2Hrs. ANSYS Laboratory	Student understanding of the lecture and achieving its objective	Theories of Failure	Theoretical Lecture	As mentioned above
(5)	2Hrs Theory+ 2Hrs. ANSYS Laboratory	Student understanding of the lecture and achieving its objective	Design Under Fluctuating Stresses	Theoretical Lecture	As mentioned above
(6-7)	2Hrs Theory+ 2Hrs. ANSYS Laboratory	Student understanding of the lecture and achieving its objective	Design of Shafts and Shaft Components	Theoretical Lecture	As mentioned above
(8-9)	2Hrs Theory+ 2Hrs. ANSYS	Student understanding of the lecture and achieving	Design of Power Screws	Theoretical Lecture	As mentioned above

	Laboratory	**its objective**			
(10-11)	**2Hrs Theory+ 2Hrs. ANSYS Laboratory**	**Student understanding of the lecture and achieving its objective**	**Design of flat Belts**	**Theoretical Lecture**	**As mentioned above**
(12-13)	**2Hrs Theory+ 2Hrs. ANSYS Laboratory**	**Student understanding of the lecture and achieving its objective**	**Design of Spur and Helical Gears**	**Theoretical Lecture**	**As mentioned above**
(14-15)	**2Hrs Theory+ 2Hrs. ANSYS Laboratory**	**Student understanding of the lecture and achieving its objective**	**Application of Computer Programs in Design of Systems**	**Theoretical Lecture**	**As mentioned above**

12· Infrastructure	
Required readings: - Core Texts - Course Materials - Other	**Recommended Text book** **1- Mechanical Engineering Design, by Joseph E. Shigley & Charles R. Mischke, (McGraw-Hill), 8th edition.** **Reference books** **1 -Machine Design: An Integrated Approach, Robert L. Norton, (Prentice Hall)** **2 -Machine Design Fundamentals (A practical approach) U. Hindhede, J .R. Zimmerman, R.B. Hopkins, R.J. Erisman, W.C. Hull, J.D. Lang, (Prentice Hall)** **3 -Kinematics, Dynamics, and Design of Machinery, Kenneth J. Waldron and Gary L. Kinzer (Wiley)** **4- Fundamentals of Machine Component Design by R.C. Juvinall and K.M. Marshek, 4rd edition, John Wiley & Sons. ISBN: 13 978-0-471-66177-1**
Special requirements (include for example workshops, periodicals, IT software, websites)	**International standards and standards, related YouTube**
Community-based facilities (include for example, guest lectures, internship,	**Nothing**

field studies)	

13· Admissions	
Pre-requisites	Engineering and industrial drawing and AutoCAD drawing program, Engineering Mechanics I & II and Strength of Materials I &II
Minimum number of students	**20**
Maximum number of students	**50**

TEMPLATE FOR COURSE SPECIFICATION

HIGHER EDUCATION PERFORMANCE REVIEW: PROGRAMME REVIEW

COURSE SPECIFICATION

Manufacturing of Medical devices is currently a rapidly growing industry over the past decades. It can be viewed as the application of manufacturing technology to medical devices manufacturing, of which the development processes are often tedious and multidisciplinary, involving advanced 3D modelling, surgical machining, pharmaceutical production and biomechanics .
This course aims to provide the essential knowledge in the medical devices manufacturing development (e.g., material properties, fabrication processes and design techniques for different applications) in order to provide ways to speed up the product development cycle. This course is multidisciplinary and covers the principles in mechanical, chemical, biological, and physiological aspects. Students can learn the techniques to apply the acquired knowledge for particular applications they are interested. Further, this course emphasizes also on inspiring students to discover and convert newly reported technologies into products/services for the future development of medical devices applications.

1. Teaching Institution	Ministry of Higher Education & Scientific Research
2. University Department/Centre	University of Technology /Biomedical Engineering Department
3. Course title/code	**Manufacturing of Medical devices (BME 8103)**
4. Programme (s) to which it contributes	(Biomechanical & Medical Instrumentation Branches)
5. Modes of Attendance offered	Google meet + Canvas+ Google classroom full time + online
6. Semester/Year	Fourth year / Second term – 2020/2021
7. Number of tuition hours (total)	2 theoretical hours + 1 theoretical discussion hour/ week (total number of hours 45 hours)
8. Date of production/revision of this specification	5/7/2021
9. Aims of the Course	

The main goals of this course are:

1-To study and characterize the Manufacturing of Medical devices methods for use in the human body to measure, restore, and improve physical functions and enhance survival and quality of life .

2- To study and characterize the assisting in regenerating, repairing, supporting and replacing defect tissues and esthetic parts.

10· Learning Outcomes, Teaching, Learning and Assessment Methods

A- Knowledge and Understanding

Students Upon successful completion of the course, the student will be able:

A1: Describe the mechanical and biochemical properties of bio-related materials, as well as their major applications as medical devices or other bio-products.

A2: Explain the principles of the fabrication/manufacturing techniques for existing biomedical devices; and identify the manufacturing processes for the biomedical applications

A3: Compare the pros and cons of different bio-materials and their corresponding manufacturing processes.

A4: Select the appropriate bio-related materials and manufacturing processes for specific applications; and apply basic design principles to specific bio-related products.

B- Subject-specific skills

At the end of the semester, the student should be able to define:

B1: Discover and elaborate newly developed technologies related to biomedical manufacturing; and propose a selected technology on how it can be converted to the corresponding biomedical product/service.

B2: Develop an attitude of discovery/innovation/creativity, as demonstrated by students possessing a strong sense of curiosity, asking questions actively, challenging assumptions or engaging in inquiry together with teachers.

B3: Develop the ability/skill needed to discover/innovate/create, as demonstrated by students possessing critical thinking skills to assess ideas, acquiring research skills, synthesizing knowledge across disciplines or applying academic knowledge to self-life problems.

B4: Demonstrate accomplishment of discovery/innovation/creativity through producing /constructing creative works/new artefacts, effective solutions to real-life problems or new processes.

Teaching and Learning Methods

Prepared lectures, Date show, direct explanations on blackboard and bio-medical related video you-tubes.

Assessment Methods

Assessment:

Coursework and quizzes exams (2 written) and homework	10%
Mid Examinations (2hr written exams)	15%

Student Attendances	5%
Coursework reports and quizzes exams	10%
Final Examination (3hr written exam)	40%

C- Thinking Skills

C1: A1: Develop an attitude of discovery/innovation/creativity, as demonstrated by students possessing a strong sense of curiosity, asking questions actively, challenging assumptions or engaging in inquiry together with teachers.

C2: Develop the ability/skill needed to discover/innovate/create, as demonstrated by students possessing critical thinking skills to assess ideas, acquiring research skills, synthesizing knowledge across disciplines or applying academic knowledge to self-life problems.

C3: Demonstrate accomplishment of discovery/innovation/creativity through producing /constructing creative works/new artefacts, effective solutions to real-life problems or new processes.

Teaching and Learning Methods

1-Employing the faculty's ability and experience in communicating the scientific material to the student

2- Encouraging the student to discuss, debate and draw conclusions

Assessment Methods

Periodic and final exams (oral questions during lectures, reports and research)

D- General and Transferable Skills (other skills relevant to employability and personal development)

D1: The learner's use of information in real life situations in medical institutions after graduation

D2: Using modern knowledge to develop examination devices within health institutions

D3: Using modern knowledge in preparing national standards for the acceptability of medical devices and biological materials, methods of examination and biological acceptability

D4: Improving writing skills, dialogue skills, and problem solving, using teamwork in all aspects of life.

11· Course Structure

Week	Hours	ILOs	Unit/Module or Topic title	Teaching Method	Assessment Method
(1-2)	**2Hrs Theory+ 1Hr. Theory Discussion**	**Student understanding of the lecture and achieving its objective**	**LECTURES 1-2 Manufacturing of Medical Devices**	**Theoretical Lecture**	**As mentioned above**

(3-4)	**2Hrs Theory+ 1Hr. Theory Discussion**	**Student understanding of the lecture and achieving its objective**	**LECTURES 3-4 Additive manufacturing and 3D Printing**	**Theoretical Lecture**	**As mentioned above**
(5)	**2Hrs Theory+ 1Hr. Theory Discussion**	**Student understanding of the lecture and achieving its objective**	**LECTURES 1-4 Manufacturing of Medical Devices - Review**	**Theoretical Lecture**	**As mentioned above**
(6-7)	**2Hrs Theory+ 1Hr. Theory Discussion**	**Student understanding of the lecture and achieving its objective**	**LECTURES 5-6 Ceramics and Glass manufacturing**	**Theoretical Lecture**	**As mentioned above**
(8-9)	**2Hrs Theory+ 1Hr. Theory Discussion**	**Student understanding of the lecture and achieving its objective**	**LECTURES 7-8 Micro and Nano Materials Manufacturing Techniques (1)**	**Theoretical Lecture**	**As mentioned above**
(10-11)	**2Hrs Theory+ 1Hr. Theory Discussion**	**Student understanding of the lecture and achieving its objective**	**LECTURES 9-10 Micro and Nano Materials Manufacturing Techniques (2)**	**Theoretical Lecture**	**As mentioned above**
(12-13)	**2Hrs Theory+ 1Hr. Theory Discussion**	**Student understanding of the lecture and achieving its objective**	**LECTURES 11-12 Powder metallurgy**	**Theoretical Lecture**	**As mentioned above**
(14)	**2Hrs Theory+ 1Hr. Theory Discussion**	**Student understanding of the lecture and achieving its objective**	**LECTURES 13-14 Emerging and Future manufacturing**	**Theoretical Lecture**	**As mentioned above**
(15)	**2Hrs Theory+ 1Hr. Theory Discussion**	**Student understanding of the lecture and achieving its objective**	**LECTURES 15 Biomanufacturing**	**Theoretical Lecture**	**As mentioned above**

12· Infrastructure	
Required readings: - Core Texts - Course Materials - Other	**Recommended Text book** **1- Lam, R. H. W., and Chen, W. (2019). Biomedical Devices: Materials, Design and Manufacturing, New York: Springer Publishing.** **Reference books** **1 .Kucklick, T. R. (2012). The Medical Device R&D Handbook, Florida: CRC Press.** **2 .Migonney, V. (2014). Biomaterials, England: John Wiley & Sons, Inc.** **3 .Masataka, Y. (2010). System Design Optimization for Product Manufacturing, London: Springer Publishing.**
Special requirements (include for example workshops, periodicals, IT software, websites)	**International standards and standards, related YouTube**
Community-based facilities (include for example, guest lectures, internship, field studies)	**Nothing**

13· Admissions	
Pre-requisites	Biomaterials, Engineering Mechanics I & II and Strength of Materials I &II
Minimum number of students	**40**
Maximum number of students	**100**

TEMPLATE FOR COURSE SPECIFICATION

HIGHER EDUCATION PERFORMANCE REVIEW: PROGRAMME REVIEW

COURSE SPECIFICATION

This Course Specification provides a concise summary of the main features of the course and the learning outcomes that a typical student might reasonably be expected to achieve and demonstrate if he/she takes full advantage of the learning opportunities that are provided. It should be cross-referenced with the programme specification.

1. Teaching Institution	Ministry of Higher Education & Scientific Research
2. University Department/Centre	Technology University/ Biomedical engineering Department.
3. Course title/code	Nutrition
4. Programme(s) to which it contributes	Joint course
5. Modes of Attendance offered	Full-time + electronic (+ Canvas + Google meet+ Google Classroom).
6. Semester/Year	2021/2020
7. Number of tuition hours (total)	My theory: 2 hours/week total school hours: 30 hours/ year
8. Date of production/revision of this specification	3/7/2021
9. Aims of the Course	
University student definition: 1 - A comprehensive definition of nutrition starting with its importance and negative effects in the event of neglect.2 Definition of large nutrients, types, benefits and harms. 3. Definition of micronutrients, types, benefits and harms. 4. Identify standard methods and guidelines for nutrition. 5. Learn how to balance the body's energy and its relationship with body weight and how to resist different diseases using the right feeding methods.	

10· Learning Outcomes, Teaching, Learning and Assessment Methods

A- Knowledge and Understanding: The student should be able at the end of the semester to identify

A1: What is nutrition and what its benefits and very serious harms are in the event of a defect in that substance.

A2: Develop the necessary skills of the student in identifying the types and branches of nutrition and applying them in daily life to ensure that the individual is healthy.

A3: Emphasize the importance of nutrition and make it a comprehensive educational and health approach that a person depends on during his or her life.

B- Subject-specific skills

B1: The learner should have the ability to analyze and interpret nutrition in all its aspects.

B2: The ability to determine what nutrition is within the living range that a person should enjoy.

B3: The ability to evaluate nutrient types, knows their harms and benefits, and emphasize a person's cognitive and health aspect.

Teaching and Learning Methods

1- Theoretical Lectures.

2 - Group Discussion and Dialogue.

3 - Comparison between applied reality, theoretical study and examples of realism related to the content of each nutrition topic.

Assessment Methods

1- Periodic and quarterly examinations 2 - Duties 3 - Reports and Short Research 4 - Short Tests

C- Thinking Skills

C1: Instilling nutrition in the mind of each student because of its importance in his or her scientific and practical life.

C2: Establishing among the university student that enjoy the practice of all sports curricula in accordance with nutrition and balancing energy and body weight and body resistance from various diseases.

Teaching and Learning Methods

1. Employing the ability of teaching and his experience in delivering the scientific material to the student.

2 - Stimulate the student to discuss, dialogue and conclusion.

Assessment Methods

1- Periodic and final examinations (documented). 2- Oral questions during lectures. 3- reports and research

D- General and Transferable Skills (other skills relevant to employability and personal development)

D1: The learner's use of information and its application in real life situations

D2: The use of knowledge in the implementation of nutrition skills to maintain human health.

D3: Improving nutrition information in order to properly apply it to maintain the healthy lifestyle of the organism

11· Course Structure

Week	Hours	ILOs	Unit/Module or Topic title	Teaching Method	Assessment Method
1	**2**	The student understood the lecture	Introduction for nutrition	Theoretical lecture	Discussion, dialogue and examples used to achieve goals and homework
1	**2**	The student understood the lecture	Lecture on micronutrients, their types and benefits	Theoretical lecture	Discussion, dialogue and examples used to achieve goals and homework
1	**2**	The student understood the lecture	Lecture on macronutrients, their types and benefits	Theoretical lecture	Discussion, dialogue and examples used to achieve goals and homework
1	**2**	The student understood the lecture	Lecture on standard nutrition and guiding methods	Theoretical lecture	Discussion, dialogue and examples used to achieve goals and homework
1	**2**	The student understood the lecture	Lecture on body balance and body weight	Theoretical lecture	Discussion, dialogue and examples used to achieve goals and homework

12· Infrastructure	
Required readings: - Core Texts - Course Materials - Other	1- The Best Fitness and Nutrition Books of 2019, Noma Nazish 2- Human Nutrition - 2020 Edition. Marie Kainoa Fialkowski Revilla, University of Hawai‘i, Mānoa Alan Titchenal, University of Hawai‘i, Mānoa Jennifer Draper, University of Hawai‘i, Mānoa
Special requirements (include for example workshops, periodicals, IT software, websites)	**Nothing**
Community-based facilities (include for example, guest lectures, internship, field studies)	**Nothing**

13· Admissions	
Pre-requisites	Success from the preparatory stage
Minimum number of students	There's no selection.
Maximum number of students	There's no selection.

TEMPLATE FOR COURSE SPECIFICATION

HIGHER EDUCATION PERFORMANCE REVIEW: PERFORMANCE REVIEW

COURSE SPECIFICATION

Biomaterials will concentrate on fundamental principles in biomedical engineering, material science, and chemistry. This course will examine the structure and properties of hard materials (ceramics, metals) and soft materials (polymers, hydrogels).

1. Teaching Institution	Ministry of Higher Education & Scientific Research
2. University Department/Centre	University of Technology
3. Course title/code	**Design and application of biomaterials**
4. Programme(s) to which it contributes	Biomedical Engineering
5. Modes of Attendance offered	Course
6. Semester/Year	2nd / 3ed level
7. Number of tuition hours (total)	4
8. Date of production/revision of this specification	6/7/2021
9. Aims of the Course	
1) Development of global perspective of interdisciplinary issues (biology, materials science, chemistry, and engineering) involved in biomaterials.	
2) Learn how to design, synthesize, evaluate, and analyze biomaterials.	
3) Critical thinking and analysis.	
4) Communication of ideas; communication to coordinate work	

10· Learning Outcomes, Teaching, Learning and Assessment Methods

A- Knowledge and Understanding

A1: apply knowledge of mathematics, science and engineering.
A2: Design and conduct experiments.
A3:Design a system, component, or process to meet desired needs within realistic constraints.

A4:function on multidisc nary teams
A5: identify, formulates, and solve engineering problems.

B- Subject-specific skills

B1: Biomaterials Selection
B2: Solve structural problems in biomaterials
B3: Apply knowledge in real case studies

Teaching and Learning Methods

Theory, Discussions, Exams , Seminars, Case studies

Assessment Methods

C- Thinking Skills

C1: interactive study
C2:Tem work
C3: Make decisions
C4: Ability to solve problems related to biomaterials
C5:
C6:

Teaching and Learning Methods

1.

Assessment Methods

Seminars, Life discussions

D- General and Transferable Skills (other skills relevant to employability and personal development)

D1:
D2:
D3:
D4:
D5:
D6:

11· Course Structure					
Week	**Hours**	**ILOs**	**Unit/Module or Topic title**	**Teaching Method**	**Assessment Method**
1	**2**		Importance of biomaterials	**Theory**	**Seminars**
2	2		General Classes and Structure of Biomaterials	Theory	**Life discussions**
3	2		Physical properties of Biomaterials	Theory	
4	2		Physical properties of Biomaterials	Theory	
5	2		Mechanical properties of Biomaterials	Theory	
6	2		Mechanical properties of Biomaterials	Theory	
7	2		Biomaterial Processing	Theory	
8	2		Surface Properties of Biomaterials	Theory	
9	2		Protein Interactions with Biomaterials	Theory	
10	2		Cell Interactions with Biomaterials	Theory	
11	2		Biomaterial Implantation and Acute Inflammation	Theory	
12	2		Wound Healing in the Presence of Biomaterials	Theory	

13	2		.Immune Response to Biomaterials	Theory	
14	2		Biomaterials corrosion and degradation	Theory	
15	2		Biomaterials corrosion and degradation	Theory	

12· Infrastructure	
Required readings: - Core Texts - Course Materials - Other	1. Biomaterials: The Intersection of Biology and Materials Science, Temenoff and Mikos 2. Buddy D. Ratner, Allan S. Hoffman, Frederick J. Schoen, Jack E. Lemons. Biomaterials Science: An Introduction to Materials in Medicine, Academic Press, 2004, USA 2. Joyce Y. Wong Joseph D.Bronzino "Biomaterials," CRC Press,2007.
Special requirements (include for example workshops, periodicals, IT software, websites)	Videos, seminars
Community-based facilities (include for example, guest lectures, internship, field studies)	Field studies

13· Admissions	
Pre-requisites	Materials science
Minimum number of students	33
Maximum number of students	34

TEMPLATE FOR COURSE SPECIFICATION

HIGHER EDUCATION PERFORMANCE REVIEW: PERFORMANCE REVIEW

COURSE SPECIFICATION

Biomaterials will concentrate on fundamental principles in biomedical engineering, material science, and chemistry. This course will examine the structure and properties of hard materials (ceramics, metals) and soft materials.

1. Teaching Institution	Ministry of Higher Education & Scientific Research
2. University Department/Centre	University of Technology
3. Course title/code	**Biomaterials and biocompatibility**
4. Programme(s) to which it contributes	Biomedical Engineering
5. Modes of Attendance offered	Course
6. Semester/Year	2nd / 2nd level
7. Number of tuition hours (total)	4
8. Date of production/revision of this specification	6/7/2021
9. Aims of the Course	
1) Development of global perspective of interdisciplinary issues (biology, materials science, chemistry, and engineering) involved in biomaterials.	
2) Learn how to design, synthesize, evaluate, and analyze biomaterials.	
3) Critical thinking and analysis.	
4) Communication of ideas; communication to coordinate work	

10· Learning Outcomes, Teaching, Learning and Assessment Methods

A- Knowledge and Understanding

A1: apply knowledge of mathematics, science and engineering.
A2: Design and conduct experiments.
A3:Design a system, component, or process to meet desired needs within realistic constraints.

A4:function on multidisc nary teams
A5: identify, formulates, and solve engineering problems.

B- Subject-specific skills

B1: Biomaterials Selection
B2: Solve structural problems in biomaterials
B3: Apply knowledge in real case studies

Teaching and Learning Methods

Theory, Discussions, Exams , Seminars, Case studies

Assessment Methods

C- Thinking Skills

C1: interactive study
C2:Tem work
C3: Make decisions
C4: Ability to solve problems related to biomaterials
C5:
C6:

Teaching and Learning Methods

1.

Assessment Methods

Seminars, Life discussions

D- General and Transferable Skills (other skills relevant to employability and personal development)

D1:
D2:
D3:
D4:
D5:
D6:

11· Course Structure					
Week	**Hours**	**ILOs**	**Unit/Module or Topic title**	**Teaching Method**	**Assessment Method**
1	**4**		Importance of biomaterials	**Theory+ Exp.**	**Seminars**
2	**4**		General Classes and Structure of Biomaterials	**Theory+ Exp.**	**Life discussions**
3	**4**		Physical properties of Biomaterials	**Theory+ Exp.**	
4	**4**		Physical properties of Biomaterials	**Theory+ Exp.**	
5	**4**		Mechanical properties of Biomaterials	**Theory+ Exp.**	
6	**4**		Mechanical properties of Biomaterials	**Theory+ Exp.**	
7	**4**		Biomaterial Processing	**Theory+ Exp.**	
8	**4**		Surface Properties of Biomaterials	**Theory+ Exp.**	
9	**4**		Protein Interactions with Biomaterials	**Theory+ Exp.**	
10	**4**		Cell Interactions with Biomaterials	**Theory+ Exp.**	
11	**4**		Biomaterial Implantation and Acute Inflammation	**Theory+ Exp.**	
12	**4**		Wound Healing in the Presence of Biomaterials	**Theory+ Exp.**	

13	**4**		.Immune Response to Biomaterials	**Theory+ Exp.**	
14	**4**		Biomaterials corrosion and degradation	**Theory+ Exp.**	
15	**4**		Biomaterials corrosion and degradation	**Theory+ Exp.**	

12· Infrastructure	
Required readings: - Core Texts - Course Materials - Other	1. Biomaterials: The Intersection of Biology and Materials Science, Temenoff and Mikos 2. Buddy D. Ratner, Allan S. Hoffman, Frederick J. Schoen, Jack E. Lemons. Biomaterials Science: An Introduction to Materials in Medicine, Academic Press, 2004, USA 2. Joyce Y. Wong Joseph D.Bronzino "Biomaterials," CRC Press,2007.
Special requirements (include for example workshops, periodicals, IT software, websites)	Videos, seminars
Community-based facilities (include for example, guest lectures, internship, field studies)	Field studies

13· Admissions	
Pre-requisites	Materials science
Minimum number of students	34
Maximum number of students	68

TEMPLATE FOR COURSE SPECIFICATION

HIGHER EDUCATION PERFORMANCE REVIEW: PERFORMANCE REVIEW

COURSE SPECIFICATION

This course will provide an introduction of materials science & engineering topics. 1). The four materials classes (metals, ceramics, polymers, composites) will be addressed with emphasis upon the material types and material properties pertinent to their use in implanted medical devices.
2) The structure and properties of biologic tissues and biocompatibility. 3) Specific implant applications will be addressed

1. Teaching Institution	Ministry of Higher Education & Scientific Research
2. University Department/Centre	University of Technology
3. Course title/code	**Advanced Biomaterials**
4. Programme(s) to which it contributes	Biomedical Engineering/ Biomechanics
5. Modes of Attendance offered	Course
6. Semester/Year	2nd / 3ed level
7. Number of tuition hours (total)	4
8. Date of production/revision of this specification	6/7/2021
9. Aims of the Course	
To introduce undergraduate students to the common types of materials and implant device currently utilized in the surgical practice of medicine.	
To present and discuss the areas of materials science and engineering, which are particularly important to achieve desired implant properties and performance.	
To address the important aspects of biocompatibility that determine how the body responds to implanted materials and devices	
To introduce regulatory and ethical concerns dealing with the implementation and commercialization of biomaterials and medical devices	

10· Learning Outcomes, Teaching, Learning and Assessment Methods

A- Knowledge and Understanding

A1: Advanced application of biomaterials
A2: the basic rules in biomaterials selection
A3: how to solve problems in biomedical application related to biomaterials
A4: Wide range of biomaterials application
A5:
A6:

B- Subject-specific skills

B1: Biomaterials Selection
B2: Solve structural problems in biomaterials
B3: Apply knowledge in real case studies

Teaching and Learning Methods

Theory, Discussions, Exams , Seminars, Case studies

Assessment Methods

C- Thinking Skills

C1: interactive study
C2:Tem work
C3: Make decisions
C4: Ability to solve problems related to biomaterials
C5:
C6:

Teaching and Learning Methods

1.

Assessment Methods

Seminars, Life discussions

D- General and Transferable Skills (other skills relevant to employability and personal development)

D1:

D2:

D3:

D4:

D5:

D6:

11· Course Structure

Week	Hours	ILOs	Unit/Module or Topic title	Teaching Method	Assessment Method
1	**4**		Review about application of biomaterials	**Theory+ Exp.**	**Seminars**
2	**4**		Hydrogels, Smart Polymers	**Theory+ Exp.**	**Life discussions**
3	**4**		Medical Fibers and Biodegradable materials	**Theory+ Exp.**	
4	**4**		Biodegradable materials, Natural materials	**Theory+ Exp.**	
5	**4**		Natural materials, Surface Modification	**Theory+ Exp.**	
6	**4**		Metallic biomaterials	**Theory+ Exp.**	
7	**4**		Ceramics and Glasses biomaterials	**Theory+ Exp.**	
8	**4**		Composites biomaterials	**Theory+ Exp.**	
9	**4**		Composites biomaterials	**Theory+ Exp.**	

10	**4**		Orthodontics Biomaterials for	**Theory+ Exp.**	
11	**4**		Functionally graded biomaterials	**Theory+ Exp.**	
12	**4**		Bone reconstruction and replacement biomaterials	**Theory+ Exp.**	
13	**4**		Dental Biomaterials	**Theory+ Exp.**	
14	**4**		Smart biomaterials I	**Theory+ Exp.**	
15	**4**		Smart biomaterials II	**Theory+ Exp.**	

12· Infrastructure	
Required readings: - Core Texts - Course Materials - Other	1. Biomaterials: The Intersection of Biology and Materials Science, Temenoff and Mikos 2. Buddy D. Ratner, Allan S. Hoffman, Frederick J. Schoen, Jack E. Lemons. Biomaterials Science: An Introduction to Materials in Medicine, Academic Press, 2004, USA 2. Joyce Y. Wong Joseph D.Bronzino "Biomaterials," CRC Press,2007.
Special requirements (include for example workshops, periodicals, IT software, websites)	Videos, seminars
Community-based facilities (include for example, guest lectures, internship, field studies)	Field studies

13· Admissions	
Pre-requisites	Design and application of biomaterials course
Minimum number of students	30
Maximum number of students	34

TEMPLATE FOR COURSE SPECIFICATION

HIGHER EDUCATION PERFORMANCE REVIEW: PROGRAMME REVIEW

COURSE SPECIFICATION

This Course Specification provides a concise summary of the main features of the course and the learning outcomes that a typical student might reasonably be expected to achieve and demonstrate if he/she takes full advantage of the learning opportunities that are provided. It should be cross-referenced with the programme specification.

1. Teaching Institution	Ministry of Higher Education & Scientific Research
2. University Department/Centre	University of Technology/ Biomedical Engineering Department
3. Course title/code	**Engineering Analysis**
4. Programme(s) to which it contributes	BM & IM
5. Modes of Attendance offered	Virtual Attendance
6. Semester/Year	I semester/3rd year
7. Number of tuition hours (total)	45 hours semester
8. Date of production/revision of this specification	6/12/2020
9. Aims of the Course	
1. understand the role of mathematics in solving the engineering problems	
2. Introduce Mathematical concepts essential to the solve the differential equation in engineering systems	
3. Apply basic concepts of discrete engineering system of equations in different applications	

10· Learning Outcomes, Teaching, Learning and Assessment Methods

A- Knowledge and Understanding

A1: ability to apply knowledge in math and science in engineering fields of biomedical engineering applications

A2: collect the necessary science in various disciplines related to biomedical engineering

A3: prepare students for the continuation of the self-learning and the collection of new technologies and skills in the field of biomedical engineering

A4: building skills by following the correct procedures

B- Subject-specific skills

B1: Ability to pick and hold the required examinations and the collection, comparison and analysis of test results

B2: Ability to derive and solve engineering problems related to the topics of biomedical engineering

Teaching and Learning Methods

The teaching method that will be used in this course will be composed of a series of mini lectures interrupted with frequent discussions and brainstorming exercises. Using white board and Data show

Assessment Methods

1. Method of rapid test and snap
2. Identify some homework
3. Quarterly exams

C- Thinking Skills

C1. Analyze problems involving differential equations and its applications

C2. Study the solution properties of discreet and continuous field problems

C3. Apply different mathematical models to describe some biomedical applications.

Teaching and Learning Methods

1. Explain the required term
2. To discuss ideas and share knowledge
3. Methodology and use the text books

Assessment Methods

For the purpose of evaluation is used

1. Method of rapid test and snap
2. Identify some homework
3. Quarterly exams

D- General and Transferable Skills (other skills relevant to employability and personal development)

D1: Ability to analyze the complex function problems.

D2: Ability to analyze and solve the differential equations using Laplace transform

D3: Ability to analyze and solve the discrete (discontinuous) functions

D4: Ability to analyze and solve Z- transform problems

D5: Ability to analyze and solve the Fourier series and Fourier transform problems

D6: Ability to analyze and solve the partial differential equations

11· Course Structure

Week	Hours	ILOs	Unit/Module or Topic title	Teaching Method	Assessment Method
1	3	Introduction to complex functions	Complex analysis	Lectures and discussions	Quizzes, H.W., and exams
2	3	Applications of complex functions	Complex analysis	Lectures and discussions	Quizzes, H.W., and exams
3	3	Laplace transform (Defined and applied to basic functions)	Laplace transform	Lectures and discussions	Quizzes, H.W., and exams
4	3	Inverse Laplace transform (Defined and applied to basic functions)	Laplace transform	Lectures and discussions	Quizzes, H.W., and exams
5	3	Solving ODEs using Laplace transform	Laplace transform	Lectures and discussions	Quizzes, H.W., and exams
6	3	Solving simultaneous ODEs using Laplace transform	Laplace transform	Lectures and discussions	Quizzes, H.W., and exams
7	3	Solving of step function in Laplace transform	Laplace transform	Lectures and discussions	Quizzes, H.W., and exams
8	3	Solving of periodic function in Laplace	Laplace transform	Lectures and	Quizzes, H.W., and

		transform		**discussions**	**exams**
9	**3**	**Introduction to Z-Transform and its applications**	**Z-Transform**	**Lectures and discussions**	**Quizzes, H.W., and exams**
10	**3**	**Solving Recurrence relations in Z-Transform**	**Z-Transform**	**Lectures and discussions**	**Quizzes, H.W., and exams**
11	**3**	**Introduction to Fourier series**	**Fourier series**	**Lectures and discussions**	**Quizzes, H.W., and exams**
12	**3**	**Even and Odd functions**	**Fourier series**	**Lectures and discussions**	**Quizzes, H.W., and exams**
13	**3**	**Fourier transform (definition and applications**	**Fourier series**	**Lectures and discussions**	**Quizzes, H.W., and exams**
14	**3**	**One dimensional partial differential equations**	**Partial differential equations**	**Lectures and discussions**	**Quizzes, H.W., and exams**
15	**3**	**Two dimensional partial differential equations**	**Partial differential equations**	**Lectures and discussions**	**Quizzes, H.W., and exams**

12· Infrastructure	
Required readings: - Core Texts - Course Materials - Other	**Advanced Engineering Mathematics By: E. Kreyszig** **Advanced Engineering Mathematics By: C. Ray Wylie**
Special requirements (include for example workshops, periodicals, IT software, websites)	**Virtual meetings**
Community-based facilities (include for example, guest lectures, internship, field studies)	

13· Admissions	
Pre-requisites	Engineering mathematics and calculus
Minimum number of students	
Maximum number of students	

TEMPLATE FOR COURSE SPECIFICATION

HIGHER EDUCATION PERFORMANCE REVIEW: PROGRAMME REVIEW

COURSE SPECIFICATION

Addresses a unique rule of biomaterial in medical device design and the use of emerging biomaterials technology in medical device. The need to understand design requirements of medical devices based on safety and efficacy will be addressed. An expected device failure due to synergistic interactions from chronic loading, aqueous environments and biologic interactions. Testing methodologies to assess accelerated effects of loading in physiologic-like environments. Evaluate biomaterials and their properties as related to design and reliability of medical devices.
Design of various biomedical systems and devices such as cardiovascular assist devices ،orthopaedic devices, pulmonary assist devices, neurological devices, and diagnostic
systems.

1. Teaching Institution	Ministry of Higher Education & Scientific Research
2. University Department/Centre	University of Technology /Biomedical Engineering Department
3. Course title/code	**Design of Medical Devices (BME 450)**
4. Programme (s) to which it contributes	(Biomechanical and Medical Instrumentation Branches)
5. Modes of Attendance offered	Google meet + Google classroom full time + online
6. Semester/Year	Fourth year / Second term – 2020/2021
7. Number of tuition hours (total)	2 theoretical hours + 2 Laboratory hours/ week (total number of hours 60 hours)
8. Date of production/revision of this specification	5/7/2021
9. Aims of the Course	

The main goals of this course are:

1- This course is designed to provide the student with an introduction to systems and devices used in the biomedical industry and the basic principles of their design.

2- It is meant to offer the students an application in the biomedical area to the basic theory developed in the lower level course work as well as an opportunity to learn basic steps and processes involved in engineering design as it specifically applies to biomedical problems.

3-Global Learning principles will be integrated into the course work through the use of international standards ،multicultural marketing and design considerations, societal and environmental considerations, as well as ethics and sustainability.

10· Learning Outcomes, Teaching, Learning and Assessment Methods

A- Knowledge and Understanding

Students Upon successful completion of the course, the student will be able:

A1: Ability to apply the principles of engineering design from recognition of need to a fully-tested product.

A2 .Ability to organize and manage a design project and work effectively in a team to complete the project.

A3 .Ability to recognize the existence, similarities and differences of various regulatory processes for assessment and approval for commercialization of biomedical devices and systems in national and the global markets.

A4 .Ability to apply knowledge of natural physiological systems to the design of their replacements and to devise means to overcome constraints in doing so.

A5 .Ability to design and conduct tests to verify design input and validate the final product to meet user needs.

A6 .Ability to Communicate items 1 through 5 in written, oral and graphical form.

A7 .Students will learn the process to formulate and present an engineered solution which will directly or indirectly enable or enhance the diagnosis or treatment of a current unresolved issue of global biomedical significance.

A8 .Ability to implement the design tools (i.e. QFD, FMECA, budget analysis, cost analysis, simulations, prototyping and verification testing) effectively toward assessment, development and verification of a Biomedical system, Device or manufacturing process which will address global clinical needs diagnostically or therapeutically.

B- Subject-specific skills

At the end of the semester, the student should be able to define:

B1: The student will be able to identify, analyze and integrate ethics, similarities and differences in multiple markets and cultures.

B2: Students will be able to conduct an analysis of an engineering problem and its global impact by identifying different factors such as technology, economics and society، and their contributions to the problem and/or solution.

B2: Students will be willing to work in teams to develop solutions, actions, and action plans to address local, global and /or international engineering problems.

Teaching and Learning Methods

Prepared lectures, Date show, direct explanations on blackboard and bio-medical related video you-tubes.

Assessment Methods

Assessment:

Coursework and quizzes exams (2 written) and homework	10%
Mid Examinations (2hr written exams)	15%
Student Attendances	5%
Coursework reports and Labaratory quizzes exams	25%
Final Examination (3hr written exam)	50%

C- Thinking Skills

C1: A1: Develop an attitude of discovery/innovation/creativity, as demonstrated by students possessing a strong sense of curiosity, asking questions actively, challenging assumptions or engaging in inquiry together with teachers.

C2: Develop the ability/skill needed to discover/innovate/create, as demonstrated by students possessing critical thinking skills to assess ideas, acquiring research skills, synthesizing knowledge across disciplines or applying academic knowledge to self-life problems.

C3: Demonstrate accomplishment of discovery/innovation/creativity through producing /constructing creative works/new artefacts, effective solutions to real-life problems or new processes.

Teaching and Learning Methods

1-Employing the faculty's ability and experience in communicating the scientific material to the student

2- Encouraging the student to discuss, debate and draw conclusions

Assessment Methods

Periodic and final exams (oral questions during lectures, reports and research)

D- General and Transferable Skills (other skills relevant to employability and personal development)

D1: The learner's use of information in real life situations in medical institutions after graduation

D2: Using modern knowledge to develop examination devices within health institutions

D3: Using modern knowledge in preparing national standards for the acceptability of medical devices and biological materials, methods of examination and biological acceptability

D4: Improving writing skills, dialogue skills, and problem solving, using teamwork in all aspects of life.

11· Course Structure

Week	Hours	ILOs	Unit/Module or Topic title	Teaching Method	Assessment Method
(1-2)	2Hrs Theory+ 2Hrs. ANSYS Laboratory	Student understanding of the lecture and achieving its objective	Risk management ·	Theoretical Lecture	As mentioned above
(3-4)	2Hrs Theory+ 2Hrs. ANSYS Laboratory	Student understanding of the lecture and achieving its objective	Device reliability ·	Theoretical Lecture	As mentioned above
(5)	2Hrs Theory+ 2Hrs. ANSYS Laboratory	Student understanding of the lecture and achieving its objective	Device durability ·	Theoretical Lecture	As mentioned above
(6-7)	2Hrs Theory+ 2Hrs. ANSYS Laboratory	Student understanding of the lecture and achieving its objective	Device maintainability ·	Theoretical Lecture	As mentioned above
(8-9)	2Hrs Theory+ 2Hrs. ANSYS Laboratory	Student understanding of the lecture and achieving its objective	Device serviceability ·	Theoretical Lecture	As mentioned above
(10-11)	2Hrs Theory+ 2Hrs. ANSYS Laboratory	Student understanding of the lecture and achieving its objective	Human factors engineering ·	Theoretical Lecture	As mentioned above
(12-13)	2Hrs Theory+ 2Hrs. ANSYS Laboratory	Student understanding of the lecture and achieving its objective	Software engineering ·	Theoretical Lecture	As mentioned above
(14-15)	2Hrs Theory+ 2Hrs. ANSYS Laboratory	Student understanding of the lecture and achieving its objective	Clinical evaluations	Theoretical Lecture	As mentioned above

12· Infrastructure	
Required readings: - Core Texts - Course Materials - Other	**Recommended Text book** **1- Reliable Design of Biomedical Devices, Second Edition (Richard Fries) by Taylor &Francis Group (ISBN 0-8247-2375-9) or (978082472370)** **Reference books** **1- Does Cultures Matter for Product Design, By Don Norman** **2-The Influence of Designers' own Culture on the Design Aspects of products, By Mohammad Tazzaghi and Mariano Ramirez J** **3-Medical Device Developments** **www.medicaldevice-developments.com** **4- Beyond Compliance: Medical Device Product Development** **https://ww2.frost.com/files/3914/2200/7195/Beyond_Compliance.pdf** **5-International Medical Device Regulators Forum (IMDRF)** **https://www.fda.gov/MedicalDevices/InternationalPrograms/IMDRF.../** **6- WHO | Medical devices www.who.int › Medical devices**
Special requirements (include for example workshops, periodicals, IT software, websites)	**International standards and standards, related YouTube**
Community-based facilities (include for example, guest lectures, internship, field studies)	**Nothing**

13· Admissions	
Pre-requisites	Engineering and industrial drawing and AutoCAD drawing program, Engineering Mechanics I & II and Strength of Materials I &II
Minimum number of students	**20**
Maximum number of students	**50**

TEMPLATE FOR COURSE SPECIFICATION

HIGHER EDUCATION PERFORMANCE REVIEW: PROGRAMME REVIEW

COURSE SPECIFICATION

This course provides a description of the most important modern methods of biomaterials inspections to encompasses the assessment of their safety and performance. As stated in FDA's Medical Device User Fee Act (MDUFA) and EU Regulation on Medical Devices, safety and performance of medical devices are of equal importance.

A wide range of in vitro and in vivo tests may be used to evaluate cytotoxicity, genotoxicity, pyrogenicity, local effects following implantation, hemocompatibility, sensitization potential and systemic toxic effects of biomaterials. If further information on the carcinogenicity or reproductive/developmental toxicity is published, they will also be considered. In very rare cases, additional tests are also carried out if required by regulators.

1. Teaching Institution	Ministry of Higher Education & Scientific Research
2. University Department/Centre	University of Technology /Biomedical Engineering Department
3. Course title/code	**Biomaterials inspections**
4. Programme (s) to which it contributes	(Medical Instrumentation Branch)
5. Modes of Attendance offered	Google meet + Canvas+ Google classroom full time + online
6. Semester/Year	Third year / Second term – 2020/2021
7. Number of tuition hours (total)	2 theoretical hours + 2 laboratory hours (total number of hours + 60 hours)
8. Date of production/revision of this specification	5/7/2021
9. Aims of the Course	

The main goals of this course are:

1 .Describe the mechanical, chemical, and biological properties of medicinal and biological materials, as well as their main applications as biomaterials or other biological products.

2 .Explain the principles of testing techniques for existing biomaterials.

3. Comparison between the pros and cons of different biomaterials and the appropriate examination methods for them.

4. To study and characterize the natural and artificial and natural materials testing methods for use in the human body to measure, restore, and improve physical functions and enhance survival and quality of life.

5. To study and characterize the assisting in regenerating, repairing, supporting and replacing defect tissues and esthetic parts.

10· Learning Outcomes, Teaching, Learning and Assessment Methods

A- Knowledge and Understanding

Students Upon successful completion of the course, the student will be able:

A1: Differentiate the various classes of biomaterials inspections.

A2: Differentiate the various analytical methods used to characterize biomaterials properties.

A3: Differentiate the various biomedical devices components inspection methods.

A4: Describe various aspects of biomedical device design, fabrication and testing.

B- Subject-specific skills

B1: Select the appropriate bio-related testing method for specific applications.

B2: Definition of institutions related to biological materials and modern examination methods

B3: Defining the relevant institutions of the most important international institutions that are concerned with setting standards for the acceptability of biological materials and modern examination methods.

Teaching and Learning Methods

Prepared lectures, Date show, direct explanations on blackboard and bio-medical related video you-tubes.

Assessment Methods

Assessment:

Coursework and quizzes exams (2 written) and homework	5%
Mid Examinations (2hr written exams)	15%
Student Attendances	5%
Laboratory coursework reports and quizzes exams	25%
Final Examination (3hr written exam)	50%

C- Thinking Skills

C1: A1: Develop an attitude of discovery/innovation/creativity, as demonstrated by students possessing a strong sense of curiosity, asking questions actively, challenging assumptions or engaging in inquiry together with teachers.

C2: Develop the ability/skill needed to discover/innovate/create, as demonstrated by students possessing critical thinking skills to assess ideas, acquiring research skills, synthesizing knowledge across disciplines or applying academic knowledge to self-life problems.

C3: Demonstrate accomplishment of discovery/innovation/creativity through producing /constructing creative works/new artefacts, effective solutions to real-life problems or new processes.

Teaching and Learning Methods

1-Employing the faculty's ability and experience in communicating the scientific material to the student

2- Encouraging the student to discuss, debate and draw conclusions

Assessment Methods

Periodic and final exams (oral questions during lectures, reports and research)

D- General and Transferable Skills (other skills relevant to employability and personal development)

D1: The learner's use of information in real life situations in medical institutions after graduation

D2: Using modern knowledge to develop examination devices within health institutions

D3: Using modern knowledge in preparing national standards for the acceptability of medical devices and biological materials, methods of examination and biological acceptability

D4: Improving writing skills, dialogue skills, and problem solving, using teamwork in all aspects of life.

11· Course Structure

Week	Hours	ILOs	Unit/Module or Topic title	Teaching Method	Assessment Method
(1-2)	2Hrs Theory+ 2Hrs Lab.	Student understanding of the lecture and achieving its objective	LECTURE (1) INTRODUCTION	Theoretical Lecture	As mentioned above
(3-4)	2Hrs Theory+ 2Hrs Lab.	Student understanding of the lecture and achieving	LECTURES (2-3) PROPERTIES AND INSPECTIONS OF	Theoretical Lecture	As mentioned above

		its objective	**BIOMATERIALS**		
(5)	**2Hrs Theory+ 2Hrs Lab.**	**Student understanding of the lecture and achieving its objective**	**LECTURE (4) Nondestructive Testing**	**Theoretical Lecture**	**As mentioned above**
(6-7)	**2Hrs Theory+ 2Hrs Lab.**	**Student understanding of the lecture and achieving its objective**	**LECTURES (5-6) BIOLOGICAL TESTING OF BIOMATERIALS (Invitro Tests)**	**Theoretical Lecture**	**As mentioned above**
(8-9)	**2Hrs Theory+ 2Hrs Lab.**	**Student understanding of the lecture and achieving its objective**	**LECTURES (7-8) In Vivo Assessment of Tissue Compatibility (1)**	**Theoretical Lecture**	**As mentioned above**
(10-11)	**2Hrs Theory+ 2Hrs Lab.**	**Student understanding of the lecture and achieving its objective**	**LECTURE (9-11) In Vivo Assessment of Tissue Compatibility (2)**	**Theoretical Lecture**	**As mentioned above**
(12-13)	**2Hrs Theory+ 2Hrs Lab.**	**Student understanding of the lecture and achieving its objective**	**LECTURES (12-13) Basic Toxicology**	**Theoretical Lecture**	**As mentioned above**
(14-15)	**2Hrs Theory+ 2Hrs Lab.**	**Student understanding of the lecture and achieving its objective**	**Lecture (14-15) Inspection of Blood-Material Interactions**	**Theoretical Lecture**	**As mentioned above**

12· Infrastructure	
Required readings: - Core Texts - Course Materials - Other	**Recommended Text book** **1 -Jeff D. Berg," MECHANICAL TESTING DEVICE FOR VISCOELASTIC BIOMATERIALS" University of Nebraska – Lincoln, 2010.** **Reference books**

	1-Dr. Bree M. Sharratt "Non-Destructive Techniques and Technologies for Qualification of Additive Manufactured Parts and Processes", DRDC-RDDC-2015-C035. March 2015 . **2-Mohammed Omar, "NONDESTRUCTIVE TESTING METHODS ANDNEW APPLICATIONS", Janeza Trdine 9, 51000 Rijeka, Croatia,2012.**
Special requirements (include for example workshops, periodicals, IT software, websites)	**International standards and standards, related YouTube**
Community-based facilities (include for example, guest lectures, internship, field studies)	**Nothing**

13· Admissions	
Pre-requisites	Biomaterials, Engineering Mechanics I & II and Strength of Materials I &II
Minimum number of students	**20**
Maximum number of students	**50**

TEMPLATE FOR COURSE SPECIFICATION

HIGHER EDUCATION PERFORMANCE REVIEW: PROGRAMME REVIEW

COURSE SPECIFICATION

Basic properties and concepts of fluid and solid mechanics are introduced in static and flow with problems and applied to the analysis of blood flow in the macro and microcirculation, and to other physiological flows. The viscosity, surface tension capillary action and its applications. Analysis of mathematical models is combined with discussions of physiological mechanisms. Energy equations, Bernolles equation, viscous flow analyses and pulsate flow.

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1. Teaching Institution	Ministry of Higher Education & Scientific Research
2. University Department/Centre	University of Technology/ Biomedical Engineering Department
3. Course title/code	Bio-fluid mechanics/ BME
4. Programme(s) to which it contributes	general
5. Modes of Attendance offered	Virtual Attendance
6. Semester/Year	II semester /2nd year
7. Number of hours tuition (total)	60 hours semester
8. Date of production/revision of this Specification	6/12/2020
9. Aims of the Course	
1. understand the role of physiological fluid mechanics in Biomedical Engineering	
2. Introduce fluid concepts essential to the understanding of biofluid mechanics and physiological fluid mechanics	
3. Apply basic concepts in fluid mechanics to clinical fluid dynamic measurements	

10· Learning Outcomes, Teaching ,Learning and Assessment Method

A- Knowledge and Understanding

A1. Revisit Basic Concepts in Fluid Mechanics and Study the kinematics of Fluid Flow
A2. Apply hydrostatics equations to clinical applications
A3. Apply conservation relations to fluid flow and Difference between viscid and inviscid flow
A4. Analyze the flow properties of blood, and blood vessel structure

B. Subject-specific skills

B1. Explain the different models of Biofluid and blood flow
B2. Apply Poiseuilli's Law to the study of Blood Flow
B3. Introduce the different classes of Non-Newtonian fluids
B4. Study the operation of heart valves and its relation to blood flow in arteries

Teaching and Learning Methods

The teaching method that will be used in this course will be composed of a series of mini lectures interrupted with frequent discussions and brainstorming exercises. Using white board and virtual meeting.

Assessment methods

For the purpose of evaluation is used

1. Method of rapid test and snap
2. Identify some homework
3. Quarterly exams

C. Thinking Skills

C1. Analyze problems involving circulatory biofluid mechanics and blood rheology
C2. Study the flow properties of blood and their relation to blood vessel structure
C3. Apply different mathematical models to describe the behavior of viscous fluids flow

Teaching and Learning Methods

1. Explain the required term
2. To discuss ideas and share knowledge
3. Methodology and use the text books

Assessment methods

D. General and Transferable Skills (other skills relevant to employability and personal development).

D1. Experimental test in laboratory.
D2. Reports set related to the theoretical objects

11. Course Structure					
Week	Hours	ILOs	Unit/Module or Topic Title	Teaching Method	Assessment Method
2nd semester					
1	4	- Introduction to Physiological Fluid Mechanics	Introduction &Basic concepts	Explain of theoretical subjects	Quiz. H.W exam and Ex. Reports
2	4	Kinematics of Fluid Flow, Hydrostatics - Conservation Relations	Fluid kinematics	Explain of theoretical subjects with examples	Quiz. H.W exam and Ex. Reports
3	4	Viscous Flow	Viscous Flow	Explain of theoretical subjects with examples	Quiz. H.W exam and Ex. Reports
4	4	- Unsteady Flow	Unsteady Flow	Explain and derive the related eqs.	Quiz. H.W exam and Ex. Reports
5	4	- Analysis of Total Peripheral Flow	Peripheral Flow	Explain and derive the related eqs.	Quiz. H.W exam and Ex. Reports
6	4	- Circulatory Biofluid Mechanics	Biofluid Circulatory	Explain and derive the related eqs.	Quiz. H.W exam and Ex. Reports
7	4	- Flow Properties of Blood	Blood flow	Explain and derive the related eqs.	Quiz. H.W exam and Ex. Reports
8	4	-Clinical Fluid Dynamic Measurements	Measurements	Explain and derive the related eqs.	Quiz. H.W exam and Ex. Reports
9	4	- Blood Vessel Structure	Blood Vessel Structure	Explain and derive the related eqs.	Quiz. H.W exam and Ex. Reports
10	4	- Applications of Poiseuilli's Law	Poiseuilli's Law	Explain and derive the related eqs	Quiz. H.W exam and Ex. Reports
11	4	Introduction to Non-Newtonian Fluids	Non-Newtonian Fluids	Explain and derive the related eqs	Quiz. H.W exam and Ex. Reports
12	4	- Operation of Heart Valves	Heart Valves	Explain and derive the related eqs	Quiz. H.W exam and Ex. Reports
13	4	- Shear Stress on Vessel Wall	Vessel Wall	Explain and derive the related eqs	Quiz. H.W exam and Ex. Reports
14	4	- Blood Vessel Bifurcation	- Blood Vessel Bifurcation	Explain and derive the related eqs	Quiz. H.W exam and Ex. Reports
15	4	Respiration and lungs function	Respiration	Explain and derive the related eqs	Quiz. H.W exam and Ex. Reports

12. Infrastructure	
Required reading: · CORE TEXTS · COURSE MATERIALS · OTHER	Lighthill, J. "Physiological Fluid Mechanics." Springer-Verlag. Hellums, J. and Brown, C. "Cardiovascular Fluid Dynamics." University Press Fung, Y.C. (1996). "Biomechanics: Properties of Living Tissues." Springer-Verlag Fung, Y.C. (1993). "First Course in Continuum Mechanics of Physical and Biological Engineers and Scientists." 3rd Ed. Prentice-Hall.
Special requirements (include for example workshops, periodicals, IT software, websites)	Experimental apparatus in fluid mechanics laboratory for perform experimental test
Community-based facilities (include for example, guest Lectures , internship , field studies)	

13. Admissions	
Pre-requisites	Fundamental basic concepts and applications of physics and Engineering mathematics.
Minimum number of students	95
Maximum number of students	101

TEMPLATE FOR COURSE SPECIFICATION

HIGHER EDUCATION PERFORMANCE REVIEW: PROGRAMME REVIEW

COURSE SPECIFICATION

Study of biotribology aim to gather information about friction, adhesion, lubrication and wear of systems, surface contact area. Friction theories, wear theories, wear in practical. Experimental methods Also The thermal and hydrolytic sensitivities of biological materials limit their applicability in many important synthetic materials applications. lubrication theories, tribology in biological systems and instruments.

1. Teaching Institution	Ministry of Higher Education & Scientific Research
2. University Department/Centre	University of Technology/ Biomedical Engineering Department
3. Course title/code	biotribology/ BME
4. Programme(s) to which it contributes	BM
5. Modes of Attendance offered	Virtual Attendance
6. Semester/Year	II semester/ 4th year
7. Number of hours tuition (total)	60 hours semester
8. Date of production/revision of this Specification	6/12/2020
9. Aims of the Course	
1. Understand the fundamental mechanisms of friction, laws and simple theories.	
2. Describe the laws and simple theories of wear, the basic mechanisms and phenomena of wear, and theories of lubrication.	
3. Appreciate the consequences of friction and wear on different types of biomaterials of implants	

10· Learning Outcomes, Teaching ,Learning and Assessment Method

A- Knowledge and Understanding

A1. Revision the Basic Concepts in biotribology and Study the surface science.
A2. Apply lubrication methods to human joints
A3. Apply and analysis of human joints.
A4. Analyze the artificial joints and their biomaterials.

B. Subject-specific skills

B1. Explain the different models of friction
B2. Apply types of friction and materials used in joints.
B3. Introduce the different human joints.

Teaching and Learning Methods

The teaching method that will be used in this course will be composed of a series of mini lectures interrupted with frequent discussions and brainstorming exercises. Using white board and Data show

Assessment methods

For the purpose of evaluation is used

1. Method of rapid test and snap
2. Identify some homework
3. Quarterly exams

C. Thinking Skills

C1. Analyze problems involving friction and surface nature.
C2. Study the joint types
C3. Study the types of materials and implants

Teaching and Learning Methods

1. Explain the required term
2. To discuss ideas and share knowledge
3. Methodology and use the text books

Assessment methods

D. General and Transferable Skills (other skills relevant to employability and personal development).

D1. Experimental test in laboratory.
D2. Reports set related to the theoretical objects

11. Course Structure					
Week	Hours	ILOs	Unit/Module or Topic Title	Teaching Method	Assessment Method
2nd semester					
1	4	Introduction to Bio-Tribology: Friction, Surface Roughness and Finishing, Lubrication ,Synovial Membrane, theories of lubrication	Introduction to Bio-Tribology:,	Explain of theoretical subjects	Quiz. H.W exam and Ex. Reports
2	4	Wear, mechanisms of wear Adhesive, Abrasive, Fatigue, Linear wear, Volumetric wear, Wear testing, Wear rate, Laws of wear, Corrosion,	Wear, mechanisms, , , Corrosion Types	Explain of theoretical subjects with examples	Quiz. H.W exam and Ex. Reports
3	4	The structure, friction and wear of natural joints, types of implants, (cemented and cementless), biomaterials of joint replacements,	The structure, friction and wear of natural joints, materials.	Explain of theoretical subjects with examples	Quiz. H.W exam and Ex. Reports
4	4	Implant geometry, Manufacturing methods and metallurgy, Tribology of metal-on-metal bearings, Effects of material and design on the	Implant geometry, Manufacturing methods and metallurgy, Tribology	Explain and derive the related eqs.	Quiz. H.W exam and Ex. Reports
5	4	Metal alloys in joint replacements, stainless steel, cobalt, nickel,	Metal alloys in joint replacements,	Explain and derive the	Quiz. H.W exam and Ex.
6	4	Titanium (Ti) Alloys, Biotribological properties of	Titanium (Ti) Alloys, Biotribological	Explain and derive the	Quiz. H.W exam and Ex.
7	4	Ceramic evolution and internal/surface treatments to use in	Ceramic evolution and internal/surface	Explain and derive the	Quiz. H.W exam and Ex.
8	4	Diamond, bioglass, Bioactive ceramics and glasses as coatings to improve bone bonding,	Diamond, bioglass, Bioactive ceramics and glasses as	Explain and derive the related eqs.	Quiz. H.W exam and Ex. Reports
9	4	Polymer evolution and internal/surface treatments,	Polymer evolution and internal/surface	Explain and derive the	Quiz. H.W exam and Ex.
10	4	Effects of temperature on performance of artificial joints,	Effects of temperature on	Explain and derive the	Quiz. H.W exam and Ex.
11	4	Experimental Wear Studies of Total Joint Replacements, Methods	Experimental Wear Studies of Total Joint	Explain and derive the	Quiz. H.W exam and Ex.
12	4	Design of Artificial Joints: Shoulder joints and its	Design of Artificial Joints	Explain and derive the	Quiz. H.W exam and Ex.
13	4	Wrist joints and its replacements, Finger joint and its replacements	Design of Artificial Joints	Explain and derive the	Quiz. H.W exam and Ex.
14	4	Hip joints and its replacements, Knee joint and its replacements,	Design of Artificial Joints	Explain and derive the	Quiz. H.W exam and Ex.
15	4	Revision	Revision	Explain and derive the	Quiz. H.W exam and Ex.

12. Infrastructure	
Required reading: · CORE TEXTS · COURSE MATERIALS · OTHER	1. J. Paulo Davim, Biotribology, John Wiley & Sons, 2013 2. JOHN H. DUMBLETON, Tribology of Natural and Artificial Joints, ELSEVI ER, 1981
Special requirements (include for example workshops, periodicals, IT software, websites)	Experimental apparatus in biotribology laboratory for perform experimental test
Community-based facilities (include for example, guest Lectures , internship , field studies)	www.elsevier.com/locate/biotri

13. Admissions	
Pre-requisites	Fundamental basic concepts and applications of biomaterial and mechanics.

TEMPLATE FOR COURSE SPECIFICATION

HIGHER EDUCATION PERFORMANCE REVIEW: PROGRAMME REVIEW

COURSE SPECIFICATION

Basic properties and concepts of thermodynamics and energy are introduced with problems and applied to the analysis of human body, the conservation of mass and energy and entropy balance; the properties, equations of state, and the processes and cycles for reversible and irreversible thermodynamic systems; metabolism and human body energy, and modes of energy transfer. Thermodynamic principles will be applied to modern engineering in biological systems.

1. Teaching Institution	Ministry of Higher Education & Scientific Research
2. University Department/Centre	University of Technology /Biomedical Engineering Department
3. Course title/code	Thermodynamics /
4. Programme(s) to which it contributes	General
5. Modes of Attendance offered	Virtual Attendance
6. Semester/Year	1st semester/ 2nd year
7. Number of hours tuition (total)	60 hours semester
8. Date of production/revision of this Specification	6/12/2020
9. Aims of the Course	
1. Appreciate the role of energy analysis in Biomedical Engineering	
2. Introduce thermodynamics concepts essential to the understanding of biological systems and instruments	
3. Apply basic concepts in thermodynamics and energy measurements	

10· Learning Outcomes, Teaching ,Learning and Assessment Method

A- Knowledge and Understanding

A1. Revision the Basic Concepts in systems and their behavior; measurement units; volume, pressure, temperature.
A2. Energy and the first law of thermodynamics: Energy, work, and heat
A3. Evaluating properties of matter: Equations of state; ideal gas law; ideal gas properties.
A4. Second law of thermodynamics: Introduction; irreversible and reversible processes

B. Subject-specific skills

B1.Demonstrate an understanding of the thermodynamic properties and equations of state.
B2. Demonstrate an ability to apply the first law of thermodynamics to engineering processes
B3. Demonstrate an understanding of entropy and the second law of thermodynamics.
B4. Demonstrate an ability to analyze reversible and irreversible systems.

Teaching and Learning Methods

The teaching method that will be used in this course will be composed of a series of mini lectures interrupted with frequent discussions and brainstorming exercises. Using white board and Data show

Assessment methods

For the purpose of evaluation is used

1. Method of rapid test and snap
2. Identify some homework
3. Quarterly exams

C. Thinking Skills

C1. Apply the laws of thermodynamics to steady state open systems.
C2. Apply the laws of thermodynamics to human body, metabolism and other activities.
C3. Apply different mathematical models to describe the thermodynamics of biological systems.

Teaching and Learning Methods

1. Explain the required term
2. To discuss ideas and share knowledge
3. Methodology and use the text books

Assessment methods

D. General and Transferable Skills (other skills relevant to employability and personal development).

D1. Experimental tests in laboratory.
D2. Reports set related to the theoretical objects

11. Course Structure					
Week	Hours	ILOs	Unit/Module or Topic Title	Teaching Method	Assessment Method
1st semester					
1	4	- Introduction to thermodynamics	Introduction &Basic concepts	Explain of theoretical subjects	Quiz. H.W exam and Ex. Reports
2	4	Properties and its measurements	Thermodynamic measurements and units	Explain of theoretical subjects with examples	Quiz. H.W exam and Ex. Reports
3	4	Energy balance - Conservation Relations, 1st law of thermodynamics	Energy and heat relations	Explain of theoretical subjects with examples	Quiz. H.W exam and Ex. Reports
4	4	- Steady Flow energy Eq.	steady Flow	Explain and derive the related eqs.	Quiz. H.W exam and Ex. Reports
5	4	- Unsteady Flow energy Eq.	Unsteady Flow	Explain and derive the related eqs.	Quiz. H.W exam and Ex. Reports
6	4	- 2nd law of thermodynamics	2nd law of thermodynamics	Explain and derive the related eqs.	Quiz. H.W exam and Ex. Reports
7	4	- Reversible and irreversible processes	Reversibility	Explain and derive the related eqs.	Quiz. H.W exam and Ex. Reports
8	4	Introduction to heat transfer, conduction, convection, and radiation	Heat transfer,	Explain and derive the related eqs.	Quiz. H.W exam and Ex. Reports
9	4	- Thermodynamics of human body and metabolism	Metabolism	Explain and derive the related eqs.	Quiz. H.W exam and Ex. Reports
10	4	- Heart and cardiovascular system	Cardiac system	Explain and derive the related eqs	Quiz. H.W exam and Ex. Reports
11	4	Lungs and respiration system	Respiration system	Explain and derive the related eqs	Quiz. H.W exam and Ex. Reports
12	4	- Protein decomposition, the 3rd law of thermodynamic and biology.	3rd law of thermo-dynamics	Explain and derive the related eqs	Quiz. H.W exam and Ex. Reports
13	4	- Thermochemistry of human body	Thermochemistry	Explain and derive the related eqs	Quiz. H.W exam and Ex. Reports
14	4	- Lymphatic system thermodynamics	- Lymphatic system	Explain and derive the related eqs	Quiz. H.W exam and Ex. Reports
15	4	Brain and Endocrine thermodynamics	Brain and Endocrine	Explain and derive the related eqs	Quiz. H.W exam and Ex. Reports

12. Infrastructure	
Required reading: · CORE TEXTS · COURSE MATERIALS · OTHER	Thermodynamics 2005 (An Engineering Approach) seventh edition, Yunus A. Cengel, & Michael A. Boles. Guyton A C, Hall J A, Textbook of Medical Physiology, Saunders Company, 1996 Hobbie R H, Intermediate physics for medicine and biology
Special requirements (include for example workshops, periodicals, IT software, websites)	Experimental apparatus in fluid mechanics laboratory for perform experimental test
Community-based facilities (include for example, guest Lectures , internship , field studies)	

13. Admissions	
Pre-requisites	Fundamental basic concepts and applications of physics and mathematics.
Minimum number of students	95
Maximum number of students	101