هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

اعتماد NCAAA T4 2020

Course Specifications

Course Title:	**Bioengineering and Nanobiotechnology**
Course Code:	**2054206-3**
Program:	**Bachelor of Biotechnology**
Department:	**Department of Biotechnology**
College:	**College of Science**
Institution:	**Taif University**

Table of Contents

A. Course Identification

1. Credit hours: 3 (2 Theory, 1 Lab)
2. Course type **a.** University ☐ College ☐ Department ☑ Others ☐ **b.** Required ☐ Elective ☑
3. Level/year at which this course is offered: 12th Level / 4th Year
4. Pre-requisites for this course (if any)**: Bioinformatics, 2054102-3**
5. Co-requisites for this course (if any)**: None**

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	**Traditional classroom**	60	100%
2	**Blended**	-	-
3	**E-learning**	-	-
4	**Distance learning**	-	-
5	**Other**	-	-

7. Contact Hours (based on academic semester)

No	Activity	Contact Hours
1	**Lecture**	30
2	**Laboratory/Studio**	30
3	**Tutorial**	-
4	**Others** (specify)	-
	Total	60

B. Course Objectives and Learning Outcomes

1. Course Description

The knowledge gained in this course will enable the students to think and use nanotechnology as a new approach to address physical, chemical, biological and environmental phenomena. It will cover synthesis methods, properties and applications of engineered nanomaterials, engineering aspects (micro-and nanofabrication, self-assembly, micro- and nanofluidic) of biosensors, lab-on-chips and biological/medical microdevices. The course will cover the development of new tools for food, agriculture, health, cosmetics production and monitoring and control biological and environmental processes and phenomena.

2. Course Main Objective

Recognize the wide range of applications of nanobiotechnology and its interdisciplinary aspect, the principles governing the effect of size on material properties at the Nano scale and perform quantitative analysis, a working knowledge in nanotechnology techniques and acquire the ability to use them to solve problems in bioengineering, biomedicine and agricultural/environmental issues.

3. Course Learning Outcomes

CLOs		Aligned PLOs
1	**Knowledge and Understanding**	
1.1	Recognize various nanoparticles and various fabrications methods for the production of nanoparticles	K.1
1.2	State types of the nano-biosensors and nanoparticles application in different fields	K.5
2	**Skills :**	
2.1	Illustrate the fabrication of lab chips	S.2
2.2	Analyze the role bio-nanotechnology in enzymes properties and drug delivery	S.2
3	**Values:**	
3.1	Adopt the values of academic and professional morals	V.1
3.2	Adapt to the vales and rules of the team work	V.2

C. Course Content

No	List of Topics	Contact Hours
1	Course overview, The world of small dimensions, Nanoscale Properties (Electrical, Optical, Chemical)	3
2	Nanoscale visualization techniques 1: Electron microscopy (TEM, SEM, Cryo-SEM)	3
3	Bionanomaterials 1: Biological building blocks, Bionanostructures (nanofibers, nanotubes, nanocellulose)	3
4	Biological nanomachines 1: Ribosomes, Photosynthesis systems, Bionanomotors	3
5	Engineered Nanomaterials 1: Carbon nanomaterials (fullerenes, graphene, nanotubes, nanofiber	3
6	Engineered Nanomaterials 3: Magnetic nanoparticles (synthesis, properties and applications)	3
7	Nanotechnology by self-assembly 3: Protein nanotechnology, Nanotechnology by self-assembly 4: DNA nanotechnology	3
8	Diffusion in solid phase and drug delivery	3
9	Biological and medical microdevices: lab on chips, organ-onchips, Biosensors (fabrication, functionalization, applications)	3
10	Nanotechnology safety and the environment	3
Total		30

No	List of Practical Topics	Contact Hours
1	Fabrication of gold nanoparticles	3
2	Visualization by TEM and SEM	3
3	Fabrication of silver nanoparticles	3
4	Study of biological effects of nanoparticles	3
5	Fabrication of Nano-biosensors using gold nanoparticles	3
6	The effect of silver nanoparticles on environment	3
7	Fabrication of magnetic nanoparticles	3
8	Enzymes studies in combination with nanoparticles	3
9	Antimicrobial of nanoparticles in combinations with biological materials	3
10	Localization of nanoparticles in biological systems	3

Total	30

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge and Understanding**		
1.1	Recognize various nanoparticles and various fabrications methods for the production of nanoparticles	Lecture	Written Exam
1.2	State types of the nano-biosensors and nanoparticles application in different fields	Lecture & Discussion	Written Exam
2.0	**Skills**		
2.1	Illustrate the fabrication of lab chips	Discussion	Group Report
2.2	Analyze the role bio-nanotechnology in enzymes properties and drug delivery	Lecturer & Discussion	Written Exam.
3.0	**Values**		
3.1	Adopt the values of academic and professional morals	Project	Report, Individual presentation
3.2	Adapt to the vales and rules of the team work	Small group work	Performance evaluation

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Midterm Exam	Week 5	20%
2	Periodical Exam	Week 8	10%
3	Project	Week 9	10%
4	Practical Evaluation	Continue	20%
5	Final Exam	Week 11	40%

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice :
Six hours per week of office hours are available for each faculty members for consultations and academic advice.

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	Leggett, G. J.; Jones, R. A. L., Bio-nanotechnology. In Nanoscale Science and Technology, John Wiley &Sons,Ltd: 2005; pp 419-445. Bucke, C., Bio-nanotechnology—lessons from nature. By David S Godsell. Wiley-Liss, Hoboken, NJ, 2004. 352pp, ISBN 0 471 41719 X. Journal of Chemical Technology & Biotechnology 2005, 80 (8), 964-965. Lectures in Bioengineering and nanobiotechnology
Essential References Materials	Dong, H.; Hu, W., Organic Nanomaterials. In Springer Handbook of Nanomaterials, Vajtai, R., Ed. Springer, Berlin Heidelberg: 2013; pp 905-940.

	Gibbs, M. R. J., Nanomagnetic Materials and Devices. In Nanoscale Science and Technology, John Wiley &Sons, Ltd: 2005; pp 203-236.
Electronic Materials	Journal of Nanobiotechnology. https://jnanobiotechnology.biomedcentral.com/
Other Learning Materials	Nanobiotechnology - Latest research and news | Nature https://www.nature.com/subjects/nanobiotechnology

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	One classroom with internet connection for 2 hours a week and one laboratory for 3 hours a week with internet facility.
Technology Resources (AV, data show, Smart Board, software, etc.)	Data show and Smart board
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	- Nanofabrication and nanomanipulation instruments: - 3D Printing system for microfluidic devices - Characterization instruments: - High precision syringe pumps, Peristaltic pumps Potentiostates, Optical Waveguide Lightmode Spectroscope (OWLS), Atomic Force Microscope (AFM), Optical Microscopes (white light/epifluorescence), Electrical Impedance spectroscopy (EIS), Multi-frequency Lock-in Amplifier, Sub-femtoamp Remote, SourceMeter Instrument, -Molecular/cell biology instruments: - Biological safety cabinet (class II), Microwell plate readers, Protein and DNA electrophoresis systems, Microincubator Okolab, Nanodrop spectrophotometer, CO2 incubator for cells: Galaxy® 48 S, 48 L, 230 V/50/60 Hz standard, Cell culture cabin: Bioii-Advance 3. -Microfluidics instruments: - High precision syringe pumps, Peristaltic pumps

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Course management and planning	Students	Indirect
Effectiveness of teaching and assessment	Students	Indirect
Quality of learning resources	Students	Indirect
Effectiveness of Evaluation and exams	Students, Peer Reviewer	Indirect, Direct

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)
Evaluators (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

H. Specification Approval Data

Council / Committee	Department Council
Reference No.	7
Date	16-6-1443