



-II-
CURRICULA AND STUDY PLANS
OF
UNDERGRADUATE PROGRAMS
SCHOOL OF SCIENCE

UNIVERSITY OF SCIENCE AND TECHNOLOGY
ZEWAIL CITY OF SCIENCE, TECHNOLOGY AND INNOVATION

SEPTEMBER 2023



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1. FOUNDATION YEAR (34 CREDIT HOURS)

1.1. DESCRIPTION

The University of Science and Technology Foundation Courses are required for all majors during the first year. Foundation courses (also known as access or bridging courses) bridge the gap between the incoming qualifications and those needed to prepare you for progression onto courses of the undergraduate degree at University of Science and Technology.

1.2. FOUNDATION YEAR STUDY PLAN (34 CREDIT HOUR)

Foundation Year Semester 1						
COURSE CODE	COURSE TITLE	CR	L	P	PREREQUISITE	
BIOL 101	Biology I	3	3	-	Concurrent with BIOL 111	
BIOL 111	Biology I Lab	1	-	3	Concurrent with BIOL 101	
CHEM 101	Chemistry I	3	3	-	Concurrent with CHEM 111	
CHEM 111	Chemistry I Lab	1	-	3	Concurrent with CHEM 101	
ENGL 152	Effective Speaking and Composition	2	1	2	ENGL 004 if the student was placed in ENGL 003 or ENGL 004 after the English placement exam.	
MATH 101	Calculus I	3	3	-		
PHYS 101	Introduction to Classical Mechanics	3	3	-	Concurrent with PHYS 111	
PHYS 111	Introduction to Classical Mechanics Lab	1	-	3	Concurrent with PHYS 101	
TOTAL		17				

Foundation Year Semester 2						
COURSE CODE	COURSE TITLE	CR	L	P	PREREQUISITE	
BIOL 102	Biology II	3	3	-	BIOL 101	
BIOL 112	Biology II Lab	1	-	3	Concurrent with BIOL 102	
CHEM 102	Chemistry II	3	3	-	CHEM 101 AND Concurrent with CHEM 112	
CHEM 112	Chemistry II Lab	1	-	3	Concurrent with CHEM 102	
ENGL 153	Scientific Writing	2	1	2	ENGL 152	
MATH 102	Calculus II	3	3	-	MATH 101	
PHYS 102	Introduction to Electromagnetism	3	3	-	PHYS 101 AND MATH 101 AND Concurrent with PHYS 112	
PHYS 112	Introduction to Electromagnetism Lab	1	-	3	Concurrent with PHYS 102	
TOTAL		17				

Cr: Semester credit hours

L: Lecture hours/week

P: Practical hours/week

2. BIOMEDICAL SCIENCES (130 CREDIT HOUR)

2.1. PROGRAM DESCRIPTION

The Biomedical Science major is designed to provide students with basic and applied knowledge in the field of biology as it applies to health and disease. In the first two years, students complete a common core foundation of basic biology in an interdisciplinary approach. The students will then choose from four concentrations: Molecular and Cell Biology, Medical Sciences, Computational Biology and Genomics, and Drug Design and Development. Courses in each concentration cover specialized knowledge in the field, technical electives, and a research thesis project. Upon graduation, students will be prepared to work in technical specialties in pharmaceutical, chemical, diagnostics companies or drug discovery centers. They would also be able to join research institutes and universities, continue postgraduate or professional degrees, or pursue leadership positions in their fields.

برنامج العلوم الطبية الحيوية

مهمة برنامج العلوم الطبية الحيوية في جامعة العلوم والتكنولوجيا هو تعليم الطلاب في العلوم الطبية الحيوية على أعلى مستوى ممكن، بما يتفق مع أهدافهم المهنية ومع إمكاناتهم. ويتحقق ذلك من خلال برنامج التعليم القائم على البحوث من المقررات الأساسية والاختيارية، ومحتوي حديث متطور. وينقسم البرنامج الي اربعة فروع هي البيولوجيا الخلية الجزيئية، العلوم الطبية، علم الأحياء الحاسوبي وعلم الجينوم، وتصميم وتطوير العقاقير. ويشجع البرنامج التفكير النقدي، والتعلم المتفاعل، وتطبيق الأساليب العلمية، واتقان التكنولوجيا الحديثة، والمهارات الميدانية والمخبرية ذات الصلة. ويهدف البرنامج إلى التكامل الحميم بين التعليم الجامعي والدراسات العليا مع الأنشطة البحثية المتميزة للباحثين والعلماء في الجامعة وبين باقي برامج العلوم والتكنولوجيا في مدينة زويل.

2.2. PROGRAM EDUCATIONAL OBJECTIVES

- Employ essential knowledge of specific fields of biomedical sciences via research-based education to enable graduates to fulfill the needs of the evolving job market in the biomedical sciences fields.
- Apply skills and knowledge of research-based education in academic careers that seek to create and spread knowledge in the field of biomedical sciences.
- Implement creative and analytical solutions for issues related to health and biomedical challenges in the society and in the industry.
- Apply multidisciplinary approach to complex problems in drug design, cell therapy, infectious diseases, and computational approaches to health issues, clinical laboratories and biomedical start-up companies.
- Develop a collaborative network to integrate ethical, environmentally sound approaches to sustainable scientific practices.

2.3. STUDENT OUTCOMES

General Science Student Outcomes	
1	An ability to identify, formulate, and solve broadly defined technical or scientific problems by applying knowledge of mathematics and science and/or technical topics to areas relevant to the discipline.
2	An ability to formulate or design a system, process, procedure or material to meet desired needs.
3	An ability to develop and conduct experiments or test hypotheses, analyze and interpret data and use scientific judgment to draw conclusions.
4	An ability to communicate effectively with a range of audiences.
5	An ability to understand ethical and professional responsibilities and the impact of technical and/or scientific solutions in global, economic, environmental, and societal contexts.
6	An ability to function effectively on teams that establish goals, plan tasks, meet deadlines, and analyze risk and uncertainty.
Program Specific Student Outcomes	
7	An ability to apply fundamental concepts in biomedical sciences to identify, evaluate and analyze problems that impact human health, and develop innovative approaches to solve emerging challenges in the field

2.4. PROGRAM EDUCATIONAL OBJECTIVES MAPPING TO STUDENT OUTCOMES

		SOs						
		1	2	3	4	5	6	7
PEOs	1	X	X	X	X			
	2		X	X	X	X		
	3	X	X	X	X			X
	4					X	X	X
	5				X	X	X	X

2.5. DEGREE REQUIREMENTS FOR B. SC. IN BIOMEDICAL SCIENCES

A Student who intends to major in Biomedical Sciences must submit a Major Declaration Form upon completion of 34 credit hours of the Foundation Year. A total of 130 credits is required for the bachelor's degree in Biomedical Sciences Program. Students should consult their advisor on a regular basis to ensure the prerequisites for their university requirements, track requirements, major requirements, concentration requirements and electives are fulfilled.

**No foundation courses could be delayed beyond the 2nd year for any students

Program	University Requirements (General Education) (Cr)	Track Requirements (Math and Basic Sciences) (Cr)	Major Requirements (Cr)	Concentration Requirements (Cr)	Total (Cr)
Biomedical Sciences	16	32	30	52	130

2.5.1. OFFERED CONCENTRATIONS:

- Computational Biology and Genomics Concentration
- Molecular Cell Biology Concentration
- Medical Sciences Concentration
- Drug Design & Development Concentration

2.5.2. UNIVERSITY REQUIREMENTS

The aim of university requirements is to provide UST students with skills and knowledge to develop an intellectual, well-rounded and successful personal identity. University requirements is a set of Humanities and Social Sciences courses which are designed to enrich students with an appreciative understanding of the natural and cultural environments in which they live and their roles in the society and community services.

University Requirements (16 Cr)				
Compulsory Courses (4 Cr)				
Course Code	Course Title	Cr	L	P
ENGL 152	Effective Speaking and Composition	2	1	2
ENGL 153	Scientific Writing	2	1	2
Elective Courses (12 Cr)				
Student must select at least 12 Cr from the offered General Education Courses				

2.5.3. TRACK REQUIREMENTS

The aim of track requirements is to provide students of science programs with skills and knowledge essential to develop a successful scientist. Track requirements include courses of basic knowledge essential to all graduates of science programs such as Mathematics, Physics, Chemistry, Biology, and Internship.

Compulsory Courses of Track Requirements (32 Cr)				
Course Code	Course Title	Cr	L	P
BIOL 101	Biology I	3	3	-
BIOL 102	Biology II	3	3	-
BIOL 111	Biology I Lab	1	-	3
BIOL 112	Biology II Lab	1	-	3
BMS 399	Internship	2	-	6
CHEM 101	Chemistry I	3	3	-
CHEM 102	Chemistry II	3	3	-
CHEM 111	Chemistry I Lab	1	-	3
CHEM 112	Chemistry II Lab	1	-	3
MATH 101	Calculus I	3	3	-
MATH 102	Calculus II	3	3	-
PHYS 101	Introduction to Classical Mechanics	3	3	-
PHYS 102	Introduction to Electromagnetism	3	3	-
PHYS 111	Introduction to Classical Mechanics Lab	1	-	3
PHYS 112	Introduction to Electromagnetism Lab	1	-	3
Total Credits		32		

2.5.4. MAJOR REQUIREMENTS

The program offers a major specialty in Biomedical Sciences, which requires successful completion of 30 credits:

Compulsory Courses of Major Requirements - Biomedical Sciences (30 Cr)

Course Code	Course Title	Cr	L	P
BMS 201	General Microbiology	3	3	
BMS 202	Cell Biology	3	3	-
BMS 203	Principles of Genetics	3	3	
BMS 204	Biochemistry	3	3	
BMS 211	General Microbiology Lab	1		3
BMS 212	Cell Biology Lab	1		3
BMS 213	Principles of Genetics Lab	1		3
BMS 214	Biochemistry Lab	1		3
BMS 303	Experimental Design and Data Analysis	3	2	3
BMS 304	Biomedical Scientific Ethics & Safety	2	2	
BMS 404	Biostatistics	3	3	
CHEM 201	Organic Chemistry	3	3	-
CHEM 211	Organic Chemistry Lab	1	-	3
CSCI 101	Introduction to Computer Science	2	1	3
Total Credits		30		

2.5.5. CONCENTRATION REQUIREMENTS

Biomedical Sciences program offers the following four concentrations, which require successful completion of at least 52 credits:

- Computational Biology and Genomics Concentration
- Molecular Cell Biology Concentration
- Medical Sciences Concentration
- Drug Design & Development Concentration

Compulsory Courses of Concentration Requirements -

Computational Biology and Genomics Concentration (52 Cr)

Course Code	Course Title	Cr	L	P
BMS 320	Introduction to Bioinformatics and Programming Language	3	2	3
BMS 321	Programming for Computational Biology	3	2	3
BMS 331	Numerical Analysis and Matlab	3	3	
BMS 401	Senior Project I	3	3	
BMS 402	Senior Project II	3	3	
BMS 422	Algorithmic Foundations of Computational Biology	3	3	
BMS 426/ BMS Elective	Developmental Biology and Genetics	3	3	
BMS 473	Foundations of Computational and Systems Biology	3	3	
BMS 474	Genomics and Data Sciences	3	2	3
BMS Electives	BMS Electives	12		
CHEM 202	Analytical and Physical Chemistry	3	3	
CHEM 212	Analytical and Physical Chemistry Lab	1		3
MATH 201	Linear Algebra and Vector Geometry	3	3	
Select Two Courses from the List Below (6 Cr)				
BMS 322	Structural Biology	3	3	
BMS 323	Comparative Biology	3	3	
BMS 328	Computer Science 2	3	2	3
BMS 364	Biophysics	3	3	
MATH 308	Discrete Math	3	3	
Total Credits		52		

Compulsory Courses of Concentration Requirements -

Molecular Cell Biology (52 Cr)

Course Code	Course Title	Cr	L	P
BMS 205	Human Physiology	3	3	
BMS 215	Human Physiology Lab	1		3
BMS 301	Molecular Biology	3	3	
BMS 311	Molecular Biology Lab	1		3
BMS 324	Molecular Genetics and Cell Regulation	3	3	
BMS 340	Advanced Techniques in BMS	4	4	
BMS 401	Senior Project I	3	-	
BMS 402	Senior Project II	3	-	
BMS Electives	BMS Electives	12		
CHEM 202	Analytical and Physical Chemistry	3	3	
CHEM 212	Analytical and Physical Chemistry Lab	1		3
SELECT TWO COURSES FROM THE LIST BELOW (6 CR)				
BMS 320	Introduction to Bioinformatics and Programming Language	3	2	3
BMS 323	Comparative Biology	3	3	
BMS 326	Molecular Mechanisms of Cell Signaling	3	3	
BMS 327	Neurobiology and Practicum	3	3	
BMS 336	Stem Cells and Regenerative Medicine and Practicum	3	3	
BMS 337	Cancer Biology and Practicum	3	3	



SELECT TWO COURSES FROM THE LIST BELOW (6 CR)				
BMS 434	Epigenetics in Health and Disease	3	3	
BMS 364	Biophysics	3	3	
BMS 475	Biochemistry of Hormones and Vitamins	3	3	
BMS 477	The Human Genome and Disease	3	3	
SELECT ONE COURSES FROM THE LIST BELOW (3 CR)				
BMS 322	Structural Biology	3	3	
BMS 429	Molecular Immunology and Practicum	3	2	3
TOTAL		52		

Compulsory Courses of Concentration Requirements –Medical Sciences Concentration (52Cr)

Course Code	Course Title	Cr	L	P
BMS 205	Human Physiology	3	3	
BMS 215	Human Physiology Lab	1		3
BMS 313	Human Anatomy Lab	1		3
BMS 325	Clinical Sciences and Practicum	3	3	0
BMS 330	Human Anatomy	3	3	
BMS 336	Stem Cells and Regenerative Medicine Lecture and Practicum	3	2	3
BMS 344	Human Embryology and practicum	3	2	3
BMS 401	Senior Project I	3	-	
BMS 402	Senior Project II	3	-	
BMS 428	Pathology	3		
BMS 429	Molecular Immunology	3	2	3
BMS 438	Human Pathophysiology	3	3	
BMS 448	Pathology Lab	1		3
BMS Electives	BMS Electives	12		
CHEM 202	Analytical and Physical Chemistry	3	3	
CHEM 212	Analytical and Physical Chemistry Lab	1		3
Select One Course of the List Below (3 Cr)				
BMS 323	Comparative Biology	3	3	
BMS 327	Neurobiology	3	3	
BMS 337	Cancer Biology	3	2	3
Total Credits		52		

**Compulsory Courses of Concentration Requirements -
Drug Design & Development Concentration (52 Cr)**

Course Code	Course Title	Cr	L	P
BMS 205	Human Physiology	3	3	
BMS 215	Human Physiology Lab	1		3
BMS 332	Drug Discovery and Development	3	3	
BMS 333	Drug Design and Computational Chemistry	3	3	
BMS 334	Pharmacokinetics & Pharmacodynamics	3	3	
BMS 339	Principles of Pharmacology and Toxicology	3	3	
BMS 343	Drug Design and Computational Chemistry Lab	1		3
BMS 349	Principles of Pharmacology and Toxicology Laboratory	1		3
BMS 401	DDD Senior Project I	3		
BMS 402	DDD Senior Project II	3		
BMS 405	Medicinal and Biological Chemistry	3	3	
BMS 406	Molecular Modeling and Targeted Drug Design	3	3	
BMS 415	Medicinal and Biological Chemistry	1		3
BMS 416	Molecular Modeling and Targeted Drug Design	1		3
BMS 435	Legal aspects in drug design and development	1	1	
BMS Electives	BMS Electives	12		
CHEM 202	Analytical and Physical Chemistry	3	3	
CHEM 203	Organic Chemistry II	3	3	
CHEM 212	Analytical and Physical Chemistry and Lab	1		3
Total Credits		52		

2.6. SAMPLE STUDY PLAN FOR B. SC. IN BIOMEDICAL SCIENCES (130 CREDIT HOUR)

2.6.1. BIOMEDICAL SCIENCES YEAR 2 (TOTAL CREDITS: 32-33 CR)

BMS YEAR 2 / SEMESTER 1					
COURSE CODE	COURSE TITLE	CR	L	P	PREREQUISITE
BMS 201	General Microbiology	3	3		BIOL 102; Concurrent with BMS211
BMS 202	Cell Biology	3	3	-	BIOL102; Concurrent with BMS 212
BMS 211	General Microbiology Lab	1		3	Concurrent with BMS 201
BMS 212	Cell Biology Lab	1		3	Concurrent with BMS 202
CHEM 201	Organic Chemistry	3	3	-	CHEM 101
CHEM 211	Organic Chemistry Lab	1	-	3	Concurrent with CHEM 201
CSCI 101	Introduction to Computer Science	2	1	3	
General Education Electives		3	3		
TOTAL		17			

BMS YEAR 2 / SEMESTER 2					
COURSE CODE	COURSE TITLE	CR	L	P	PREREQUISITE
BMS 203	Principles of Genetics	3	3		BIOL 102; Concurrent with BMS 213
BMS 204	Biochemistry	3	3		CHEM 201; Concurrent with BMS 214
BMS 213	Principles of Genetics Lab	1		3	Concurrent with BMS 203
BMS 214	Biochemistry Lab	1		3	Concurrent with BMS 204
BMS Concentration Courses		7-8			
TOTAL		15-16			



BMS / COMPUTATIONAL BIOLOGY AND GENOMICS CONCENTRATION / YEAR 2 / SEMESTER 2

COURSE CODE	COURSE TITLE	CR	L	P	PREREQUISITE
CHEM 202	Analytical and Physical Chemistry	3	3		CHEM 201; Concurrent with CHEM 212
CHEM 212	Analytical and Physical Chemistry Lab	1		3	Concurrent with CHEM 202
MATH 201	Linear Algebra and Vector Geometry	3	3		
TOTAL		7			

BMS / MOLECULAR CELL BIOLOGY, MEDICAL SCIENCE CONCENTRATION / YEAR 2 / SEMESTER 2

COURSE CODE	COURSE TITLE	CR	L	P	PREREQUISITE
BMS 205	Human Physiology	3	3		BIOL 102; Concurrent with BMS 215
BMS 215	Human Physiology Lab	1		3	Concurrent with BMS 205
CHEM 202	Analytical and Physical Chemistry	3	3		CHEM 201; Concurrent with CHEM 212
CHEM 212	Analytical and Physical Chemistry Lab	1		3	Concurrent with CHEM 202
TOTAL		8			

BMS / DDD / YEAR 2 / SEMESTER 2

COURSE CODE	COURSE TITLE	CR	L	P	PREREQUISITE
BMS 205	Human Physiology	3	3		BIOL 102; Concurrent with BMS 215
BMS 215	Human Physiology Lab	1		3	Concurrent with BMS 205
CHEM 203	Organic Chemistry II	3	3		CHEM 201

TOTAL	7
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2.6.2. BIOMEDICAL SCIENCES YEAR 3 (TOTAL CREDITS: 31 - 35 CR)

BMS YEAR 3 / SEMESTER 1					
COURSE CODE	COURSE TITLE	CR	L	P	PREREQUISITE
BMS 304	Biomedical Scientific Ethics & Safety	2	2		BIOL 102
BMS 404	Biostatistics	3	3		BIOL 101
BMS Electives		3	3		
General Education Electives		2	2		
BMS Concentration Courses		6-7			
TOTAL		16-17			

BMS YEAR 3 / SEMESTER 2					
COURSE CODE	COURSE TITLE	CR	L	P	PREREQUISITE
BMS 303	Experimental Design and Data Analysis	3	2	3	BIOL 102
BMS Concentration Courses		10-12			
General Education Electives		2	2		
TOTAL		15- 17			

BMS YEAR 3 / SEMESTER 3 (SUMMER)					
COURSE CODE	COURSE TITLE	CR	L	P	PREREQUISITE
BMS 399	Internship	2	-	6	Pass/Fail
TOTAL		2			

2.6.3. BIOMEDICAL CONCENTRATION COURSES FOR YEAR 3

BMS / COMPUTATIONAL BIOLOGY AND GENOMICS CONCENTRATION / YEAR 3 / SEMESTER 1					
COURSE CODE	COURSE TITLE	CR	L	P	PREREQUISITE
BMS 321	Programming for Computational Biology	3	2	3	MATH 102 AND BIOL 102
BMS Electives		3	3		
TOTAL		6			

BMS / MOLECULAR CELL BIOLOGY / YEAR 3 / SEMESTER 1					
COURSE CODE	COURSE TITLE	CR	L	P	PREREQUISITE
BMS 301	Molecular Biology	3	3		BMS 202; Concurrent with BMS 311
BMS 311	Molecular Biology Lab	1		3	Concurrent with BMS 301
General Education Electives		3	3		
TOTAL		7			

BMS / MEDICAL SCIENCE / YEAR 3 / SEMESTER 1					
COURSE CODE	COURSE TITLE	CR	L	P	PREREQUISITE
BMS 325	Clinical Sciences and Practicum	3	2	0	BIOL 102
BMS 344	Human Embryology and practicum	3	2	3	BIOL 102
TOTAL		6			

BMS / DRUG DESIGN AND DEVELOPMENT / YEAR 3 / SEMESTER 1

COURSE CODE	COURSE TITLE	CR	L	P	PREREQUISITE
BMS 332	Drug Discovery and Development	3	3		BMS 204
BMS 334	Pharmacokinetics & Pharmacodynamics	3	3		BIOL 102 AND CHEM 203
TOTAL		6			

BMS / COMPUTATIONAL BIOLOGY AND GENOMICS CONCENTRATION / YEAR 3 / SEMESTER 2

COURSE CODE	COURSE TITLE	CR	L	P	PREREQUISITE
BMS 320	Introduction to Bioinformatics and Programming Language	3	2	3	BIOL 102 AND CSCI 101 AND MATH 102
BMS 331	Numerical Analysis and Matlab	3	3		MATH 201
SELECT TWO COURSES FROM THE LIST BELOW (6 CR)					
BMS 322	Structural Biology	3	3		BIOL 102 AND (CHEM 202 OR PHYS 201)
BMS 323	Comparative Biology	3	3		BMS 203
BMS 328	Computer Science 2	3	2	3	CSCI 101
BMS 364	Biophysics	3	3		CHEM 202 or PHYS 201
MATH 308	Discrete Mathematics	3	3		
TOTAL		12			

BMS / MOLECULAR CELL BIOLOGY / YEAR 3 / SEMESTER 2

COURSE CODE	COURSE TITLE	CR	L	P	PREREQUISITE	
BMS 324	Molecular Genetics and Cell Regulation	3	3		BMS 202	
BMS 340	Advanced Techniques in BMS	4		4	BIOL 102	
SELECT TWO COURSES FROM THE LIST BELOW (6 CR)						
BMS 320	Introduction to Bioinformatics and Programming Language	3	2	3	CSCI 101 AND MATH 102 AND BIOL 101	
BMS 323	Comparative Biology	3	3		BMS 203	
BMS 326	Molecular Mechanisms of Cell Signaling	3	3		BMS 202	
BMS 327	Neurobiology and Practicum	3	3		BMS 202	
BMS 336	Stem Cells and Regenerative Medicine and Practicum	3	3		BIOL 102	
BMS 337	Cancer Biology and Practicum	3	3		BMS 202	
TOTAL		13				

BMS / MEDICAL SCIENCE / YEAR 3 / SEMESTER 2

COURSE CODE	COURSE TITLE	CR	L	P	PREREQUISITE
BMS 313	Human Anatomy Lab	1		1	Concurrent with BMS 330
BMS 330	Human Anatomy	3	3		BIOL 102 Concurrent with BMS 313
BMS 336	Stem Cells and Regenerative Medicine Lecture and Practicum	3	2	3	BIOL 102



SELECT ONE COURSES FROM THE LIST BELOW (3 CR)

BMS 323	Comparative Biology	3	3		BMS 203
BMS 327	Neurobiology and practicum	3	2	3	BMS 202
BMS 337	Cancer Biology and practicum	3	2	3	BMS 202
TOTAL		10			

BMS / DRUG DESIGN AND DEVELOPMENT / YEAR 3 / SEMESTER 2

COURSE CODE	COURSE TITLE	CR	L	P	PREREQUISITE
BMS 333	Drug Design and Computational Chemistry	3	3		BMS 204
BMS 339	Principles of Pharmacology and Toxicology	3	3		BMS 204 AND BMS 205
BMS 343	Drug Design and Computational Chemistry Lab	1		3	Concurrent with BMS 333
BMS 349	Principles of Pharmacology and Toxicology Lab	1		3	Concurrent with BMS 339
CHEM 202	Analytical and Physical Chemistry	3	3		CHEM 102; Concurrent with CHEM 212
CHEM 212	Analytical and Physical Chemistry and Lab	1		3	Concurrent with CHEM 202
TOTAL		12			

2.6.4. BIOMEDICAL SCIENCES YEAR 4 (TOTAL CREDITS: 26 – 30 CR)

2.6.4.1. BIOMEDICAL SCIENCES, COMPUTATIONAL BIOLOGY AND GENOMICS CONCENTRATION, YEAR 4 (TOTAL CREDITS: 29 CR)

BMS / COMPUTATIONAL BIOLOGY AND GENOMICS / YEAR 4 / SEMESTER 1					
COURSE CODE	COURSE TITLE	CR	L	P	PREREQUISITE
BMS 401	Senior Project I	3	-		
BMS 473	Foundations of Computational and Systems Biology	3	3		BIOL 101 AND CSCI 101 AND MATH 102
BMS 474	Genomics and Data Sciences	3	2	3	MATH 201 AND BMS 321
BMS Electives		3	3		
General Education Electives		3	3		
Total		15			

BMS / COMPUTATIONAL BIOLOGY AND GENOMICS / YEAR 4 / SEMESTER 2					
COURSE CODE	COURSE TITLE	CR	L	P	PREREQUISITE
BMS 402	Senior Project II	3	3		
BMS 422	Algorithmic Foundations of Computational Biology	3	3		BMS 321 AND MATH 201
BMS 426	Developmental Biology and Genetics	3	3		BMS 202 AND BMS 203
BMS Electives		3	3		
General Education Electives		2	2		
TOTAL		14			

2.6.4.2. BIOMEDICAL SCIENCES, MOLECULAR CELL BIOLOGY YEAR 4 (TOTAL CREDITS: 26 CR)

BMS / MOLECULAR CELL BIOLOGY / YEAR 4 / SEMESTER 1					
COURSE CODE	COURSE TITLE	CR	L	P	PREREQUISITE
BMS 401	Senior Project I	3	-		
BMS Electives		3	3		
General Education Electives		2	2		
SELECT TWO COURSES FROM THE LIST BELOW (6 CR)					
BMS 364	Biophysics	3	3		CHEM 202 OR PHYS 201
BMS 434	Epigenetics in Health and Disease	3	3		BMS 202
BMS 475	Biochemistry of Hormones and Vitamins	3	3		BMS 204
BMS 477	The Human Genome and Disease	3	3		BMS 202 AND BMS 203
TOTAL		14			

BMS / MOLECULAR CELL BIOLOGY / YEAR 4 / SEMESTER 2					
COURSE CODE	COURSE TITLE	CR	L	P	PREREQUISITE
BMS 402	Senior Project II	3	-		
BMS Electives		6	6		
SELECT ONE COURSE FROM THE LIST BELOW (3 CR)					
BMS 322	Structural Biology	3	3		BIOL 102 AND (CHEM 202 OR PHYS 201)
BMS 429	Molecular Immunology and Practicum	3	2	3	BMS 202
TOTAL		12			

2.6.4.3. BIOMEDICAL SCIENCES, MEDICAL SCIENCES, YEAR 4 (TOTAL CREDITS: 30 CR)

BMS / MEDICAL SCIENCES / YEAR 4 / SEMESTER 1					
COURSE CODE	COURSE TITLE	CR	L	P	PREREQUISITE
BMS 401	Senior Project I	3	3		
BMS 438	Human Pathophysiology	3	3		BMS 330
BMS Electives		6	6		
General Education Electives		3	3		
TOTAL		15			

BMS / MEDICAL SCIENCES / YEAR 4 / SEMESTER 2					
COURSE CODE	COURSE TITLE	CR	L	P	PREREQUISITE
BMS 402	Senior Project II	3	3		
BMS 428	Pathology	3	3		BMS 330
BMS 429	Molecular Immunology and practicum	3	2	3	BMS 202
BMS 448	Pathology Lab	1		3	Concurrent with BMS 428
BMS Electives		3	3		
General Education Electives		2	2		
TOTAL		15			

2.6.4.4. BIOMEDICAL SCIENCES, DRUG DESIGN AND DEVELOPMENT, YEAR 4 (TOTAL CREDITS: 29 CR)

BMS / DRUG DESIGN AND DEVELOPMENT / YEAR 4 / SEMESTER 1					
COURSE CODE	COURSE TITLE	CR	L	P	PREREQUISITE
BMS 401	Senior Project 1	3			
BMS 405	Medicinal and Biological Chemistry	3	3		CHEM 203 AND BMS 339
BMS 415	Medicinal and Biological Chemistry lab	1		3	Concurrent with BMS 405
BMS 435	Legal aspects in drug design and development	1	1		
BMS Electives		3	3		
General Education Electives		3	3		
TOTAL		14			

BMS / DRUG DESIGN AND DEVELOPMENT / YEAR 4 / SEMESTER 2					
COURSE CODE	COURSE TITLE	CR	L	P	PREREQUISITE
BMS 402	Senior Project II	3			
BMS 406	Molecular Modeling and Targeted Drug Design	3	3		CHEM 203 AND BMS 333
BMS 416	Molecular Modeling and Targeted Drug Design lab.	1		3	Concurrent with BMS 406
BMS Electives		6	6		
General Education Electives		2	2		
TOTAL		15			

2.7. BIOMEDICAL SCIENCES ELECTIVE COURSES

BMS students are expected to select their program electives from the BMS electives list below. Also, BMS students in one concentration can use BMS courses in the other BMS concentrations to fulfil their elective requirements. This is detailed after the table of program electives.

2.7.1. ELECTIVES LIST FOR ALL BMS STUDENTS

Biomedical Sciences Electives					
Course Code	Course Title	Cr	L	P	Prerequisite
BMS 335	Advanced Microbiology	3	2	3	BMS 201
BMS 409	Drug Targets Identification and Validation	3	3	-	BMS 205 AND BMS 339
BMS 425	Protein Structure and Function	3			BMS 204 AND PHYS 102 AND MATH 102 AND (CHEM 202 OR PHYS 202)
BMS 430	Advanced Strategies in Organic Synthesis	3	3		CHEM 201 AND CHEM 203
BMS 432	Structural Elucidation and Instrumental Analysis	3	3		CHEM 201 AND BMS 201
BMS 444	Metagenomics	3	3	-	BMS 202
BMS 451	Biology of Aging	3			BMS 202 AND BMS 301
BMS 452	Mitochondria in Health and Disease	3			BMS 202 AND BMS 301
BMS 455	Cellular and Molecular Imaging	3			BMS 204
BMS 456	Forensic Biology	3	3	-	BMS 202 AND BMS 204
BMS 457	Clinical Nutrition	3	3	-	BIOL 102
BMS 458	Fermentation	3	3	-	BIOL 202 AND BIOL 204
BMS 459	Pathogens and Host Defense	3	3	-	BIOL 102
BMS 460	Development and Commercialization	3	3	-	
BMS 462	Pharmacogenomics	3	3	-	BMS 202 AND BMS 204

BMS 463	Vaccines	3	3	-	Concurrent with BMS 429
BMS 465	Virology	3	3	-	BIOL 102
BMS 467	Bacteriophages as Antibacterial Agent	3	3	-	BMS 201
BMS 471	Clinical Trials Design, Administration and Management	4	3	3	CHEM 202 AND BMS 333
BMS 499	Selected Topics in BMS	3	3	-	

2.7.2. MORE ELECTIVES FOR COMPUTATIONAL BIOLOGY AND GENOMICS CONCENTRATION

Students in Computational Biology and Genomics Concentration are allowed to use these courses from the other concentrations in fulfilling their Electives requirements:

BMS 205, BMS 215, BMS 301, BMS 311, BMS 313, BMS 324, BMS 325,
BMS 326, BMS 327, BMS 330, BMS 332, BMS 333, BMS 334, BMS 336,
BMS 337, BMS 339, BMS 340, BMS 343, BMS 344, BMS 349, BMS 405,
BMS 406, BMS 415, BMS 416, BMS 428, BMS 429, BMS 434, BMS 435,
BMS 438, BMS 448, BMS 475, BMS 477

2.7.3. MORE ELECTIVES FOR MOLECULAR CELL BIOLOGY CONCENTRATION

Students in Molecular Cell Biology Concentration are allowed to use these courses from the other concentrations in fulfilling their Electives requirements:

BMS 313, BMS 321, BMS 325, BMS 328, BMS 330, BMS 331, BMS 332,
BMS 333, BMS 334, BMS 339, BMS 343, BMS 344, BMS 349, BMS 405,
BMS 406, BMS 415, BMS 416, BMS 422, BMS 426, BMS 428, BMS 435,
BMS 438, BMS 448, BMS 473, BMS 474

2.7.4. MORE ELECTIVES FOR MEDICAL SCIENCES CONCENTRATION

Students in Medical Sciences Concentration are allowed to use these courses from the other concentrations in fulfilling their Electives requirements:

BMS 340, BMS 343, BMS 349, BMS 364, BMS 405, BMS 406, BMS 415,
BMS 416, BMS 422, BMS 426, BMS 434, BMS 435, BMS 473, BMS 474,
BMS 475, BMS 477



2.7.5. MORE ELECTIVES FOR DRUG DESIGN & DEVELOPMENT CONCENTRATION

Students in Drug Design & Development Concentration are allowed to use these courses from the other concentrations in fulfilling their Electives requirements:

BMS 331,	BMS 336,	BMS 337,	BMS 340,	BMS 344,	BMS 364,	BMS 422,
BMS 426,	BMS 428,	BMS 429,	BMS 434,	BMS 438,	BMS 448,	BMS 473,
BMS 474,	BMS 475,	BMS 477				

3. NANO SCIENCE (130 CREDIT HOUR)

3.1. PROGRAM DESCRIPTION

The Nano science program focuses on scientific phenomena that occur at sizes around a nanometer. The first two years of the program give the student a solid foundation in basic sciences. A strong emphasis on Physics, Chemistry and Mathematics will provide students with a unique and versatile set of theoretical skills. During the last two years students can choose one of four concentrations, namely; nano-medicine, bio-nanotechnology, nano chemistry or nanophysics. Most of the courses in the Nano science program have an advanced lab component, giving students hands on experience. In addition, all concentrations are carefully selected to have full support from various research institutes at Zewail City. Furthermore, capstone projects are directly linked to real life problems that will help the graduate to have a running start immediately after graduation.

برنامج علوم النانو

يهتم برنامج علوم النانو بجامعة العلوم والتكنولوجيا بمدينة زويل بدراسة معالجة المادة على المقياس الذري والجزيئي وكذلك دراسة الظواهر التي تحدث على مستوى الأبعاد متناهية الصغر والتي تقاس بالنانومتر وهو جزء من المليون من المليمتر أي جزء من المليار من المتر، وفي المعتاد تتعامل علوم وتقنيات النانو مع قياسات في الحدود ما بين 1 إلى 100 نانومتر، أي تتعامل مع تجمعات ذرية تتراوح بين خمس ذرات إلى ألف ذرة.

يتمحور الاهتمام الأكبر في مقررات الطلاب في اول عامين دراسيين بالبرنامج حول تكوين بنية علمية صلبة في العلوم الأساسية والتي يتم التركيز فيها بشكل رئيسي على علوم الفيزياء والكيمياء والرياضيات والاحياء، ومن ثم يكتسب الطلاب مهارات علمية فريدة ومتنوعة على كلا الجانبين النظري والعملي. بعد إنهاء مرحلة العلوم الأساسية وتحديداً في السنتين النهائيتين، فيستطيع الطلاب اختيار واحد من أصل أربعة تخصصات غاية في الحداثة، وهي طب النانو وتقنية النانو الحيوية وكيمياء النانو وفيزياء النانو. ومما يستوجب الذكر أنه بالإضافة الى المحتوى العلمي المميز المقدم للطلاب، فان معظم المقررات الدراسية تكون مصحوبة بمقرر عملي لإكسابهم العديد من المهارات الفنية. علاوةً على ذلك، فإن كل التخصصات البيئية في برنامج النانو تم اختيارها بعناية شديدة لكي تلقى الدعم الكامل من كل المراكز البحثية داخل مدينة زويل. وإنه لجدير بالذكر أيضاً أن مشاريع تخرج الطلاب يتم الموافقة عليها بشروط من ضمنها ان تكون متصلة مباشرة بمشكلات الحياة الفعلية مما يساهم في خدمة المجتمع ويضع الخريج على البداية الصحيحة للالتحاق بسوق العمل فور تخرجه.

3.2. Program Educational Objectives

The educational objectives of the Nanoscience program have been constructed in such a way to fulfil the mission and vision of Zewail City. Nanoscience program educational objectives (PEOs) are strongly relevant to career and professional accomplishments desired of students three to five years after their graduation. The following Nanoscience program objectives have been identified to satisfy constituents' needs and fulfill the program's mission.

Within a few years of graduation, Nanoscience program alumni will have:

- Gained employment in academia, research, education, governmental sector, private sector or industry in the field of Nanoscience in its broad context ranging from nanomaterials design, synthesis/fabrication, characterization, and applications.
- Created value by analyzing and designing sustainable solutions to problems involving biomedical, biotechnological, chemical, and industrial challenges via well-designing of appropriate advanced nanomaterials.
- Successfully engaged in advanced studies in Nanoscience and establishing ties to international institutions.
- Actively participated in research development in Nanoscience, both in theoretical and experimental fronts.
- Facilitated collaboration and built strong professional relationships by working successfully in multi-disciplinary teams and effectively communicating with a diverse group of stakeholders.

3.3. Student Outcomes

General Science Student Outcomes	
1	An ability to identify, formulate, and solve broadly defined technical or scientific problems by applying knowledge of mathematics, chemistry, physics and/or technical topics to areas relevant to the discipline.
2	An ability to formulate or design a system, process, procedure or nanomaterial to meet desired needs.
3	An ability to develop and conduct experiments or test hypotheses, analyze and interpret data and use scientific judgment to draw conclusions.
4	An ability to communicate effectively with a range of audiences.
5	An ability to understand ethical and professional responsibilities and the impact of technical and/or scientific solutions in global, economic, environ
6	An ability to function effectively on teams that establish goals, plan tasks, meet deadlines, and analyze risk and uncertainty.
Program Specific Student Outcomes	
7	An ability to synthesize/fabricate, and characterize various types of nanomaterials with desirable characteristics for specific application(s).

3.4. PROGRAM EDUCATIONAL OBJECTIVES MAPPING TO STUDENT OUTCOMES

		SOs						
		1	2	3	4	5	6	7
PEOs	1	X			X			X
	2		X				X	
	3	X		X				
	4		X		X			X
	5			X		X		
	6				X		X	

3.5. Degree Requirements for B. Sc. In Nano Science

A Student who intends to major in Nanoscience has to submit a “Major Declaration Form” upon completion of 34 credit hours of the Foundation Year. A total of 130 credits is required for the bachelor’s degree in Nanoscience Program. Students have to consult their advisors on a regular basis to ensure the prerequisites for their university requirements, track requirements, major requirements, concentration requirements and electives need to be fulfilled.

University Requirements (General Edu.) (Cr)	Track Requirements (Math and Basic Sciences) (Cr)	Major Requirements (Cr)	Concentration Requirements (Cr)	Total (Cr)
16	32	28	54	130

3.5.1. University Requirements

The aim of university requirements is to provide UST students with skills and knowledge to develop an intellectual, well-rounded and successful personal identity. University requirements is a set of Humanities and Social Sciences courses which are designed to enrich students with an appreciative understanding of the natural and cultural environments in which they live and their roles in the society and community services.

University Requirements (16 Cr)				
Compulsory Courses (4 Cr)				
Course Code	Course Title	Cr	L	P
ENGL 152	Effective Speaking and Composition	2	1	2
ENGL 153	Scientific Writing	2	1	2
Elective Courses (12 Cr)				
Student must select at least 12 Cr from the offered General Education Courses				

3.5.2. Track Requirements

The aim of track requirements is to provide students of science programs with skills and knowledge essential to develop a successful scientist. Track requirements include courses of basic knowledge essential to all graduates of science programs such as Mathematics, Physics, Chemistry, Biology, and Internship.

Compulsory Courses of Track Requirements (32 Cr)				
Course Code	Course Title	Cr	L	P
BIOL 101	Biology I	3	3	-
BIOL 102	Biology II	3	3	-
BIOL 111	Biology I Lab	1	-	3
BIOL 112	Biology II Lab	1	-	3
CHEM 101	Chemistry I	3	3	-
CHEM 102	Chemistry II	3	3	-
CHEM 111	Chemistry I Lab	1	-	3
CHEM 112	Chemistry II Lab	1	-	3
MATH 101	Calculus I	3	3	-
MATH 102	Calculus II	3	3	-
NANOSC 399	Internship	2	-	6
PHYS 101	Introduction to Classical Mechanics	3	3	-
PHYS 102	Introduction to Electromagnetism	3	3	-
PHYS 111	Introduction to Classical Mechanics Lab	1	-	3
PHYS 112	Introduction to Electromagnetism Lab	1	-	3
Total Credits		32		

3.5.3. Major Requirements

The program offers a major specialty in Nanoscience, which requires successful completion of at least **28** credits:

Compulsory Courses of Major Requirements- Nanoscience (28 Cr)				
Course Code	Course Title	Cr	L	P
CHEM 201	Organic Chemistry	3	3	-
CHEM 202	Analytical and Physical Chemistry	3	3	-
CHEM 211	Organic Chemistry Lab	1	-	3
CHEM 212	Analytical and Physical Chemistry Lab	1	-	3
CSCI 101	Introduction to Computer Science	2	1	3
MATH 201	Linear Algebra and Vector Geometry	3	3	-
MATSCI 201	Fundamentals of Materials Science and Engineering	3	3	-
NANOSC 301	Spectroscopy of Nanomaterials	3	3	-
NANOSC 302	Modern Characterization Techniques I	3	3	-
NANOSC 305	Synthesis/Fabrication of Nanomaterials	3	3	-
NANOSC 307	Nano Sciences Research Lab Rotations	1	-	3
NANOSC 312	Modern Characterization Techniques I Lab	1	-	3
NANOSC 315	Synthesis/Fabrication of Nanomaterials Lab	1	-	3
Total Credits		28		

3.5.4. Concentration Requirements

Nanoscience program offers the following four concentrations, with each one requires successful completion of at least **54** credits:

- a. Nanomedicine
- b. Nanophysics
- c. Bio-nanotechnology
- d. Nanochemistry

**Compulsory Courses of Concentration Requirements -
Nanomedicine (54 Cr)**

Course Code	Course Title	Cr	L	P
BMS 202	Cell Biology	3	3	-
BMS 212	Cell Biology Lab	1	-	3
BMS 204	Biochemistry	3	3	-
BMS 214	Biochemistry Lab	1	-	3
CHEM 203	Organic Chemistry II	3	3	-
NANOSC 308	Introduction to polymer Science	3	3	-
NANOSC 310	Computer Aided Drug Design	3	2	1
BMS 205	Human Physiology	3	3	-
NANOSC 309	Principles of Pharmacokinetics	3	3	-
NANOSC 403	Special Topics in Nanomedicine	3	3	-
NANOSC 404	Principles of Pharmacology	3	3	-
NANOSC 405	Nanopharmaceutics	3	3	-
NANOSC 406	Nanomaterials for regenerative medicine and tissue engineering	3	3	-
NANOSC 417	Nanomedicine Lab	1	-	3
NANOSC 458	Nanoscience Capstone Research Project I	3	-	-
NANOSC 498	Nanoscience Capstone Research Project II	3	-	-
NANOSC Electives		12	12	
Total		54		

**Compulsory Courses of Concentration Requirements -
Nanophysics (54 Cr)**

Course Code	Course Title	Cr	L	P
PHYS 201	Thermodynamics, Wave Motion & Optics	3	3	-
PHYS 211	Thermodynamics, Wave Motion and Optics Lab	1	-	3
PHYS 202	Modern Physics	3	3	-
PHYS 212	Modern Physics Lab	1	-	3
MATH 202	Ordinary Differential Equations	3	3	-
NANOSC 306	Statistical Mechanics I & Thermodynamics for Nanoscale Systems	3	3	-
MATSCI 302	Solid State Physics	3	3	-
NANOSC 413	Photonics & Laser Physics	3	3	-
NANOSC 415	Electronic & Magnetic properties of Nano materials	3	3	-
NANOSC 416	Modeling of Nanomaterials	3	3	-
NANOSC 499	Nanoscience Capstone Research Project	4	-	-
PHYS 210	Advanced Electromagnetism	3	3	-
PHYS 323	Quantum Mechanics I	3	3	-
PHYS 346	Mathematical Physics I	3	3	-
PHYS 348	Quantum Mechanics II	3	3	-
NANOSC Electives		12	12	
Total		54		

**Compulsory Courses of Concentration Requirements -
Bio-Nanotechnology (54 Cr)**

Course Code	Course Title	Cr	L	P
PHYS 201	Thermodynamics, Wave Motion & Optics	3	3	-
PHYS 211	Thermodynamics, Wave Motion and Optics Lab	1	-	3
PHYS 202	Modern Physics	3	3	-
PHYS 212	Modern Physics Lab	1	-	3
MATH 202	Ordinary Differential Equations	3	3	-
NANOSC 306	Statistical Mechanics I & Thermodynamics for Nanoscale Systems	3	3	-
MATH 306	Numerical analysis	3	3	-
NANOSC 411	Bio-Nanotechnology Lab	1	-	3
NANOSC 303	Quantum Mechanics	3	3	-
NANOSC 308	Introduction to Polymer Science	3	3	-
NANOSC 317	Special Topics in Bio-Nanotechnology	3	3	-
NANOSC 328	Biological Nanomaterials	3	3	-
NANOSC 408	Synthetic Biology	3	3	-
NANOSC 409	Biotechnology Applications	3	3	-
NANOSC 458	Nanoscience Capstone Research Project I	3	-	-
NANOSC 498	Nanoscience Capstone Research Project II	3	-	-
NANOSC Electives		12	12	
Total		54		

**Compulsory Courses of Concentration Requirements -
Nanochemistry (54 Cr)**

Course Code	Course Title	Cr	L	P
PHYS 201	Thermodynamics, Wave Motion & Optics	3	3	-
PHYS 211	Thermodynamics, Wave Motion and Optics Lab	1	-	3
PHYS 202	Modern Physics	3	3	-
PHYS 212	Modern Physics Lab	1	-	3
CHEM 203	Organic Chemistry II	3	3	-
NANOSC 306	Statistical Mechanics I & Thermodynamics for Nanoscale Systems	3	3	-
MATH 306	Numerical analysis	3	3	-
NANOSC 412	Nanochemistry Lab	1	-	3
NANOSC 303	Quantum Mechanics	3	3	-
NANOSC 308	Introduction to Polymer Science	3	3	-
NANOSC 322	Chemistry & Physics of Nanomaterials	3	3	-
NANOSC 392	Introduction to Nanochemistry	3	3	-
NANOSC 409	Surfaces and colloidal Science	3	3	-
MATSCI 480	Self-assembled Systems	3	3	-
NANOSC 458	Nanoscience Capstone Research Project I	3	-	-
NANOSC 498	Nanoscience Capstone Research Project II	3	-	-
NANOSC Electives		12	12	
Total		54		

3.6. Sample Study Plan for B. Sc. In Nano Science

3.6.1. NANO SCIENCE YEAR 2 (TOTAL CREDITS: 29 CR)

NANOSC YEAR 2 / SEMESTER 1 (NANOPHYSICS, NANO CHEMISTRY, BIO-NANOTECHNOLOGY)					
COURSE CODE	COURSE TITLE	CR	L	P	PREREQUISITE
CHEM 201	Organic Chemistry	3	3	-	CHEM 101; Concurrent with CHEM 211
CHEM 211	Organic Chemistry Lab	1	-	3	Concurrent with CHEM 201
CSCI 101	Introduction to Computer Science	2	1	3	
MATH 201	Linear Algebra and Vector Geometry	3	3	-	
PHYS 201	Introduction to Thermodynamics, Wave Motion and Optics	3	3	-	PHYS 102; Concurrent with PHYS 211
PHYS 211	Thermodynamics, Wave Motion and Optics Lab	1	-	3	Concurrent with PHYS 201
TOTAL		13			

NANOSC YEAR 2 / SEMESTER 1 (NANOMEDICINE)					
COURSE CODE	COURSE TITLE	Cr	L	P	Prerequisite
CHEM 201	Organic Chemistry	3	3	-	CHEM 101; Concurrent with CHEM 211
CHEM 211	Organic Chemistry Lab	1	-	3	Concurrent with CHEM 201
CSCI 101	Introduction to Computer Science	2	1	3	
MATH 201	Linear Algebra and Vector Geometry	3	3	-	
BMS 202	Cell Biology	3	3	-	BIOL102; Concurrent with BMS 212
BMS 212	Cell Biology Lab	1	-	3	Concurrent with BMS 202
TOTAL		13			



NANOSC YEAR 2 / SEMESTER 2 (NANOPHYSICS & BIO-NANOTECHNOLOGY)					
COURSE CODE	COURSE TITLE	CR	L	P	PREREQUISITE
CHEM 202	Analytical and Physical Chemistry	3	3	-	CHEM 102; Concurrent with CHEM 212
CHEM 212	Analytical and Physical Chemistry Lab	1	-	3	Concurrent with CHEM 202
MATH 202	Ordinary Differential Equations	3	3	-	MATH 102
MATSCI 201	Fundamentals of Materials Science and Engineering	3	3	-	CHEM 101
PHYS 202	Modern Physics	3	3	-	PHYS 102; concurrent with PHYS 212
PHYS 212	Modern Physics Lab	1	-	3	concurrent with PHYS 202
General Education Electives		2	2	-	
TOTAL		16			

NANOSC YEAR 2 / SEMESTER 2 (NANOMEDICINE)					
COURSE CODE	COURSE TITLE	CR	L	P	PREREQUISITE
CHEM 202	Analytical and Physical Chemistry	3	3	-	CHEM 102; Concurrent with CHEM 212
CHEM 212	Analytical and Physical Chemistry Lab	1	-	3	Concurrent with CHEM 202
CHEM 203	Organic Chemistry II	3	3	-	CHEM 201
MATSCI 201	Fundamentals of Materials Science and Engineering	3	3	-	CHEM 101
BMS 204	Biochemistry	3	3	-	CHEM 201; Concurrent with BMS 214
BMS 214	Biochemistry Lab	1	-	3	Concurrent with BMS 204
General Education Electives		2	2	-	
TOTAL		16			



NANOSC YEAR 2 / SEMESTER 2 (NANO CHEMISTRY)					
COURSE CODE	COURSE TITLE	CR	L	P	PREREQUISITE
CHEM 202	Analytical and Physical Chemistry	3	3	-	CHEM 102; Concurrent with CHEM 212
CHEM 212	Analytical and Physical Chemistry Lab	1	-	3	Concurrent with CHEM 202
CHEM 203	Organic Chemistry II	3	3	-	CHEM 201
MATSCI 201	Fundamentals of Materials Science and Engineering	3	3	-	CHEM 101
PHYS 202	Modern Physics	3	3	-	PHYS 102; concurrent with PHYS 212
PHYS 212	Modern Physics Lab	1	-	3	concurrent with PHYS 202
General Education Electives		2	2	-	
TOTAL		16			

3.6.2. NANO SCIENCE YEAR 3

3.6.2.1. NANOMEDICINE (TOTAL CREDITS: 35 CR)

NANOMEDICINE YEAR 3 / SEMESTER 1						
COURSE CODE	COURSE TITLE	CR	L	P	PREREQUISITE	
NANOSC 302	Modern Characterization Techniques I	3	3	-	Concurrent with NANOSC 312	
NANOSC 305	Synthesis/Fabrication of Nanomaterials	3	3	-	Concurrent with NANOSC 315	
NANOSC 308	Introduction to Polymer Science	3	3	-		
NANOSC 312	Modern Characterization Techniques I Lab	1	-	3	Concurrent with NANOSC 302	
NANOSC 315	Synthesis/Fabrication of Nanomaterials Lab	1	-	3	Concurrent with NANOSC 305	
General Education Electives		2	2			
NANOSC Electives		3	3	-		
TOTAL		16				

NANOMEDICINE YEAR 3 / SEMESTER 2						
COURSE CODE	COURSE TITLE	CR	L	P	PREREQUISITE	
BMS 205	Human Physiology	3	3	-	BIOL 102; Concurrent with BMS 215	
NANOSC 301	Spectroscopy of Nanomaterials	3	3	-		
NANOSC 307	Nano Sciences Research Lab Rotations	1	-	3	-	
NANOSC 309	Principles of Pharmacokinetics	3	3	-		
NANOSC 310	Computer Aided Drug Design	3	2	3		
General Education Electives		4	4	-		
TOTAL		17				

NANOMEDICINE YEAR 3 / SEMESTER 3 (SUMMER)						
COURSE CODE	COURSE TITLE	CR	L	P	PREREQUISITE	
NANOSC 399	Internship	2	-	6	Pass/Fail	
TOTAL		2				

3.6.2.2. NANOPHYSICS (TOTAL CREDITS: 38 CR)

NANOPHYSICS YEAR 3 / SEMESTER 1					
COURSE CODE	COURSE TITLE	CR	L	P	PREREQUISITE
NANOSC 302	Modern Characterization Techniques I	3	3	-	Concurrent with NANOSC 312
NANOSC 305	Synthesis/Fabrication of Nanomaterials	3	3	-	Concurrent with NANOSC 315
NANOSC 306	Statistical Mechanics I & Thermodynamics for Nanoscale Systems	3	3	-	
NANOSC 312	Modern Characterization Techniques I Lab	1	-	3	Concurrent with NANOSC 302
NANOSC 315	Synthesis/Fabrication of Nanomaterials Lab	1	-	3	Concurrent with NANOSC 305
PHYS 323	Quantum Mechanics I	3	3	-	PHYS 202
PHYS 346	Mathematical Physics I	3	3	-	MATH 202
TOTAL		17			

NANOPHYSICS YEAR 3 / SEMESTER 2					
COURSE CODE	COURSE TITLE	CR	L	P	PREREQUISITE
MATSCI 302	Solid State Physics	3	3	-	PHYS 202
NANOSC 301	Spectroscopy of Nanomaterials	3	3	-	
NANOSC 307	Nano Sciences Research Lab Rotations	1	-	3	
PHYS 210	Advanced Electromagnetism	3	3	-	PHYS 102
PHYS 348	Quantum Mechanics II	3	3	-	PHYS 323
General Education Electives		6	6	-	
TOTAL		19			

NANOPHYSICS YEAR 3 / SEMESTER 3 (SUMMER)					
COURSE CODE	COURSE TITLE	CR	L	P	PREREQUISITE
NANOSC 399	Internship	2	-	6	Pass/Fail
TOTAL		2			

3.6.2.3. BIO-NANOTECHNOLOGY (TOTAL CREDITS: 35 CR)

BIO-NANOTECHNOLOGY YEAR 3 / SEMESTER 1					
COURSE CODE	COURSE TITLE	CR	L	P	PREREQUISITE
NANOSC 302	Modern Characterization Techniques I	3	3	-	Concurrent with NANOSC 312
NANOSC 303	Quantum Mechanics	3	3	-	PHYS 202
NANOSC 305	Synthesis/Fabrication of Nanomaterials	3	3	-	Concurrent with NANOSC 315
NANOSC 306	Statistical Mechanics I & Thermodynamics for Nanoscale Systems	3	3	-	
NANOSC 312	Modern Characterization Techniques I Lab	1	-	3	Concurrent with NANOSC 302
NANOSC 315	Synthesis/Fabrication of Nanomaterials Lab	1	-	3	Concurrent with NANOSC 305
NANOSC Electives		3	3	-	
TOTAL		17			

BIO-NANOTECHNOLOGY YEAR 3 / SEMESTER 2					
COURSE CODE	COURSE TITLE	CR	L	P	PREREQUISITE
NANOSC 301	Spectroscopy of Nanomaterials	3	3	-	
NANOSC 307	Nano Sciences Research Lab Rotations	1	-	3	
NANOSC 317	Special Topics in Bio-Nanotechnology	3	3	-	BIOL 102 AND CHEM 201
NANOSC 328	Biological Nanomaterials	3	3	-	CHEM 202
General Education Electives		6	6	-	
TOTAL		16			

BIO-NANOTECHNOLOGY YEAR 3 / SEMESTER 3 (SUMMER)					
COURSE CODE	COURSE TITLE	CR	L	P	PREREQUISITE
NANOSC 399	Internship	2	-	6	Pass/Fail
TOTAL		2			

3.6.2.4. NANOCHEMISTRY (TOTAL CREDITS: 35 CR)

NANOCHEMISTRY YEAR 3 / SEMESTER 1					
COURSE CODE	COURSE TITLE	CR	L	P	PREREQUISITE
NANOSC 302	Modern Characterization Techniques I	3	3	-	Concurrent with NANOSC 312
NANOSC 303	Quantum Mechanics	3	3	-	PHYS 202
NANOSC 305	Synthesis/Fabrication of Nanomaterials	3	3	-	Concurrent with NANOSC 315
NANOSC 306	Statistical Mechanics I & Thermodynamics for Nanoscale Systems	3	3	-	
NANOSC 312	Modern Characterization Techniques I Lab	1	-	3	Concurrent with NANOSC 302
NANOSC 315	Synthesis/Fabrication of Nanomaterials Lab	1	-	3	Concurrent with NANOSC 305
NANOSC Electives		3	3	-	
TOTAL		17			

NANOCHEMISTRY YEAR 3 / SEMESTER 2					
COURSE CODE	COURSE TITLE	CR	L	P	PREREQUISITE
NANOSC 301	Spectroscopy of Nanomaterials	3	3	-	
NANOSC 307	Nano Sciences Research Lab Rotations	1	-	3	
NANOSC 322	Chemistry & Physics of Nanomaterials	3	2	3	MATH 201
NANOSC 392	Introduction to Nanochemistry	3	3	-	CHEM 202
General Education Electives		6	6	-	
TOTAL		16			

NANOCHEMISTRY YEAR 3 / SEMESTER 3 (SUMMER)					
COURSE CODE	COURSE TITLE	CR	L	P	PREREQUISITE
NANOSC 399	Internship	2	-	6	Pass/Fail
TOTAL		2			

3.6.3. NANO SCIENCE YEAR 4 (29 - 32 CR)

NANOSC YEAR 4 / SEMESTER 1					
COURSE CODE	COURSE TITLE	CR	L	P	PREREQUISITE
General Education Electives		4	4	-	
Nanomedicine/ Bio-Nanotechnology/Nanochemistry					
Concentration Courses		16			
Nanophysics					
Concentration Courses		12			
TOTAL		16 - 20			

NANOSC YEAR 4 / SEMESTER 2					
COURSE CODE	COURSE TITLE	CR	L	P	PREREQUISITE
Nanomedicine/ Bio-Nanotechnology/Nanochemistry					
Concentration Courses		12			
Nanophysics					
Concentration Courses		13			
TOTAL		12 - 13			

3.6.3.1. NANOMEDICINE CONCENTRATION COURSES

NANO MEDICINE CONCENTRATION COURSES/ SEMESTER 1					
COURSE CODE	COURSE TITLE	CR	L	P	PREREQUISITE
NANOSC 403	Special Topics in Nanomedicine	3	3	-	NANOSC 305 AND BIOL 102; Concurrent with NANOSC 417
NANOSC 405	Nanopharmaceutics	3	3	-	NANOSC 305
NANOSC 417	Nanomedicine Lab	1	-	1	NANOSC 305 AND BIOL 102; Concurrent with NANOSC 403
NANOSC 458	Nanoscience Capstone Research Project I	3	-	-	
NANOSC Electives		6	6	-	
TOTAL		16			

NANO MEDICINE CONCENTRATION COURSES/ SEMESTER 2					
COURSE CODE	COURSE TITLE	CR	L	P	PREREQUISITE
NANOSC 404	Principles of Pharmacology	3	3	-	BIOL 102 AND BMS 204
NANOSC 406	Nanomaterials for regenerative medicine and tissue engineering	3	3	-	NANOSC 305
NANOSC 498	Nanoscience Capstone Research Project II	3	-	-	
NANOSC Electives		3	3	-	
TOTAL		12			

3.6.3.2. NANOPHYSICS CONCENTRATION COURSES

NANOPHYSICS CONCENTRATION COURSES / SEMESTER 1					
COURSE CODE	COURSE TITLE	CR	L	P	PREREQUISITE
NANOSC 413	Photonics & Laser Physics	3	3	-	PHYS 202
NANOSC 415	Electronic & Magnetic properties of Nano materials	3	3	-	PHYS 202
NANOSC Electives		6	6		
TOTAL		12			

NANOPHYSICS CONCENTRATION COURSES / SEMESTER 2					
COURSE CODE	COURSE TITLE	CR	L	P	PREREQUISITE
NANOSC 416	Modeling of Nano materials	3	3	-	PHYS 202
NANOSC 499	Nanoscience Capstone Research Project	4	-	-	-
NANOSC Electives		6	6		
TOTAL		13			

3.6.3.3. Bio-NANOTECHNOLOGY CONCENTRATION COURSES

BIO-NANOTECHNOLOGY CONCENTRATION COURSES/ SEMESTER 1					
COURSE CODE	COURSE TITLE	CR	L	P	PREREQUISITE
MATH 306	Numerical analysis	3	3	-	MATH 201 AND MATH 202
NANOSC 308	Introduction to Polymer Science	3	3	-	
NANOSC 411	Bio-Nanotechnology Lab	1	-	3	NANOSC 315 AND NANOSC 317
NANOSC 458	Nanoscience Capstone Research Project I	3	-	-	
NANOSC Electives		6	6	-	
TOTAL		16			

BIO-NANOTECHNOLOGY CONCENTRATION COURSES/ SEMESTER 2					
COURSE CODE	COURSE TITLE	CR	L	P	PREREQUISITE
NANOSC 408	Synthetic Biology	3	3	-	
NANOSC 409	Biotechnology Applications	3	3	-	
NANOSC 498	Nanoscience Capstone Research Project II	3	-	-	
NANOSC Electives		3	3	-	
TOTAL		12			

3.6.3.4. NANO CHEMISTRY CONCENTRATION COURSES

NANO CHEMISTRY CONCENTRATION COURSES/ SEMESTER 1					
COURSE CODE	COURSE TITLE	CR	L	P	PREREQUISITE
MATH 306	Numerical analysis	3	3	-	MATH 201 AND MATH 202
NANOSC 308	Introduction to Polymer Science	3	3	-	
NANOSC 412	Nanochemistry Lab	1	-	3	NANOSC 315 AND NANOSC 392
NANOSC 458	Nanoscience Capstone Research Project I	3	-	-	
NANOSC Electives		6	6	-	
TOTAL		16			

NANO CHEMISTRY CONCENTRATION COURSES/ SEMESTER 2					
COURSE CODE	COURSE TITLE	CR	L	P	PREREQUISITE
MATSCI 480	Self-assembled Systems	3	3	-	CHEM 201
NANOSC 409	Surfaces and colloidal Science	3	3	-	
NANOSC 498	Nanoscience Capstone Research Project II	3	-	-	
NANOSC Electives		3	3	-	
TOTAL		12			

3.7. Nano Science Program Elective Courses

NANO SCIENCE ELECTIVE COURSES					
COURSE CODE	COURSE TITLE	CR	L	P	PREREQUISITE
BMS 201	General Microbiology	3	3	-	BIOL 102 Concurrent with BMS 211
BMS 202	Cell Biology	3	3	-	BIOL 102 Concurrent with BMS 212
BMS 204	Biochemistry	3	3	-	CHEM 201 Concurrent with BMS 214
BMS 205	Human Physiology	3	3	-	BOIL 102 Concurrent with BMS 215
BMS 301	Molecular Biology	3	3	-	BMS 202
BMS 320	Introduction to Bioinformatics and Programming Language	3	3	-	BIOL 102 AND CSCI 101 AND MATH 102
BMS 322	Structural Biology	3	3	-	BIOL 102 AND (CHEM 202 OR PHYS 201)
BMS 337	Cancer Biology	3	3	-	BMS 202
BMS 364	Biophysics	3	3	-	CHEM 202 OR PHYS 201
BMS 465	Virology	3	3	-	BIOL 102
CHEM 203	Organic Chemistry II	3	3	-	CHEM 201
CIE 202	Fundamentals of Computer Programming	3	2	3	CSCI 101
CIE 205	Data Structures and Algorithm Analysis	3	2	3	CIE 202
ENGR 207	Fluid Mechanics	3	3	-	PHYS 101 AND MATH 201
MATH 301	Probability and Statistics	3	2	2	MATH 102
MATSCI 204	Inorganic chemistry	3	3	-	CHEM 102
MATSCI 301	Catalysis	3	3	-	CHEM 102
MATSCI 303	Macromolecular Chemistry	3	3	-	CHEM 102
MATSCI 308	Computational Modeling	3	3	-	PHYS 202 AND MATH 202
NANENG 301	Micro/Nano Fabrication Techniques	3	3	-	CHEM 102 AND MATSCI 201
NANOSC 308	Introduction to Polymer Science	3	3	-	
NANOSC 313 (Equivalent to MATSCI 304)	Advanced Characterization Techniques	3	3	-	CHEM 102 AND PHYS 102
NANOSC 401	Nanotoxicology	3	3	-	NANOSC 305
NANOSC 402	Nano Imaging	3	3		NANOSC 302 NANOSC 305



NANOSC 420	Physics of Nanostructured Semiconductors	3	3	-	PHYS 202
NANOSC 421	Nano-Structured Materials & Nanoscale Thin Films	3	3	-	NANOSC 302 AND NANOSC 305
NANOSC 424	Kinetics and Energetics in Nanobiological Systems	3	3	-	CHEM 202 AND BIOL 102
NANOSC 425	Quantum Theory for Nanoscale Systems	3	3	-	CHEM 202
NANOSC 426	Colloidal Nanoscience	3	3	-	CHEM 202
NANOSC 427	Biological Routes for Nanomaterials Synthesis & Growth of Nanostructured Materials	3	3	-	BIOL 102
NANOSC 431	Nanobiology	3	3	-	BIOL 102
NANOSC 433	Nano- and biophotonics	3	3	-	PHYS 202
PHYS 326	Mathematical Physics II	3	3	-	PHYS 346 AND MATH 201 AND MATH 202
PHYS 430	Quantum Mechanics III	3	3	-	PHYS 348
PHYS 450	Computational Physics	3	3	-	CSCI 101
PHYS 455	Mathematical Physics III	3	3	-	PHYS 316
SPC 303	Remote Sensing & Instrumentation	3	3	-	PHYS 102 And MATH 202

4. PHYSICS OF UNIVERSE (130 CREDIT HOUR)

4.1. PROGRAM DESCRIPTION

The Physics of Universe, PU, Major is designed to provide the rigorous background in Mathematics and Physical Sciences required for a career in theoretical, computational, or experimental scientific research and/or education. During the first two years, all students will take foundation courses in Basic Science and Mathematics, with an emphasis on Physics. They are also exposed to the two concentration options available for advanced study: Astrophysics and High Energy Physics. During the final two years students pursue advanced study within their chosen area of concentration, together with advanced training in Physics. Each concentration includes specialized instruction from Zewail City research center experts in Theoretical Physics, Computational and Experimental Physics. The advanced Mathematical and Computational skills of PU graduates can be readily transferred to many applications in business and industry, as well as academic and government research.

برنامج فيزياء الكون

تم تصميم برنامج فيزياء الكون ليمد طلابه بالخلفيات اللازمة من علوم الرياضيات والعلوم الطبيعية التي تؤهلهم للعمل في البحث والنشر العلمي و/أو التعليم في علوم الرياضيات والعلوم الطبيعية النظرية، الحاسوبية، أو التجريبية. خلال العامين الأولين؛ يدرس الطلاب مناهج تأسيسية في العلوم والرياضيات مع التركيز على علم الطبيعة. كما يتعرف الطلاب خلال تلك المرحلة على التخصصات الرئيسية والتي تشمل: علوم الفيزياء الفلكية وفيزياء الطاقة العالية. خلال العامين التاليين (العام الثالث والرابع) يدرس الطلاب مناهج متقدمة في التخصص الذي تم اختياره من قبلهم، بالإضافة إلى تدريب مكثف في مجال العلوم الطبيعية. كما يرتبط التخصصان الرئيسيان المذكوران بالمراكز البحثية المتواجدة في مدينة زويل حيث يتواجد باحثين ذوي خبرة في هذه التخصصات، بحيث يمكن نقل خبراتهم المكتسبة للطلاب من خلال العمل على تطبيقات عملية اقتصادية وصناعية وأكاديمية.

4.2. PROGRAM EDUCATIONAL OBJECTIVES

Within a few years of graduation, physics of universe alumni will have:

- Gained employment in the field of astrophysics, high energy physics, and physics in general; for Educational, Industrial, and Academic applications.
- Created value by analyzing and designing sustainable solutions to problems involving our universe evaluation, the characteristics of its matter content and the forces governing it.
- Successfully engaged in advanced studies in high energy physics theory and lab, working with groups around the world especially the Large Hadron Collider experiment.
- Actively participated in research development in astrophysics, in theoretical and observational fronts.
- Facilitated collaboration and built strong professional relationships by working successfully in multidisciplinary teams and effectively communicating with a diverse group of stakeholders.

4.3. STUDENT OUTCOMES

General Science Student Outcomes	
1	An ability to identify, formulate, and solve broadly defined technical or scientific problems by applying knowledge of mathematics and science and/or technical topics to areas relevant to the discipline.
2	An ability to formulate or design a system, process, procedure or material to meet desired needs.
3	An ability to develop and conduct experiments or test hypotheses, analyze and interpret data and use scientific judgment to draw conclusions.
4	An ability to communicate effectively with a range of audiences.
5	An ability to understand ethical and professional responsibilities and the impact of technical and/or scientific solutions in global, economic, environmental, and societal contexts.
6	An ability to function effectively on teams that establish goals, plan tasks, meet deadlines, and analyze risk and uncertainty.
Program Specific Student Outcomes	
7	An ability to identify, formulate and solve scientific problems in High Energy Physics and Astrophysics Sciences.

4.4. PROGRAM EDUCATIONAL OBJECTIVES MAPPING TO STUDENT OUTCOMES

		SOs						
		1	2	3	4	5	6	7
PEOs	1		X	X	X	X	X	X
	2	X	X	X	X		X	X
	3	X	X	X	X	X	X	X
	4	X	X	X	X		X	X
	5				X	X	X	

4.5. DEGREE REQUIREMENTS FOR B.SC. IN PHYSICS OF UNIVERSE

A Student who intends to major in Physics of Universe must submit a Major Declaration Form upon completion of 34 credit hours of the Foundation Year. A total of 130 credits is required for the bachelor's degree in Physics of Universe Program. Students should consult their advisor on a regular basis to ensure that the prerequisites for their university requirements, track requirements, major requirements, concentration requirements and electives are fulfilled.

<i>Program</i>	<i>University Requirements (General Education) (Cr)</i>	<i>Track Requirements (Math and Basic Sciences) (Cr)</i>	<i>Major Requirements (Cr)</i>	<i>Concentration Requirements (Cr)</i>	<i>Total (Cr)</i>
Physics of Universe	16	32	70	12	130

4.5.1. UNIVERSITY REQUIREMENTS

The aim of university requirements is to provide UST students with skills and knowledge to develop an intellectual, well-rounded and successful personal identity. University requirements is a set of Humanities and Social Sciences courses which are designed to enrich students with an appreciative understanding of the natural and cultural environments in which they live and their roles in the society and community services.

University Requirements (16 Cr)				
Compulsory Courses (4 Cr)				
Course Code	Course Title	Cr	L	P
ENGL 152	Effective Speaking and Composition	2	1	2
ENGL 153	Scientific Writing	2	1	2
Elective Courses (12 Cr)				
Student must select at least 12 Cr from the offered General Education Courses				

4.5.2. TRACK REQUIREMENTS

The aim of track requirements is to provide students of science programs with skills and knowledge essential to develop a successful scientist. Track requirements include courses of basic knowledge essential to all graduates of science programs such as Mathematics, Physics, Chemistry, Biology, and Internship training.

Compulsory Courses of Track Requirements (32 Cr)				
Course Code	Course Title	Cr	L	P
BIOL 101	Biology I	3	3	-
BIOL 102	Biology II	3	3	-
BIOL 111	Biology I Lab	1	-	3
BIOL 112	Biology II Lab	1	-	3
CHEM 101	Chemistry I	3	3	-
CHEM 102	Chemistry II	3	3	-
CHEM 111	Chemistry I Lab	1	-	3
CHEM 112	Chemistry II Lab	1	-	3
MATH 101	Calculus I	3	3	-
MATH 102	Calculus II	3	3	-
PHYS 399	Internship	2	-	6
PHYS 101	Introduction to Classical Mechanics	3	3	-
PHYS 102	Introduction to Electromagnetism	3	3	-
PHYS 111	Introduction to Classical Mechanics Lab	1	-	3
PHYS 112	Introduction to Electromagnetism Lab	1	-	3
Total Credits		32		

4.5.3. MAJOR REQUIREMENTS

The program offers a major specialty in Physics of Universe, which requires successful completion of at least 70 credits:

Compulsory Courses of Major Requirements - Physics of Universe (70 Cr)				
Course Code	Course Title	Cr	L	P
CSCI 101	Introduction to Computer Science	2	1	3
MATH 201	Linear Algebra and Vector Geometry	3	3	-
MATH 202	Ordinary Differential Equations	3	3	-
PHYS 201	Thermodynamics, Wave Motion and Optics	3	3	-
MATSCI 302	Solid State Physics	3	3	-
PHYS 202	Modern Physics	3	3	-
PHYS 204	Analytical Mechanics	3	3	-
PHYS 205	Introduction to Modern Astrophysics	3	3	-
PHYS 208	Electrodynamics I	3	3	-
PHYS 211	Thermodynamics, Wave Motion and Optics Lab	1	-	3
PHYS 212	Modern Physics Lab	1	-	3
PHYS 308	Electrodynamics II	3	3	-
PHYS 311	Thermal and Statistical Physics	3	3	-
PHYS 316	Mathematical Physics I	3	3	-
PHYS 323	Quantum Mechanics I	3	3	-
PHYS 327	Observational Astrophysics Laboratory	2	-	6
PHYS 356	Mathematical Physics II	4	4	-
PHYS 405	Cosmology	3		
PHYS 453	Gravity & General Relativity	3		
PHYS 455	Mathematical Physics III	3		
PHYS 498	Senior Project I	1	0	3
PHYS 499	Senior Project II	2	0	6
PU Electives		12		
Total Credits		70		

4.5.4. CONCENTRATION REQUIREMENTS

Physics of Universe program offers the following two concentrations, which require successful completion of 12 credits:

- Astrophysics
- High Energy Physics

Compulsory Courses of Concentration Requirements - Astrophysics Concentration (12 Cr)				
Course Code	Course Title	Cr	L	P
PHYS 331	Stellar Structure and Evolution	3	3	
PHYS 416	Galactic & Extragalactic Astrophysics	3	3	
ENGR 207	Fluid Mechanics	3	3	
PHYS 438	Compact Objects & High Energy Astrophysics	3	3	
Total Credits		12		

Compulsory Courses of Concentration Requirements - High Energy Physics Concentration (12 Cr)				
Course Code	Course Title	Cr	L	P
PHYS 348	Quantum Mechanics II	3	3	
PHYS 430	Quantum Mechanics III	3	3	
PHYS 431	Quantum Field Theory and Particle Phys	6	6	
Total Credits		12		

4.6. SAMPLE STUDY PLAN FOR B.SC. IN PHYSICS OF UNIVERSE

4.6.1. PHYSICS OF UNIVERSE YEAR 2 (33 Cr)

PU YEAR 2 / SEMESTER 1					
COURSE CODE	COURSE TITLE	CR	L	P	PREREQUISITE
CSCI 101	Introduction to Computer Science	2	1	3	
MATH 201	Linear Algebra and Vector Geometry	3	3	0	
PHYS 205	Introduction to Modern Astrophysics	3	3	0	PHYS 101
PHYS 204	Analytical Mechanics	3	3	0	PHYS 101
PHYS 201	Thermodynamics, Wave Motion and Optics	3	3		PHYS 102; Concurrent with PHYS 211
PHYS 211	Thermodynamics, Wave Motion and Optics Lab	1	0	3	Concurrent with PHYS 201
General Education Electives		3	3		
TOTAL CONTACT HOURS (21)					
TOTAL CR		18			

PU YEAR 2 / SEMESTER 2					
COURSE CODE	COURSE TITLE	CR	L	P	PREREQUISITE
MATH 202	Ordinary Differential Equations	3	3	0	MATH 102
PHYS 202	Modern Physics	3	3	0	PHYS 102; Concurrent with PHYS 212
PHYS 212	Modern Physics Lab	1	0	3	Concurrent with PHYS 202
PHYS 208	Electrodynamics I	3	3		PHYS 102
PHYS Electives		3	3	0	
General Education Electives		2	1	2	
Total Contact hours (21)				3	
TOTAL CR		15			

4.6.2. PHYSICS OF UNIVERSE YEAR 3 (34Cr)

PU YEAR 3 / SEMESTER 1					
COURSE CODE	COURSE TITLE	CR	L	P	PREREQUISITE
PHYS 311	Thermal and Statistical Physics	3	3	0	PHYS 201
PHYS 316	Mathematical Physics I	3	3	0	
PHYS 323	Quantum Mechanics I	3	3	0	PHYS 202
PU Electives		3	3		
General Education Electives		2	1	2	
Total Contact Hours (15)					
TOTAL CR		14			

PU YEAR 3 / SEMESTER 2					
COURSE CODE	COURSE TITLE	CR	L	P	PREREQUISITE
MATSCI 302	Solid State Physics	3	3	0	PHYS 202
PHYS 308	Electrodynamics II	3	3	0	PHYS 208
PHYS 327	Observational Astrophysics Laboratory	2		6	PHYS 205
PHYS 356	Mathematical Physics II	4	4	0	MATH 201
General Education Electives		3	3	0	
PU Concentration Courses		3	3	0	
Total Contact Hours (22)					
TOTAL CR		18			

PU / ASTROPHYSICS / YEAR 3 / SEMESTER 2 (3Cr)					
COURSE CODE	COURSE TITLE	CR	L	P	PREREQUISITE
PHYS 331	Stellar Structure and Evolution	3	3	0	PHYS 205
TOTAL		3			



PU / HIGH ENERGY PHYSICS / YEAR 3 / SEMESTER 2 (3 CR)					
COURSE CODE	COURSE TITLE	CR	L	P	PREREQUISITE
PHYS 348	Quantum Mechanics II	3	3	0	PHYS 323
TOTAL		3			

PU YEAR 3 / SEMESTER 3 / SUMMER (2 CR)					
COURSE CODE	COURSE TITLE	CR	L	P	PREREQUISITE
PHYS 399	Internship	2		6	Pass/Fail
TOTAL		2			

4.6.3. PHYSICS OF UNIVERSE YEAR 4 (29 CR)

4.6.3.1. PHYSICS OF UNIVERSE YEAR 4 / SEMESTER 1

PU YEAR 4 / SEMESTER 1					
COURSE CODE	COURSE TITLE	CR	L	P	PREREQUISITE
PHYS 498	Senior Project I	1	0	3	
PHYS 453	Gravity and General Relativity	3	3	0	
PHYS 455	Mathematical Physics III	3	3	0	PHYS 316
PU Electives		3	3		
General Education Electives		2	2		
PU Concentration Courses		3	3		
Total Contact Hours (16)					
TOTAL CR		15			

PU / ASTROPHYSICS / YEAR 4 / SEMESTER 1 (3 CR)					
COURSE CODE	COURSE TITLE	CR	L	P	PREREQUISITE
PHYS 438	Compact Objects and High Energy Astrophysics	3	3	0	PHYS 205
TOTAL		3			

PU/HIGH ENERGY PHYSICS/YEAR 4/SEMESTER 1 /3 CR

COURSE CODE	COURSE TITLE	CR	L	P	PREREQUISITE
PHYS 430	Quantum Mechanics III	3	3	0	PHYS 348
TOTAL		3			

PU YEAR 4 / SEMESTER 2

COURSE CODE	COURSE TITLE	CR	L	P	PREREQUISITE
PHYS 405	Cosmology	3	3	0	PHYS 205
PHYS 499	Senior Project II	2	0	6	PHYS 498
PU Electives		3	3		
PHYS Concentration Courses		6	6		
Total Contact Hours (18 hours)					
TOTAL CR		15			

PU / ASTROPHYSICS / YEAR 4 / SEMESTER 2 (6 Cr)

COURSE CODE	COURSE TITLE	CR	L	P	PREREQUISITE
PHYS 416	Galactic and Extragalactic Astrophysics	3	3	0	PHYS 205
ENGR 207	Fluid Mechanics	3	3	0	MATH 102 AND PHYS 101
TOTAL		6			

PU / HIGH ENERGY PHYSICS / YEAR 4 / SEMESTER 2 (6 Cr)

COURSE CODE	COURSE TITLE	CR	L	P	PREREQUISITE
PHYS 431	Quantum Field Theory and Particle Physics	6	6	0	PHYS 323
TOTAL		6			

4.7. PHYSICS OF UNIVERSE ELECTIVE COURSES

The program requires successful completion of at least 12 credits of the following electives.

PHYSICS OF UNIVERSE ELECTIVE COURSES					
COURSE CODE	COURSE TITLE	CR	L	P	PREREQUISITE
CIE 202	Fundamentals of Computer Programming	3	2	3	CSCI 101
CIE 205	Data Structures and Algorithm Analysis	3	-	-	CIE 202
MATH 301	Probability and Statistics	3	3	-	MATH 102
MATH 302	Partial Differential Equations and Complex Analysis	3	3	-	MATH 202
MATH 310	Abstract Algebra	3	3	-	MATH 201
MATH 306	Numerical Analysis	3	3	-	MATH 201 AND MATH 202
MATH 308	Discrete Mathematics	3	3	-	
MATH 403	Introduction to Real Analysis and Topology	3	3	-	MATH 202
PHYS 218	Vector Calculus	3	3	-	MATH 102
NANOSC 413	Photonics & Laser Physics	3	3	-	PHYS 202
NANOSC 415	Electronic & Magnetic properties of Nano materials	3	3	-	PHYS 202
PHYS 364	Biological Physics	3	3	-	BIOL 102 AND (CHEM 202 OR PHYS 201)
PHYS 420	The Solar System	3	3	-	PHYS 205
PHYS 422	Astrophysical Fluid Dynamics	3	3	-	
PHYS 432	Advanced Dynamics	3	3	-	PHYS 101
PHYS 450	Computational Physics	3	3	-	CSCI 101
CIE 470	Introduction to Quantum Computation and Quantum Information	3	2	3	MATH 201



PHYSICS OF UNIVERSE ELECTIVE COURSES (OTHER ELECTIVES FOR ASTROPHYSICS CONCENTRATION)

COURSE CODE	COURSE TITLE	CR	L	P	PREREQUISITE
PHYS 430	Quantum Mechanics III	3	3	0	PHYS 348

PHYSICS OF UNIVERSE ELECTIVE COURSES (OTHER ELECTIVES FOR HIGH ENERGY PHYSICS CONCENTRATION)

COURSE CODE	COURSE TITLE	CR	L	P	PREREQUISITE
ENGR 207	Fluid Mechanics	3	3	0	PHYS 101 AND MATH 201
PHYS 331	Stellar Structure and Evolution	3	3	0	PHYS 205