German Jordanian University

School of Applied Medical Science

Department of Pharmaceutical and Chemical Engineering

Bachelor of Science in Pharmaceutical and Chemical Engineering

Study Plan 2022

I. Program Vision

Leadership in the field of pharmaceutical and chemical engineering in terms of teaching, scientific research, and social impact.

II. Program Mission

Providing students with distinctive education in pharmaceutical and chemical engineering based on hybrid integration of Pharmacy and Chemical Engineering to meet the needs of the pharmaceutical and chemical industries and provide novel and sustainable solutions to national and global challenges.

III. Program General Description

The Department of Pharmaceutical and Chemical Engineering (PCE) at the German Jordanian University (GJU) offers a five-year bachelor's degree program. The 180 credit hours (Cr Hr) are divided as follows: 21 Cr Hr represent compulsory university requirements as listed in Table 1.2, 6 Cr Hr represent elective university requirements that must be selected from Table 1.3, 27 CH school requirements as listed in Table 2, 104 Cr Hr compulsory program requirements as listed in Table 3.1, 10 Cr Hr ancillary program requirements as listed in Table 3.2, and finally, 12 Cr Hr elective program requirements that must be selected from Table 3.3.

The PCE program at GJU is unique at the local and regional level, as it combines the disciplines of pharmacy and chemical engineering to prepare graduates to meet the needs of both the pharmaceutical and chemical industries. The PCE department is distinguished by its emphasis on practical and applied aspects of engineering and pharmaceutical sciences, with 12 laboratories equipped with the state-of-the-art equipment allowing for practical implementation of engineering principles that satisfies the needs of the pharmaceutical and chemical industries. Moreover, in the vicinity of the university, there are numerous pharmaceutical plants where our students can train, and our graduates can find suitable job opportunities.

At the Bachelor's level, all students in the Department of Pharmaceutical and Chemical Engineering must spend one year (fourth or fifth year) in Germany, studying for one semester at a partner university and fulfilling twenty weeks' internship in German companies or industries as a compulsory requirement of graduation. Additionally, the students may conduct their graduation projects in Germany.

Emphasizing the applied approach, the department offers a Dual Study Track for undergraduate program in Pharmaceutical and Chemical Engineering. In this track, students work and study at the same time. It is a reaction to two challenges: how to raise the employability of university graduates and how to provide the labor market with qualified employees who possess sound skills in practice and theory. Students will take place in alternating phases at two places; the GJU and one of our partner companies. Students will take their courses in the first and second semesters regularly at GJU and then spend the summer time at the partner company facilities for the first three years. The fourth and fifth years are similar to the regular track.

Graduates of the PCE program are qualified and prepared to work in a variety of labor markets, including Jordanian, German, and International markets. Graduates have the opportunity to work in a variety of industries, including pharmaceuticals, cosmetics, biochemicals, chemicals, refineries, petrochemicals, oil and gas, environmental, water and wastewater treatment, fertilizers, phosphates, potash, food, paints, polymers, and plastics, paper, and cement.

In addition, pharmaceutical and chemical engineering discipline enable graduates to take several roles in the industry. Some of these roles might include operation engineer, manufacturing engineer, process design

engineer, total quality management (GMP, validation, quality assurance, quality control), safety engineer, researcher, research and teaching assistant, sales engineer, marketing engineer, project manager, consultant, quality assurance engineer/manager, and quality control engineer/manager.

The following values constitute the main values that are emphasized throughout the program:

1. **Interdisciplinary program**: Establishing a learning environment that embraces diversity.
2. **Applied education**: Linking theory to application.
3. **Innovation**: promotes creative thinking and finding innovative solutions.
4. **Ethical principle**: Embodiment of ethical principles in our education, research, practice and service activities.

IV. Program Objectives

The educational objectives of the Pharmaceutical and Chemical Engineering Program at the German Jordanian University are to produce graduates who possess the following qualities:

1. A solid foundation of scientific knowledge and required skills in the labor market.
2. Efficiency in working in various pharmaceutical and chemical industries.
3. High ethical and professional principles.
4. The ability to reach leadership roles in various fields of specialization.
5. Continuous learning.
6. Ability to provide new and sustainable solutions to national and global challenges.

V. Learning Outcomes

Upon completion of this program, the student will have the following outcomes:

1. An ability to apply the principles of chemistry, physics, mathematics, and engineering in the development of various processes in the pharmaceutical and chemical industries.
2. An ability to communicate effectively through proficiency in three languages (Arabic, English, and German) and applying various communication skills.
3. An ability to work in various labor markets, such as the Jordanian, German and international markets.
4. An ability to apply ethical and professional principles in the presented technical solutions.
5. An ability to work in teams and cooperate to achieve plans and tasks.
6. An ability to analyze data, draw conclusions and use present new solutions.
7. An ability to learn continuously.

VI. Framework for B.Sc. Degree (180 credit hours)

Classification	Credit Hours			ECTS		
	Compulsory	Elective	Total	Compulsory	Elective	Total
University Requirements	21	6	27	31	6	37
School Requirements	27	0	27	43	0	43
Program Requirements	114	12	126	200	20	220
Total	**162**	**18**	**180**	**274**	**26**	**300**

1. University Requirements: (27 credit hours)

1.1. Prerequisite courses (6 credit hours)

Course ID	Course Name	Credit Hours	ECTS	Contact Hours		Prerequisites / Co-requisites
				Lect	Lab	
ARB099	Arabic 99[a]	0	0	3	-	-
ENGL099	English II[a]	0	0	3	-	-
	Total	**0**	**0**	**6**	**0**	

[a] Not required for students who pass a placement test

1.2. Compulsory: (21 credit hours)

Course ID	Course Name	Credit Hours	ECTS	Teaching method	Contact Hours		Prerequisites / Co-requisites
					Lect	Lab	
ARB100	Arabic	3	3	Online	3	-	ARB099
ENGL101	English III	1	3	Face to face	3	-	ENGL099
ENGL102	English IV	1	3	Face to face	3	-	ENGL101
ENGL201	English V	2	3	Face to face	3	-	ENGL102
ENGL202	English VI	2	3	Face to face	3	-	ENGL201
GERL101B1	German I B1 track	3	6	Face to face	9	-	-
GERL102B1	German II B1 track	3	6	Face to face	9	-	GERL101B1
GERL102B2	German II B2 track	3	6		9	-	GERL101B1
MILS100	Military Science	3	2	Online	3	-	-
NE101 NEE101	National Education National Education (English)	3	2	Online	3	-	ARB099
	Total	**21**	**31**		**39**	**0**	

1.3. Elective: (6 Credit Hours) (two courses out of the following)

Course ID	Course Name	Credit Hours	ECTS	Teaching method	Contact Hours		Prerequisites / Co-requisites
					Lect	Lab	
BE302	Business Entrepreneurship	3	3	Online	3	-	ENGL101
DES101	Arts' Appreciation	3	3	Online	3	-	ARB099
EI101	Leadership and Emotional Intelligence	3	3	Online	3	-	ENGL101
IC101	Intercultural Communications	3	3	Online	3	-	ENGL101
PE101	Sports and Health	3	3	Online	3	-	ARB099
SE301	Social Entrepreneurship and Enterprises	3	3	Online	3	-	ENGL101
SFTS101	Soft Skills	3	3	Online	3	-	ENGL101
	Total	**6**	**6**		**6**	**0**	

2. School Requirements: (27 Credit Hours)

Course ID	Course Name	Credit Hours	ECTS	Teaching method	Contact Hours		Prerequisites / Co-requisites
					Lect	Lab	
GERL201B1	German III B1 track	3	4	Face to face	6	-	GERL102B1
GERL201B2	German III B2 track	3	4		6	-	GERL102B2
GERL202B1	German IV B1 track	3	6	Face to face	9	-	GERL201B1
GERL202B2	German IV B2 track	3	6		9	-	GERL201B2
MATH099	Pre-Math	0	0	Blended	3	0	-
MATH101	Calculus I	3	5	Blended	3	0	MATH099
MATH102	Calculus II	3	5	Face to face	3	0	MATH101
PHYS103	Physics I	3	5	Blended	3	0	-
PHYS104	Physics II	3	5	Face to face	3	0	PHYS103
PHYS106	General Physics Lab	1	2	Blended	0	3	PHYS104
CS116	Computing Fundamentals	3	6	Blended	3	0	-
CS1160	Computing Fundamentals Lab	1	0	Blended	0	1	CS116
CHEM103	General Chemistry I	3	5	Face to face	3	0	CHEM106
CHEM106	General Chemistry Lab	1	0	Blended	0	3	CHEM103
	Total	**27**	**43**		**36**	**7**	

3. Program Requirements (126 credit hours)

3.1. Program Requirements (Compulsory): (104 credit hours)

Course ID	Course Name	Credit Hours	ECTS	Teaching method	Contact Hours		Prerequisites / Co-requisites
					Lect	Lab	
GERL301B1 GERL301B2	German V B1 track German V B2 track	3 3	6 6	Face to face	9 9	-	GERL202B1 GERL202B2
GERL302REG GERL302INT GERL302B2	German VI Regular German VI Intensive German VI B2 track	3 3 3	6 6 6	Face to face	6 9 6	-	GERL301B1 ,GERL302CH GERL301B1, GERL302CH GERL301B2, GERL302CH
BIO111	Human Biology	3	5	Online	3	0	-
PCE211	Introduction to Pharmaceutical and Chemical Engineering	1	2	Blended	1	0	CHEM103
IE0121	Probability and Statistics	3	4	Face to face	3	0	MATH101
PCE212	Principles of Chemical Engineering	3	5	Face to face	3	0	PCE221 PCE211
PCE221	Thermodynamics for Pharmaceutical and Chemical Engineering	3	4	Face to face	3	0	MATH102
PCE222	Fluid Mechanics for Chemical and Medical Engineers	3	5	Face to face	3	0	MATH203
PCE242	Pharmaceutical Physical Chemistry	2	5	Blended	2	0	PCE221
PCE272	Pharmaceutical Physical Chemistry Lab	1	0	Blended	0	3	PCE221, PCE242
PCE251	Analytical Chemistry	3	5	Face to face	3	0	CHEM103
PCE281	Analytical Chemistry Lab	1	0	Blended	0	3	CHEM106, PCE251
PCE2523	Microbiology	3	5	Online	3	0	BIO111
PCE282	Microbiology Lab	1	0	Blended	0	1	PCE2523
PCE254	Organic Chemistry	2	4	Blended	2	0	CHEM103
PCE311	Transport Phenomena	3	4	Face to face	3	0	PCE212, PCE222
PCE312	Separation Processes	3	5	Face to face	3	0	PCE311
PCE321	Chemical Reaction Engineering	3	4	Face to face	3	0	PCE212
BM325	Automatic Control Systems for Medical Applications	3	5	Face to face	3	0	MATH205 PHYS104
BM328	Automatic Control Systems for Medical Applications Lab	1	0	Blended	0	3	BM325
PCE332	Chemical Engineering Economics	3	5	Blended	3	0	PCE212
PCE341	Pharmaceutical Organic Chemistry	2	5	Blended	2	0	PCE254
PCE371	Pharmaceutical Organic Chemistry Lab	1	0	Blended	0	3	PCE341
PCE342	Instrumental Analysis	3	5	Face to face	3	0	PCE251

PCE372	Instrumental Analysis Lab	1	0	Blended	0	3	PCE281, PCE342
PCE343	Pharmaceutical Technology – Liquid Forms	3	6	Blended	3	0	PCE242
PCE373	Pharmaceutical Technology – Liquid Forms Lab	1	0	Blended	0	3	PCE343
PCE344	Pharmaceutical Technology – Solid Forms	3	6	Blended	3	0	PCE242
PCE374	Pharmaceutical Technology – Solid Forms Lab	1	0	Blended	0	3	PCE344
PCE3513	Biochemistry	3	5	Blended	0	3	BIO111 PCE254
PCE381	Biochemistry Lab	1	0	Blended	0	3	PCE3513
PCE362	Fluid, Heat and Reaction Engineering Lab	1	3	Blended	0	3	PCE222 PCE311 PCE321
PCE391	Field Training*	0	6	Face to face	0	0	DA
PCE511	Unit Operations and Industrial Safety	3	5	Face to face	3	0	PCE312
PCE499	International Internship	12	30	TBD	0	0	DA
PCE5322	Quality Assurance and Process Validation	2	3	Blended	2	0	PCE344
PCE5333	Hazardous Waste and Risk Management	3	5	Blended	3	0	PCE2523
PCE541	Medicinal Chemistry	3	4	Blended	3	0	PCE3513
PCE5423	Pharmaceutical Packaging Technology	3	5	Blended	3	0	PCE343 or PCE344
PCE543	Pharmaceutical Plant Design	3	5	Blended	3	0	PCE312 PCE332
PCE562	Separation Processes Lab	1	3	Blended	0	3	PCE312 PCE511
PCE591	Graduation Project I	1	2	Blended	0	0	DA
PCE592	Graduation Project II	2	6	Blended	0	0	PCE591
	Total	**104**	**183**				

* Students must complete 160 hours of field training in approved industries in Jordan by the end of their third academic year

3.2. Program Requirements (Ancillary): (10 credit hours)

Course ID	Course Name	Credit Hours	ECTS	Teaching method	Contact Hours		Prerequisites / Co-requisites
					Lect	Lab	
IE121	Workshop	1	2	Face to face	0	3	-
MATH203	Applied Mathematics for Engineers	3	5	Face to face	3	0	MATH102
MATH205	Differential Equations	3	5	Face to face	3	0	MATH102
BM371	Numerical Methods for Engineers	3	5	Blended	2	3	-
	Total	**10**	**17**				

3.3. Program Requirements (Electives[b]): (12 credit hours)

A minimum of 12 credit hours of engineering coursework are required. This list is open for modifications based on school council decisions.

Course ID	Course Name	Credit Hours	ECTS	Teaching method	Contact Hours		Prerequisites / Co-requisites
					Lect	Lab	
PCE401	Biotechnology	3	5	Blended	3	0	PCE321 PCE2523 BSC001
PCE402	Gene Technology	3	5	Blended	3	0	PCE3513 BSC001
PCE403	Nutrition	3	5	Blended	3	0	BIO111 BSC001
PCE404	Introduction to Polymer Science	3	5	Blended	3	0	PCE254 BSC001
PCE405	Colloids and Surface Chemistry	3	5	Blended	3	0	PCE242 BSC001
PCE406	Corrosion Engineering	3	5	Blended	3	0	PCE242 BSC001
PCE407	Chemical & Physical Sensors	3	5	Blended	3	0	PCE342 BSC001
PCE408	Shale Oil Production Processes	3	5	Blended	3	0	BSC001
PCE409	Introduction to Oil and Gas Production	3	5	Blended	3	0	BSC001
PCE412	Nanotechnology	3	5	Blended	3	0	PCE344 BSC001
PCE413	Membrane Separation Processes	3	5	Blended	3	0	PCE312 BSC001
PCE421	Fluid Mixing Technology	3	5	Blended	3	0	PCE222 BSC001
PCE422	Chemical Reaction Engineering II	3	5	Blended	3	0	PCE321 BSC001
PCE431	Chemical Process Safety	3	5	Blended	3	0	BSC001
PCE444	Antibiotics	3	5	Blended	3	0	PCE2523 BIO111
PCE5312	Industrial Processes Management and Industrial Safety	3	5	Blended	3	0	PCE332 BSC001
PCE445	Particle Tchnology	3	5	Blended	3	0	PCE344 BSC001
PCE446	Pharmacokinetics	3	5	Blended	3	0	PCE 321 BSC001
PCE447	Toxicology	3	5	Blended	3	0	BIO111 BSC001
PCE448	Modern Drug Forms & Delivery Systems	3	5	Blended	3	0	BIO111 BSC001
PCE491	Environmental Engineering	3	5	Blended	3	0	PCE251 BSC001
PCE492	Special Topics in Pharmaceutical and Chemical Engineering I	3	5	Blended	3	0	BSC001
PCE493	Special Topics in Pharmaceutical and	3	5	Blended	3	0	BSC001

	Chemical Engineering II						
PCE494	Special Topics in Pharmaceutical and Chemical Engineering III	3	5	Blended	3	0	BSC001
PCE495	Special Topics in Pharmaceutical and Chemical Engineering IV	3	5	Blended	3	0	BSC001
PCE593	Special Topics in Pharmaceutical and Chemical Engineering V	2	4	Blended	2	0	BSC001
PCE594	Special Topics in Pharmaceutical and Chemical Engineering VI	1	3	Blended	1	0	BSC001
PCE595	Special Field Projects	3	5	Blended	0	0	BSC001
WEEM528	Air Pollution Control	4	5	Blended	4	0	BSC001
WEEM545	Water and Wastewater Treatment	3	5	Blended	3	0	BSC001
MGT525	Project Management	3	5	Blended	3	0	PCE332 BSC001
TME553	Reliability and Quality Control	3	5	Blended	3	0	BSC001
	Total	**12**	**20**				

[b]International Internship is a prerequisite for all elective courses

TBD: To be Determined

BSC001: Registered in Germany

VII. Study Plan[c] Guide for the Bachelor's Degree in (Pharmaceutical and Chemical Engineering)

First Year				
First Semester				
Course ID	**Course Name**	**Cr Hr**	**Prerequisites**	**Co-requisite**
GERL101	German I	3	-	-
ENGL101	English III	1	ENGL099	-
MATH101	Calculus I	3	MATH099	-
PHYS103	Physics I	3	-	-
CHEM103	General Chemistry	3	-	CHEM106
CHEM106	General Chemistry Lab	1	-	CHEM103
ARB100	Arabic	3	ARB099	-
IE121	Workshop	1	-	-
	Total	**18**		

First Year				
Second Semester				
Course ID	**Course Name**	**Cr Hr**	**Prerequisites**	**Co-requisite**
GERL102	German II	3	GERL101	-
ENGL102	English IV	1	ENGL101	-
MATH102	Calculus II	3	MATH101	-
PHYS104	Physics II	3	PHYS103	-
PHYS106	General Physics Lab	1	-	PHYS104
CS116	Computing Fundamental Technical	3	-	-
CS1160	Computing Fundamental lab	1	-	CS116
BIO111	Human Biology	3	-	-
	Total	**18**		

[c] The following study plan guide assumes having passed all placement tests

Second Year				
First Semester				
Course ID	**Course Name**	**Cr Hr**	**Prerequisites**	**Co-requisite**
GERL201	German III	3	GERL102	-
ENGL201	English V	2	ENGL102	-
PCE211	Introduction to Pharmaceutical and Chemical Engineering	1	CHEM103	-
PCE251	Analytical Chemistry	3	CHEM103	-
PCE281	Analytical Chemistry Lab	1	CHEM106	PCE251
PCE221	Thermodynamics for Pharmaceutical and Chemical Engineering	3	MATH102	-
MATH205	Differential Equations	3	MATH102	-
MATH203	Applied Mathematics for Engineers	3	MATH102	-
-	University Elective I	3	-	-
	Total	**22**		

Second Year				
Second Semester				
Course ID	**Course Name**	**Cr Hr**	**Prerequisites**	**Co-requisite**
GERL202	German IV	3	GERL201	-
PCE254	Organic Chemistry	2	CHEM103	-
ENGL202	English VI	2	ENGL201	-
PCE2523	Microbiology	3	BIO111	-
PCE282	Microbiology Lab	1	-	PCE2523
PCE242	Pharmaceutical Physical Chemistry	2	PCE221	-
PCE272	Pharmaceutical Physical Chemistry Lab	1	PCE221	PCE242
PCE212	Principles of Chemical Engineering	3	PCE221 PCE211	-
PCE222	Fluid Mechanics for Chemical and Medical Engineers	3	MATH203	-
	Total	**20**		

Third Year				
First Semester				
Course ID	**Course Name**	**Cr Hr**	**Prerequisites**	**Co-requisite**
GERL301	German V	3	GERL202	-
BM371	Numerical Methods for Engineers	3	-	-
PCE311	Transport Phenomena	3	PCE212 PCE222	-
PCE341	Pharmaceutical Organic Chemistry	2	PCE245	-
PCE371	Pharmaceutical Organic Chemistry Lab	1	-	PCE341
PCE3513	Biochemistry	3	BIO111 PCE254	-
PCE381	Biochemistry Lab	1	-	PCE3513
PCE321	Chemical Reaction Engineering	3	PCE212	-
PCE391	Field Training*	0	DA	-
PCE343	Pharmaceutical Technology – Liquid Forms	3	PCE242	-
PCE373	Pharmaceutical Technology – Liquid Forms Lab	1	-	PCE343
	Total	**23**		

*Students must complete 160 hours of field training in approved industries in Jordan by the end of their third academic year

Third Year				
Second Semester				
Course ID	**Course Name**	**Cr Hr**	**Prerequisites**	**Co-requisite**
GERL302	German VI	3	GERL301	GERL302CH:German 6 technical for pharmaceutical and chemical engineering
PCE344	Pharmaceutical Technology – Solid Forms	3	PCE242	-
PCE374	Pharmaceutical Technology – Solid Forms Lab	1	-	PCE344
PCE342	Instrumental Analysis	3	PCE251	-
PCE372	Instrumental Analysis Lab	1	PCE281	PCE342
PCE362	Fluid, Heat and Reaction Engineering Lab	1	PCE222 PCE311 PCE321	-
IE0121	Probability and Statistics	3	MATH101	-
PCE312	Separation Processes	3	PCE311	-
PCE332	Chemical Engineering Economics	3	PCE212	-
	Total	**21**		

Fourth Year				
First Semester				
Course ID	**Course Name**	**Cr Hr**	**Prerequisites**	**Co-requisite**
	Program Elective I	3	-	-
	Program Elective II	3	-	-
	Program Elective III	3	-	-
	Program Elective IV	3	-	-
	Total	**12**		

Fourth Year				
Second Semester				
Course ID	**Course Name**	**Cr Hr**	**Prerequisites**	**Co-requisite**
PCE499*	International Internship[d]	12	DA	-
	Total	**12**		

German year prerequisites are:

1. A minimum GPA of 61.0%
2. Successful completion of 90 credit hours excluding all German language courses
3. Passing GERL302 German VI and B1 German language test (all 4 language skills) conducted by Goethe Institute or another approved provider
4. ENGL201 English V, and Arabic 99
5. Passing three out of the four following courses:
   a. PCE251 - Analytical Chemistry
   b. PCE321 - Chemical Reaction Engineering)
   c. PCE343 - Pharmaceutical Technology – Liquid Forms
   d. PCE344 - Pharmaceutical Technology – Solid Forms

[d] Courses attended and/or passed during International Internship are not transferable

Fifth Year				
First Semester				
Course ID	**Course Name**	**Cr Hr**	**Prerequisites**	**Co-requisite**
PCE543*	Pharmaceutical Plant Design	3	PCE312 PCE332	-
PCE5333	Hazardous Waste and Risk Management	3	PCE2523	-
BM325	Automatic Control Systems for Medical Applications	3	MATH205 PHYS104	-
BM328	Automatic Control Systems for Medical Applications Lab	1	-	BM325
PCE511*	Unit Operations and Industrial Safety	3	PCE312	-
PCE541	Medicinal Chemistry	3	PCE3513	-
PCE591	Graduation Project I	1	DA	-
	Total	**17**		

Fifth Year				
Second Semester				
Course ID	**Course Name**	**Cr Hr**	**Prerequisites**	**Co-requisite**
PCE5322	Quality Assurance and Process Validation	2	PCE344	-
	University Elective II	3	-	-
NE101	National Education	3	ARB099	-
MILS100	Military Science*For Jordanian Only	3	-	-
PCE562	Separation Processes Lab	1	PCE312	PCE511
PCE5423	Pharmaceutical Packaging Technology	3	PCE343 or PCE344	-
PCE592	Graduation Project II	2	PCE591	-
	Total	**17**		

* The student cannot take an alternative course to the following courses:

1- PCE511 - Unit Operations and Industrial Safety
2- PCE543 - Pharmaceutical Plant Design

VIII. Compulsory Courses Offered by PCE Department

PCE211: Introduction to Pharmaceutical and Chemical Engineering **1 Cr Hr (1,0)** **2 ECTS**

Chemical engineering in the pharmaceutical industry: an introduction. Current challenges and opportunities in the pharmaceutical industry. Engineering calculations: units, dimensional homogeneity and dimensionless quantities. Process data presentation and analysis. Processes and process variables.

Prerequisites: CHEM103

PCE212: Principles of Chemical Engineering **3 Cr Hr (3,0)** **5 ECTS**

This course is designed to introduce the Chemical Engineering students the basic chemical engineering concepts and methods of system analysis. The topics in this course will include introduction to engineering calculations, process and process variable, fundamentals of material balances, single- and multi-phase systems, and energy balances related to reactive and non-reactive systems. Some case studies of chemical process industries will also be analyzed in more details.

Prerequisites: PCE221, PCE211

PCE221: Thermodynamics for Pharmaceutical and Chemical Engineering **3 Cr Hr (3,0)** **4 ECTS**

Development of fundamental thermodynamic property relations and complete energy and entropy balances. Analysis of heat pumps and engines and use of combined energy-entropy balance in flow devices. Calculation and application of total and partial properties in physical and chemical equilibria. Prediction and correlation of physical/chemical properties of various states and aggregate.

Prerequisites: MATH102

PCE222: Fluid Mechanics for Chemical and Medical Engineers **3 Cr Hr (3,0)** **5 ECTS**

Fluid mechanics in chemical and medical engineering. Density, viscosity and surface tension. Fluid Statics. Mass, energy and momentum balances. Bernoulli's equation. Fluid friction in pipes. Flow in engineering equipment: pumps and compressors. Non-Newtonian fluid flow in circular pipe.

Prerequisites: MATH203

PCE242: Pharmaceutical Physical Chemistry **2 Cr Hr (2,0)** **5 ECTS**

Introduction to physical pharmacy. Study the underpinning physicochemical sciences which pertain to the formulation of pharmaceutical products. Main themes: Pharmaceutical solutions: Colligative properties of solutions, Solutions equilibria: Solubility, Partitioning and distribution phenomena. The solid state: Solid state properties: The crystalline structure, Polymorphism and the amorphous state. Physicochemical properties which control complex formation including drug stability and factors affecting its shelf-life. Discussion of diffusion and interfacial phenomenon of adsorption will be included.

Prerequisites: PCE221

PCE272: Pharmaceutical Physical Chemistry Lab **1Cr Hr (0,3)** **0 ECTS**

Determination of molar mass using the ideal gas law. Partial molar volumes. Boiling point elevation. Boiling point diagram of a binary mixture. Miscibility gap in a ternary system. Kinetics of saccharose inversion. Reaction rate and activation energy of the acid hydrolysis of ethyl acetate. Single electrode potential. Effect of ionic strength on solubility of benzoic acid in water. Adsorption isotherm. Reaction rate of acetic acid and magnesium Determining surface tension using the ring method. Viscosity measurement.

Prerequisites: PCE221

PCE251: Analytical Chemistry **3 Cr Hr (3,0)** **5 ECTS**

Chemical measurements, chemical equilibrium, activity and the systematic treatment of equilibrium, monoprotic acid-base equilibria, polyprotic acid-base equilibria, acid-base titrations, EDTA titrations, fundamentals of electrochemistry, reduction-oxidation titrations, gravimetric analysis, precipitation titrations, and combustion analysis.

Prerequisites: CHEM103

PCE281: Analytical Chemistry Lab **1 Cr Hr (0,3)** **0 ECTS**

Statistical treatment of data, titration of strong dibasic base with strong acids (monoprotic and diprotic), titrations of strong acids/bases with weak bases/acids (monoprotic and polyprotic), determination of carbonate and bicarbonate in mixtures, buffer solutions and buffer capacity, EDTA determination of calcium in milk, redox titration of dichromate with iron(II), redox titration of permanganate with oxalate, determination of calcium as calcium oxalate, determination of chloride by Mohr's method, separation of permanganate and chromate by adsorption chromatography, separation of zinc and magnesium ions by ion exchange chromatography, gravimetric determination of iron as iron oxide.

Prerequisites: CHEM106

PCE2523: Microbiology **3 Cr Hr (3,0)** **5 ECTS**

The study of the nature of microorganisms; their structure, function, growth, interaction with the environment, metabolism and genetics. The study of viruses, fungi, cyanobacteria and different types of bacteria. Also, it studies the relationship between deferent microorganisms, the ability of some of them to fix atmospheric nitrogen, the diseases caused by bacteria and the economic importance of microorganisms.

Prerequisites: BIO111

PCE282: Microbiology laboratory **1 Cr Hr (0,1)** **0 ECTS**

Main experiments performed in the lab, General orientation and safety in microbiology lab. Microscopic techniques and microscopic research methods; sterility and microorganisms microscopy. Cultural research methods: including media preparation; bacterial culturing, isolation & purification. Cultural, biological and biochemical research methods. Bacterial counting and bacterial growth curve, Coliform testing in water. Chemo-resistance testing: agar diffusion test, MIC and E-Test. Urinary tract and genital infection testing. Gastrointestinal tract infection testing; bacteria, fungal and parasites. Respiratory tract infections testing.

Prerequisites:-

PCE254: Organic Chemistry **2 Cr Hr (2,0)** **4 ECTS**

Bonding models for CH, simple CC and multiple CC bonds. The possibilities for isomer of open chained cyclic hydrocarbons including their dynamics (conformation). Electron structure of conjugated double bonds and aromatic π-systems. Stereoisomerism, chirality and enantiomers. Polar single and multiple bonds and the resulting electronic substituent effects. The most important classes of organic compounds including organic halogens, alcohols, aldehydes, ketones, and carboxylic acids. Overview of various reaction types and initial mechanistic reaction observations.

Prerequisites: CHEM103

PCE311: Transport Phenomena **3 Cr Hr (3,0)** **4 ECTS**

A fundamental course in heat transfer processes and an introduction to mass transfer. It introduces the student to precise formulation of transport using the conversation principles and flux expressions. Topics include Introduction to conductive, convective and radiative mechanisms of heat transfer. Conduction heat transfer. Steady heat conduction. Boundary and initial conditions. Convective heat transfer. Analysis of convective heat transfer in external and internal flow. Empirical correlations for convective heat transfer in laminar and turbulent flow. Simultaneous heat and mass transfer. Heat exchangers. Introduction to diffusive and convective mass transfer. One dimensional steady-state mass transfer in common geometries.

Prerequisites: PCE212, PCE222

PCE312: Separation Processes **3 Cr Hr (3,0)** **5 ECTS**

Equilibrium between phases; the equilibrium stage concept. Study of mass transfer operation. Vapor-liquid separation processes; absorption, stripping, distillation and drying of materials.

Prerequisites: PCE311

PCE321: Chemical Reaction Engineering **3 Cr Hr (3,0)** **4 ECTS**

Overview of chemical reaction engineering. Kinetics of homogeneous reaction. Interpretation of batch reactors data. Introduction to reactor design. Ideal reactors for single reaction. Design of single reactions. Introduction to heterogeneous reactions. Solid catalyzed reactions.

Prerequisites: PCE212

PCE332: Chemical Engineering Economics **3 Cr Hr (3,0)** **5 ECTS**

Accuracy and purpose of capital cost estimates. Fixed and working capital estimate (total capital investment cost). Inflation. Rapid cost estimating methods. The factorial method of cost estimation: Lang factors, detailed factorial method. Estimation of the purchased equipment cost. Operating costs. Economics evaluation of projects: cash flow, tax and depreciation, discount cash flow, rate of return, discount cash flow rate of return, sensitivity analysis. Computer methods for costing and project evaluation.

Prerequisites: PCE212

PCE341: Pharmaceutical Organic Chemistry **2 Cr Hr (2,0)** **5 ECTS**

Spectroscopy and structure determination with IR, NMR, mass spectroscopy. Amines and the most important organic nitrogen compounds including their reactions. Organic phosphorus compounds. Organic Sulphur compounds. Heterocyclic and polycyclic aromatic compounds of pharmaceutical interest with examples related biologically active compounds.

Prerequisites: PCE254

PCE371: Pharmaceutical Organic Chemistry Lab **1 Cr Hr (0,3)** **0 ECTS**

The course involves separation, purification of and identification organic compounds through their physical properties: melting point, distillation, crystallization, extraction, and chromatography; preparation of simple organic compounds; qualitative tests for selected classes of organic compounds.

Prerequisites: PCE341

PCE342: Instrumental Analysis **3 Cr Hr (3,0)** **5 ECTS**

Introduction to instrumental analysis, signals and noise, components of optical instruments, an introduction to ultraviolet- visible molecular spectrometry, applications of ultraviolet- visible molecular spectrometry, atomic absorption spectrometry, atomic x-ray spectrometry, molecular luminescence spectrometry, an introduction to electroanalytical chemistry, potentiometry, an introduction to chromatographic separations, gas chromatography, liquid chromatography, thermal methods.

Prerequisites: PCE251

PCE372: Instrumental Analysis Lab **1 Cr Hr (0,3)** **0 ECTS**

Ultraviolet-Visible Spectroscopy: Photometric Titration, Food and Drug Analysis, Infrared Spectroscopy: Functional Group Determination, Atomic Spectroscopy: Determination of Metals in Water and Soil Samples, Potentiometry: Potentiometric Titration and Ion Selective Electrode Measurement, Thermal Analysis: Thermal Gravimetric Analysis and Differential Scanning Calorimetry, Chromatography: High Performance Liquid Chromatography and Gas Chromatography.

Prerequisites: PCE281

PCE343: Pharmaceutical Technology – Liquid Forms **3 Cr Hr (3,0)** **6 ECTS**

This course includes the major liquid dosage forms (solutions, injectables and dispersed systems including emulsions, suspensions and aerosols) and types of semisolid dosage forms like ointments, pastes and gels. The principles of biopharmaceutics including formulation and drug delivery design will be approached for each form. On the basis of physiochemistry knowledge the students will be trained to formulate and how to control pharmaceutical dosage forms. Preparation evaluation, storage and packaging will be also discussed.

Prerequisites: PCE242

PCE373: Pharmaceutical Technology – Liquid Forms Lab **1 Cr Hr (0,3)** **0 ECTS**

The laboratory course will serve as a foundation course for applying the knowledge and skills to practice the science and practice of pharmaceutical compounding. Special emphasis is given on preparation of dosage formulations in a laboratory scale while keeping the industrial practice in view. Evaluation tests are also included for every formulation; this includes practical implementation and use of some solid-state characterization techniques.

Prerequisites:-

PCE344: Pharmaceutical Technology – Solid Forms **3 Cr Hr (3,0)** **6 ECTS**

This course includes the major conventional pharmaceutical solid dosage forms intended for oral use and forms for rectal use. It is designed to provide a practical understanding to the solid dose manufacture and the theory behind Processes and technologies for manufacturing the finished solid dosage forms including granulation, blending and milling, powder transfer, compression, coating, powder transfer and contaminant. An introduction to the GMP requirements for the formulation, scale up and optimization of finished Dose Forms, and Validation requirements as it applies to solid dose formulations will be also included.

Prerequisites: PCE242

PCE374: Pharmaceutical Technology – Solid Forms Lab **1 Cr Hr (0,3)** **0 ECTS**

This laboratory course will concentrate on solid dosage forms and will build on the knowledge obtained from various earlier pharmacy relevant courses including fundamentals of PCE 343. It will ensure competency of skills to drug analysis, solid dosage preparation, pharmaceutical and pharmacokinetic calculations. An appreciation of the practical experience of the scope of various analytical and characterization techniques with the opportunity to design, undertake measurement protocols, description of the concepts associated with the drug performance will be included.

Prerequisites:-

PCE3513: Biochemistry **3 Cr Hr (0,3)** **5 ECTS**

This course covers the following: The study of the principles of biochemistry by studying the molecular composition of the cell; proteins, enzymes, sugars, lipids, nucleic acids vitamins, coenzymes, and enzymes. In addition, the course covers DNA replication and gene expression (transcription and translation).

Prerequisites: BIO111, PCE254

PCE381: Biochemistry Lab **1 Cr Hr (0,3)** **0 ECTS**

The Biochemistry laboratory course will enable students to apply basic biochemistry lab techniques to solve problems. The students will learn the theoretical background of each experiment and the methods used and will have enough knowledge to decide which tool to be used in real situations. The methods/experiments included in this course are: Extraction/purification and characterization of the macromolecules [proteins (SDS lysis, determination of protein content and SDS-PAGE), carbohydrates, lipids and nucleic acids (DNA extraction, 260/280 nm spectrophotometry and gel electrophoresis)]. At the end of this course the students will be able to work as a team, write scientific reports and interpret results.

Prerequisites: -

PCE362: Fluid, Heat and Reaction Engineering Lab **1 Cr Hr (0,3)** **3 ECTS**

There are different experimental setup available in the laboratory to cover chemical engineering concepts heat transfer. Experiments are: Jacketed vessel with coil and stirrer, shell and tube heat exchanger, concentric tube heat exchanger, extended plate heat exchanger, Linear and radial heat conduction, combined convection radiation heat transfer, continuous stirred tank reactor, batch reactor, tubular reactor, diffusion coefficient, parallel and series pumps, losses in pipes, Reynolds number.

Prerequisites: PCE222, PCE311, PCE321

PCE511: Unit Operations and Industrial Safety **3 Cr Hr (3,0)** **5 ECTS**

This course is a combination of two parts; the first one is an application of fluid mechanics, phase transition, and transport phenomena in chemical engineering. It deepensthe students' knowledge of the unit operations with a focus on adsorption, crystallization, evaporation, leaching, liquid - liquid extraction and membrane separation. The second part focus on chemical process safety, subjects include toxicology, industrial hygiene, gas dispersion, fires and explosions.

Prerequisites: PCE312

PCE5322: Quality Assurance and Process Validation **2 Cr Hr (2,0)** **3 ECTS**

This module provides integrated learning across the pharmaceutical and scientific disciplines by consideration of basic qualification and validation regulations for different themes that relate to pharmaceutical production and quality of medicines. Being informing but influencing practice, this course prepares students for professional career in quality assurance and regulatory affairs department. It covers, The legal principles and regulations of the medicines, active ingredients and medical devices. British Pharmacopeia act. Sterile manufacturing. Industry quality control concepts, auditing and regulatory inspection. Specifications for raw materials and packaging material purchasing. Standards for quality management, contents for registration documents and marketing authorization dossiers.

Prerequisites: PCE344

PCE5333: Hazardous Waste and Risk Management **3 Cr Hr (3,0)** **5 ECTS**

Definition of hazardous waste. Fate and transport of contaminants, Toxicology. Pollution prevention, waste minimization, reuse, and recycling. Facility development and operations. Treatment and disposal methods: physicochemical processes; biological methods; stabilization and solidification; thermal methods; land disposal. Medical/biomedical/infectious waste management. Hazardous waste worker health and safety.

Prerequisites: PCE2523

PCE541: Medicinal Chemistry **3 Cr Hr (3,0)** **4 ECTS**

3D-structure of protein, protein data banks, PDB files and protein visualization. Enzymes, receptors, nucleic acids as drug targets. Drug discovery and design concepts and practical examples of computer aided drug design. Quantitative structure activity relationship models. Case studies and examples on anti-bacterial, antiviral, anticancer and other important drugs.

Prerequisites: PCE3513

PCE5423: Pharmaceutical Packaging Technology **3 Cr Hr (3,0)** **5 ECTS**

Introduction. Types of packaging systems. Criteria for the selection of package type and package materials. Packaging evaluation. Dosage forms and package forms. Containers. Adhesives and inks. Closures: glass, plastic, metal, paper and board, films, foils and laminates, rubber compounds, cotton. Special type of delivery – Devices: Aerosols, Transdermal. Packaging of medical/surgical devices. Economic aspects.

Prerequisites: PCE343 or PCE344

PCE543: Pharmaceutical Plant Design **3 Cr Hr (3,0)** **5 ECTS**

Project definition and organization. Input information and batch versus continuous. Input-output structure of the flowsheet. Recycle structure of the flowsheet. Separation system. Index flowsheet. Process flowsheet. Equipment sizing and design. Safety analysis. Safety and environmental analysis. Economic Evaluation. Considerations in the design of pharmaceutical plants; Site selection, layout, Cleanrooms, utilities, special production systems.

Prerequisites: PCE312, PCE332

PCE562: Separation Processes Lab **1 Cr Hr (0,3)** **3 ECTS**

Conduct experiments applying separation processes concepts. Spray dryer, tray dryer, fixed and fluidized bed, batch distillation, cooling tower, single stage evaporation unit, liquid-liquid extraction, filtration unit with plate and frame, reverse osmosis, solid-liquid extraction.

Prerequisites:PCE312

CHEM103:General Chemistry I **3 Cr Hr (3,0)** **5 ECTS**

Components of matter. Stoichiometry of formulas and equations. Major classes of chemical reactions (precipitation, acid-base, oxidation-reduction and reversible reactions). Gases and the kinetic theory. Thermochemistry: Energy flow and chemical change. Kinetics: Rates and mechanisms of chemical reactions. Equilibrium: The extent of chemical reactions. Acid-base equilibria. Ionic equilibria in aqueous systems.

Prerequisites: -

CHEM106:General Chemistry Lab **1 Cr Hr (0,3)** **0 ECTS**

Laboratory safety, first aid. Measurement and proper use of laboratory glassware. Density measurement. Classification of matter: Basic separation techniques. Precipitation reaction. Limiting reactant. Determination of acetic acid in vinegar. Quantitative titration of an antacid tablet. Determination of ions in hard water using EDTA. Molecular weight of a volatile liquid. Kinetic study of reaction of peroxydisulfate and iodide ions. Calorimetry.

Prerequisites: -

PCE591: Graduation Project I **1 Cr Hr (0,0)** **2 ECTS**

Theoretical and/or experimental investigation of a problem in chemical/pharmaceutical engineering, or design and development of a chemical process. A student or a group of students undertake an independent project under the supervision of a faculty member. The general objectives are to improve the student's skills and creativity, and to give him/her the experience of problem solving with integration of chemical/pharmaceutical engineering principles.

Prerequisites: D.A

PCE592: Graduation Project II **2 Cr Hr (0,0)** **6 ECTS**

Completion of the same project started in PCE 591 with more details, theoretical and/or experimental work, design and calculations.

Prerequisites: PCE591

PCE499: International Internship **12 Cr Hr (0,0)** **30 ECTS**

Practical training for 6 months after the completion of at least 90 credit hours (See Practical Training Regulations of the College of Applied Medical Sciences).

Prerequisites: D.A

IX. Elective Course Offered by PCE Department

PCE401: Biotechnology **3 Cr Hr (3,0)** **5 ECTS**

The tasks of biotechnology in the pharmaceutical industry, agriculture, food industry. Biotechnological methods and processes. Fermentation process and reactors. Processing of biotechnological products for applications from intra and extra cellular products to packaging. What are enzymes, their biotechnological production, their applications in medicine, diagnostics, food production, pharmacy, agriculture and research Biotechnological production of biomass, low molecular weight products and macromolecules and also biotransformations.

Prerequisites PCE32, BSC001, PCE2523

PCE402: Gene Technology **3 Cr Hr (3,0)** **5 ECTS**

Introduction; transfer of genetic information into proteins: transcription/ translation; tools of the genetic engineer; host organisms and properties; cloning; polymerase chain reaction; applications in genetic engineering.

Prerequisites: PCE3513, BSC001

PCE403: Nutrition **3 Cr Hr (3,0)** **5 ECTS**

This Course is designed to make the student aware of their food environment in relation to nutrition and disease. The course also deals with the description of balanced diet and the influence of food habits on health and physical performance.

Prerequisites BIO111, BSC001

PCE404: Introduction to Polymer Science **3 Cr Hr (3,0)** **5 ECTS**

Definitions and classification, nomenclature, basic concepts on structure and on thermal and mechanical behavior. Polycondensation and polyaddition, radical, ionic and metal catalyzed polymerization. Copolymerization. Chemical modification of polymers. Polymer blends and new developments. Equipment and additives, processing of plastics. Disposal and recycling. Natural macromolecular substances and their most important technical and pharmaceutical derivatives. The characterization of polymers.

Prerequisites: PCE254, BSC001

PCE405: Colloids and Surface Chemistry **3 Cr Hr (3,0)** **5 ECTS**

Nature of colloidal dispersions. Thermodynamics of surfaces. Transport properties of suspensions. Particle size and shape. Adsorption onto solid surfaces. Electrically charged interfaces. Particle interaction and coagulation. Rheology of colloidal dispersions.

Prerequisites: PCE242, BSC001

PCE406: Corrosion Engineering **3 Cr Hr (3,0)** **5 ECTS**

Electrochemical and metallurgical aspects of corrosion. Forms of corrosion. Modern theory of corrosion and its application. Iron and steel corrosion. Corrosion prevention. Case studies.

Prerequisites: PCE242, BSC001

PCE407: Chemical & Physical Sensors **3 Cr Hr (3,0)** **5 ECTS**

Definitions and basic concepts of chemical sensor technology, physio-chemical basics of sensor technology, dividing sensors into classes, properties and design of sensors, general fields of application, types of detection in sensors, sensor systems and applications, sensors as parts of Microsystems. Definition and basic concepts of physical sensor technology, general fields of application.

Prerequisites: PCE342, BSC001

PCE408: Shale Oil Production Processes **3 Cr Hr (3,0)** **5 ECTS**

Origin and properties of oil shale. Oil shale resources in Jordan. The chemical and physical nature of kerogen, the precursor to oil shale. Mining and reporting oil shale. In situ retorting. Refining shale oil. The environmental aspects of shale.

Prerequisites: BSC001

PCE409: Introduction to Oil and Gas Production **3 Cr Hr (3,0)** **5 ECTS**

Process Overview: facilities, main process sections, utility Systems. Reservoir and Wellheads: crude oil and natural gas, the reservoir, exploration and drilling, the well, wellhead, artificial lift, well workover, intervention and stimulation, unconventional sources of oil and gas. The Oil and Gas Process: manifolds and gathering, separation, gas treatment and compression, oil and gas storage, metering and export. Utility systems: control and safety systems, power generation and distribution, flare and atmospheric ventilation, Instrument air, water systems, chemical treatment.

Prerequisites: BSC001

PCE412: Nanotechnology **3 Cr Hr (3,0)** **5 ECTS**

Basic Concepts; Molecular Structures; Macromolecular Structures; Surfaces and Interfaces; Properties of Nanostructures; Nanofabrication; Characterization of Nanostructures and Nanomaterials; Nanomaterials and Applications; Thin Films; Nanoparticles; Nano Porous Structures; Nanotubes and Fibers; Nanocomposites; Nanosystems .

Prerequisites: PCE344, BSC001

PCE413: Membrane Separation Processes **3 Cr Hr (3,0)** **5 ECTS**

Introduction; classification; definitions. Membranes: materials, preparation, modules, characterization, transport Mechanisms. Membrane Processes: microfiltration, ultrafiltration, nanofiltration, reverse osmosis, dialysis, electrodialysis, pervaporation, gas separation, liquid membranes, other techniques, membrane reactors.

Prerequisites: PCE312, BSC001

PCE421: Fluid Mixing Technology **3 Cr Hr (3,0)** **5 ECTS**

Theory of mixing processes in laminar and turbulent flows. Practical aspects of mixing processes (equipment selection, design, scale-up). Mechanical design of fluid mixers. Heat transfer in agitated vessels.

Prerequisites: PCE222, BSC001

PCE422: Chemical Reaction Engineering II **3 Cr Hr (3,0)** **5 ECTS**

Nonideal flow. Mixing of fluids. Fluid-particle reactions. Fluid-fluid reactions. Deactivating catalysts.

Prerequisites: PCE321, BSC001

PCE431: Chemical Process Safety **3 Cr Hr (3,0)** **5 ECTS**

This course will cover safety subjects that are considered core for process safety. Subjects include toxicology, industrial hygiene, sources of toxic releases, gas dispersion, fires and explosions, relief valves and their sizing, flaring, hazard identification and risk assessment.

Prerequisites: BSC001

PCE446: Pharmacokinetics **3 Cr Hr (3,0)** **5 ECTS**

Introduction to Pharmacokinetics and Pharmacodynamics, Passage of Drug through Membranes, Drug Absorption, Drug Distribution, Drug Elimination.

Prerequisites: PCE 321, BSC001

PCE444: Antibiotics **3 Cr Hr (3,0)** **5 ECTS**

Introduction to antibiotics and antibacterial chemotherapy. Classification and structure-activity relationship of antibiotics and antibacterial agents. Epidemiology of resistance to antibacterial agents. Development of an antibiotic. Inhibitors of ß-lactamases, DNA-gyrase. Codrugs. Coumarin antibiotics. Development of resistance and the use of multiple antibacterials during an infection. Drug interactions. Antibacterials and bioterrorism. Clinical quality assurance and the international development of new anti-infective agents.

Prerequisites: PCE2523,BIO111, BSC001

PCE445: Particle Technology **3 Cr Hr (3,0)** **5 ECTS**

Particle size analysis. Single particles in a fluid. Multiple particle systems. Fluid flow through a packed bed of particles. Fluidization. Pneumatic transport and standpipes. Separation of particles from a gas: gas cyclones. Storage and flow of powders. Mixing and segregation. Particle size reduction. Size enlargement. Fire and explosion hazards of fine powders.

Prerequisites: PCE344, BSC001

PCE447: Toxicology **3 Cr Hr (3,0)** **5 ECTS**

Disposition of toxic compounds, metabolism of foreign compounds, types of exposure and response, drugs as toxic substances, industrial toxicology, food additives and contaminants, pesticides, environmental pollutants, natural products, household products, toxicity testing and risk assessment.

Prerequisites: BIO111, BSC001

PCE448: Modern Drug Forms & Delivery Systems **3 Cr Hr (3,0)** **5 ECTS**

Therapeutic systems, nanoparticles, nanosuspensions, microemulsions, Self-Macro Emulsifying Delivery Systems (SMEDDS), multiple emulsions. Special Adsorbates. Biopharmaceutical in vitro models of drug release investigation of several drug delivery systems and in vitro absorption models, exploitation of drug release and absorption investigations, biopharmaceutical aspects of application sites and drug delivery systems, investigation of plasma concentration curve, bioavailability.

Prerequisites: BIO111, BSC001

PCE491: Environmental Engineering **3 Cr Hr (3,0)** **5 ECTS**

Legal framework in the fields of water, soil and air. Sampling techniques in the different environmental domains. Online analytical processes. Legal framework in the fields of water, soil and air. Sampling techniques in the different environmental domains. Online analytical processes.

Prerequisites: PCE251, BSC001

PCE492: Special Topics in Chemical/Pharmaceutical Engineering I **3 Cr Hr (3,0)** **5 ECTS**

Title and course contents of the topic must be approved by the Department's Council and preannounced by the Department.

Prerequisites: BSC001

PCE493: Special Topics in Chemical/Pharmaceutical Engineering II **3 Cr Hr (3,0)** **5 ECTS**

Title and course contents of the topic must be approved by the Department's Council and preannounced by the Department.

Prerequisites: BSC001

PCE494: Special Topics in Chemical/Pharmaceutical Engineering III **3 Cr Hr (3,0)** **5 ECTS**

Title and course contents of the topic must be approved by the Department's Council and preannounced by the Department.

Prerequisites: BSC001

PCE495: Special Topics in Chemical/Pharmaceutical Engineering IV **3 Cr Hr (3,0)** **5 ECTS**

Title and course contents of the topic must be approved by the Department's Council and preannounced by the Department.

Prerequisites: BSC001

PCE593: Special Topics in Chemical/Pharmaceutical Engineering V **2 Cr Hr (2,0)** **4 ECTS**

Title and course contents of the topic must be approved by the Department's Council and preannounced by the Department.

Prerequisites: BSC001

PCE594: Special Topics in Chemical/Pharmaceutical Engineering VI **1 Cr Hr (1,0)** **3 ECTS**

Title and course contents of the topic must be approved by the Department's Council and preannounced by the Department.

Prerequisites: BSC001

PCE595: Special Field Projects **3 Cr Hr (0,0)** **5 ECTS**

Title and course contents of the topic must be approved by the Department's Council and preannounced by the Department.

Prerequisites: BSC001

PCE5312: Industrial Processes Management and Industrial Safety **3 Cr Hr (3,0)** **5 ECTS**

Operations and supply chain management. Quality and quality management. Process capability and statistical control. Designing products. Process design technology. Capacity and facilities planning. Human Resources in Operations Management. Managing projects. Strategic supply chain management and design. Forecasting

Prerequisites:PCE332, BSC001

X. Course Offered by Other Departments

BM325: Automatic Control Systems for Medical Applications **3 Cr Hr (3,0)** **5 ECTS**

Modeling of biological electrical, Fluid (pneumatic and hydraulic), and mechanical systems. Components of control systems, Transfer functions, block diagrams, and signal flow graph. Time and frequency domain analysis and Modeling, test signals, transient response, steady state error and stability. Root locus, bode plots, PID control, phase lead, phase lag. Case studies: Distillation Process, Reactor Process, Mixing Process. Software application such as Matlab and Simulink.

Prerequisites: MATH205*,* PHYS104

BM328: Automatic Control Systems for Medical Applications Lab **1 Cr Hr (0,3)** **0 ECTS**

Laboratory to introduce the concepts learned in the course through practical experiments using Software application such as Matlab and Simulink.

Prerequisites: -

BIO111: Human Biology **3 Cr Hr (3,0)** **5 ECTS**

Human Biology course examines how the human body functions, and looksin detail at cellular events, from the developing embryo to the adult. Topics covered will include cell biology, human reproduction and embryology, physiology and biochemistry, the origins of human variation and inheritance in humans. In addition, students will be introduced to human dysfunction, treatments and preventions.

Prerequisites: -

IE0121: Probability and Statistics **3 Cr Hr (3,0)** **4 ECTS**

Probability, Discrete Distributions and their applications, Continuous Distributions and their applications, Estimation of parameters, Hypothesis testing, Regression, Quality control for engineers.

Prerequisites: MATH101

MATH203: Applied Mathematics for Engineers **3 Cr Hr (3,0)** **5 ECTS**

Vector analysis in Cartesian coordinates; Curvilinear coordinates and transformations to Cartesian, Spherical, and Cylindrical coordinates; line integrals, surface integrals, Green's theorem, Gauss's divergence theorem, and Stokes's theorem. Scalar and vector potential. Review of Series. Linear Algebra; Matrices and linear equations; Matrices and Linear Operators; Determinants, Eigenvalues and eigenvectors. Complex Numbers and Complex Variable; Representation of complex numbers, DeMoivre's formula, Powers and roots of complex numbers, Functions of complex variable.

Prerequisites: MATH102

MATH205: Differential Equations **3 Cr Hr (3,0)** **5 ECTS**

First-order ordinary differential equations, Second-order ordinary differential equations, System of ODEs. Solution Techniques including Laplace transforms, Fourier series: eigenvalue problems and expansions in orthogonal functions. Partial differential equation: classification, separation of variables, solution by series and transform methods. Models in Applied Mathematics; Applications to illustrate typical problems and methods of applied mathematics in solid and fluid mechanics, fields of physics, dynamics and vibrations, wave phenomena, diffusion phenomena, heat conduction, and biological processes.

Prerequisites: MATH102

BM371: Numerical Methods for Engineers **3 Cr Hr (2,3)** **5 ECTS**

Fundamentals of error analysis, numerical solutions of linear and nonlinear equations, numerical solution of system of equations, curve fitting, numerical integration and differentiation, numerical solution of ordinary differential equations. Application of numerical methods using relevant software packages.

Prerequisites: -

WEEM528: Air Pollution Control **4 Cr Hr (4,0)** **5 ECTS**

Air pollution control law and regulations. Air pollution measurements, emission estimates. Meteorology for air pollution control engineers. Air pollution concentration models. Designing air pollution control systems and equipment. Combustion and control systems. (Particulate pollutants, primary particulates, VOCs, Sox and NOx). Air pollutants and global climate

Prerequisites: BSC001

WEEM545: Water and Wastewater Treatment **3 Cr Hr (3,0)** **5 ECTS**

Definition of pollutions as applied to water, soil and air; Basic concepts in environmental chemistry, microbiology and biochemistry; water sources; chemical, physical and biological water quality and water quality parameters; standards and criteria; population estimation; stream pollution, organic loading and oxygen depletion model; process kinetics and reactor types: CSTR, plug flow and batch reactors; continuity equation and mass balance approach; introduction to unit process and operations used in water and wastewater treatment plants

Prerequisites: BSC001

MGT525: Project Management **3 Cr Hr (3,0)** **5 ECTS**

This module is designed for business students. We will start with defining the project and the project management processes. Then we will move on to the project management knowledge areas: scope management, project scheduling management (networks, duration estimation and critical path), project risk management, project leadership, project selection and portfolio management, project organizational context, and cost management.

Prerequisites: PCE332, BSC001

TME553: Reliability and Quality Control **3 Cr Hr (3,0)** **5 ECTS**

Study and application of statistical models and methods for defining, measuring and evaluating reliability of products, processes and services: life distributions, reliability functions, reliability configurations, reliability estimation, parametric reliability models, accelerated life testing, reliability improvement. Introduction to statistically based quality control and improvement methods.

Prerequisites: BSC001

CS116: Computing Fundamental Technical **3 Cr Hr (3,0)** **6 ECTS**

Basic computer skill; Programming concepts; algorithms: data types, arithmetic, logical, relational, Boolean, and assignment operators, simple input and output statements; programming control structures; data structures: single and multidimensional arrays; character strings; functions; pointers; file structures and representation. Based on programming language such as C

.

Prerequisites: -

CS1160: Computing Fundamental lab **1 Cr Hr (0,1)** **0 ECTS**

3-hours lab session every week to enhance hands-on experience on topics that are theoretically covered: Programming concepts; algorithms: data types, arithmetic, logical, relational, Boolean, and assignment operators, simple input and output statements; programming control structures; data structures: single and multidimensional arrays; character strings; functions; pointers; file structures and representation. Based on programming language such as C.

Prerequisites: -

PHYS103: Physics I **3 Cr Hr (3,0)** **5 ECTS**

Physics 103 is concerned with mechanics, the study of motion. Mechanics, in turn, consists of two major areas; kinematics and dynamics. Mechanics is basic to the understanding all the other areas of physics. Only three simple laws (Newton's laws of motion) and two fundamental conservation principles (the conservation of energy and the conservation of momentum) are needed to describe almost all the motion that we observe in our everyday world. The purpose of Physics 103 is to gain some understanding of these basic laws and principles and to learn how to apply them to physical happenings that occur in our daily life and work. The basic method of study will be to define the concepts, discuss and demonstrate the principles and laws, and to test and refine understanding by problem solving.

Prerequisites: -

PHYS104: Physics II **3 Cr Hr (3,0)** **5 ECTS**

To provide you with theoretical knowledge about Electricity & Magnetism. Many courses to come during your study will depend directly or indirectly on this course.
They include that you:

- develop a good understanding of a few important concepts in physics
- learn to apply these concepts to different situations
- gain the ability to reason qualitatively and quantitatively about physics

Prerequisites: PHYS103

MATH101: Calculus I **3 Cr Hr (3,0)** **5 ECTS**

This course introduces the student to the calculus of single-valued functions. Topics include: limits, continuity, rates of change, rules for differentiating, differentials and local linear approximations, maxima and minima problems, L'Hôpital's rule, related rates, logarithmic and implicit differentiation, inverse trigonometric and hyperbolic functions, Rolle 's Theorem, the mean-value theorem, and applications of derivatives and integrals. An overview of integration, basic techniques for integration, algebraic techniques of integration and applications of integrations are also included.

Prerequisites: MATH099

MATH102: Calculus II **3 Cr Hr (3,0)** **5 ECTS**

Sequences and series, power series, convergence theorems: integral, ratio, and alternating - series tests, Polar coordinates, and functions, integration and differentiation of polar functions, Vectors in three-dimensional space, spherical and cylindrical coordinates, Vector-valued functions, Partial derivatives, Multiple integrals, Topics in vector calculus.

Prerequisites: MATH101

PHYS106: General Physics Lab **1 Cr Hr (0,3)** **2 ECTS**

Developing a good understanding of a few important concepts in Mechanics, Electricity, and Magnetism. Learning to apply these concepts to familiar and unfamiliar situations and Gaining the ability to reason qualitatively and quantitatively. This lab consists of 12 experiments, six in Mechanics and six in Electricity and Magnetism.

Prerequisites: -

XI. Courses offered by Other Schools

ARB099: Arabic 99 **0 Cr Hr (3,0)** **0 ECTS**

This course aims to develop student's ability to read, comprehend, literary analyze, grammatically analyze, linguistically analyze, poetically analyze, and rhetorically analyze texts properly. The course also includes a selection of Arabic literature in poetry and prose representing different literary ages, in addition to several common forms of writing such as scientific article, news article, and others.

Prerequisites: -

ARB100: Arabic **3 Cr Hr (3,0)** **3 ECTS**

This course aims to improve the student's competence in the various linguistic skills in terms of reading, comprehension, and taste. This is achieved through the study of selected texts with many implications that raise issues in spelling, grammar, composition, meaning, and inference, and the use of an old and modern thesaurus.

Prerequisites: ARB099

ENGL099: English II **0 Cr Hr (3,0)** **0 ECTS**

Students will focus on English at a pre-intermediate level concentrating on the receptive skills of reading and listening and the productive skills of writing and speaking. These will include such things as comparatives and superlatives, quantifiers, possessive adjectives and pronouns, vocabulary building, role-play activities for speaking, reading comprehension and writing short descriptive paragraphs.

Prerequisites: -

ENGL101: English III **1 Cr Hr (3,0)** **3 ECTS**

Students will focus on English at an intermediate level concentrating on the receptive skills of reading and listening and the productive skills of writing and speaking. These will include collocations, tense review, affirmative, negative statements, synonyms and antonyms, time clauses, conditionals, active and passive forms, reported speech, phrasal verbs, reading comprehension with detailed questions, vocabulary and writing developed descriptive and opinion essays.

Prerequisites: ENGL099

ENGL102: English IV **1 Cr Hr (3,0)** **3 ECTS**

Students will focus on English at an upper-intermediate level concentrating on the receptive skills of reading and listening and the productive skills of writing and speaking. Model verb review, silent letters and proper pronunciation, jobs and careers, requests and offers, more phrasal verbs with vocabulary building, relative clauses and relative pronouns, narrative tenses for writing exercises, wishes and regrets, reading and comprehending longer passages with direct and inference questions of medium difficulty, hypothesizing, and writing fully developed descriptive, argumentative and analytical essays of 350 words.

Prerequisites: ENGL101

ENGL 201: English V **2 Cr Hr (3,0)** **3 ECTS**

Students will focus on English at an Advanced level. Students will analyze and produce 2 – 3 page essays with an emphasis on argumentation and persuasion working both independently and cooperatively to gather, evaluate, and synthesize necessary information. Class activities include interactive lectures, small group and class discussions, informal debates, peer feedback, individual presentations, focused listening exercises and focused viewing exercises as well as assorted reading, writing, and grammar assignments. There will be some poetry analysis together with reading and understanding a short story and a drama using basic literary terms and concepts.

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Prerequisites: ENGL102

ENGL 202: English VI **2 Cr Hr (3,0)** **3 ECTS**

Students will continue to focus on English at an Advanced level. Students will analyze and produce 4 – 5 page essays emphasizing argumentative, persuasive and discursive styles of writing, working both independently and cooperatively to gather, evaluate, and synthesize necessary information. Students will integrate the practice of critical thinking and reading into the writing process. Class activities include interactive lectures, small group and class discussions, informal debates, mini-conferences, peer feedback, individual presentations, focused listening exercises and focused viewing exercises as well as assorted reading, writing, and grammar assignments. There will be some poetry analysis together with reading and understanding a short story and a drama using stronger and more intensive literary terms and concepts than in 201.

Prerequisites: ENGL 201

ENGL 202: English VI **2 Cr Hr (3,0)** **3 ECTS**

Students will continue to focus on English at an Advanced level. Students will analyze and produce 4 – 5 page essays emphasizing argumentative, persuasive and discursive styles of writing, working both independently and cooperatively to gather, evaluate, and synthesize necessary information. Students will integrate the practice of critical thinking and reading into the writing process. Class activities include interactive lectures, small group and class discussions, informal debates, mini-conferences, peer feedback, individual presentations, focused listening exercises and focused viewing exercises as well as assorted reading, writing, and grammar assignments. There will be some poetry analysis together with reading and understanding a short story and a drama using stronger and more intensive literary terms and concepts than in 201.

Prerequisites: ENGL201

GERL101B1: German I B1 track **3 Cr Hr (9,0)** **6 ECTS**

By the end of this module, the student will be able to:

- Comprehend very familiar, everyday expressions and very simple sentences and structures related to areas of most immediate relevance according to the discretionary standards in the *Common European Framework of Reference for Languages* (CEFR) at the Level A1.1 (beginners without pre-knowledge).
- Introduce herself/himself and others, express likes and dislikes, fill out a personal form, ask questions and give answers in present and partially in past tense, set private and semi-official appointments, describe people and things and express frequency and quantity in a very basic way both orally and in writing.
- Communicate with native speakers on a very basic level if those involved in the conversation speak slowly and clearly and are willing to support the non-native speaker.

Prerequisites: Intensive pre-course (only for 1st semester of an academic year)

GERL102B1: German II B1 track **3 Cr Hr (9,0)** **6 ECTS**

By the end of this module, the student will be able to:

- Understand and use familiar, everyday expressions and very simple sentences and structures related to areas of most immediate relevance according to the discretionary standards in the *Common European Framework of Reference for Languages* (CEFR) at the level A1.2 (basic users).
- Introduce herself/himself and others, express likes and dislikes, fill out a personal form, ask questions and give answers in present and past tense, set private and official appointments, describe people and things, ask for directions, express frequency and quantity in a basic way both orally and in writing.
- Communicate with native speakers on a very basic level if those involved in the conversation speak slowly and clearly and, if need be, are willing to support the non-native speaker.

Prerequisites: GERL101B1

GERL201B1: German III B1 track **3 Cr Hr (6,0)** **4 ECTS**

By the end of this module, the student will be able to:

- Understand and use familiar, frequently used expressions and simple sentences and structures related to areas of a wider immediate relevance according to the discretionary standards in the *Common European Framework of Reference for Languages* (CEFR) at the level A2.1 (basic users).
- Talk about their academic and/or professional background, describe their living conditions, express likes and dislikes, ask questions and give answers in present and past tense, ask for help and support, make suggestions and give advice, describe health problems and talk with medical doctors and nurses, express pity, sorrow and hopes, express frequency and quantity in a basic way both orally and in writing.
- Communicate with native speakers within simple and familiar tasks requiring a simple and direct exchange of information on familiar and routine matters.

Prerequisites: GERL102B1

GERL202B1: German IV B1 track **3 Cr Hr (9,0)** **6 ECTS**

By the end of this module, the student will be able to:

- Distinguish between familiar expressions, sentences and structures related to areas of immediate relevance and more elaborated components like the main points of clear standard input on familiar matters regularly encountered in work, school, leisure etc. according to the discretionary standards in the *Common European Framework of Reference for Languages* (CEFR) at the level A2.2 (basic users) and, partially, at the level B1.1 (independent user).
- Talk about personal experiences with languages, express feelings of happiness, joy and discomfort, describe own media consumption habits, describe travel experiences, convince others, describe and report in official situations, describe statistics, write formal invitations and short emails, make suggestions and talk about future events and situations, describe dreams hopes and ambitions and briefly give reasons or explanations for opinions and plans.
- Communicate with native speakers about essential points and ideas in familiar contexts.
- Understand the characteristics of the official B1 exam according to the CEFR and use strategies to overcome obstacles while solving said exam.

Prerequisites: GERL201B1

GERL301B1: German V B1 track **3 Cr Hr (9,0)** **6 ECTS**

By the end of this module, the student will be able to:

- Understand the main points of clear standard input on familiar matters regularly encountered in work, school, leisure etc. according to the discretionary standards in the *Common European Framework of Reference for Languages* (CEFR) at the level B1.1 and B1.2 (independent user).
- Deal with most situations likely to arise whilst traveling in an area where German is spoken, produce simple connected texts on topic which are familiar or of personal interest, describe experiences and events, dreams, hopes and ambitions, statistics, and briefly give reasons and explanations for opinions and plans.
- Understand the main point of many radio or TV programmes on current events and topics, understand the description of events, feelings and wishes in personal letters, write personal letters/texts describing experiences and impressions, write straightforward connected texts on topics which are familiar or of personal interest.
- Communicate with native speakers about essential points and ideas in familiar contexts and about topics of personal or partially professional interest.
- Follow a lecture or talk within her/his field, provided the subject matter is familiar and the presentation straightforward and clearly structured.
- Understand simple technical information, such as operating instructions for everyday equipment.
- Understand all characteristics of the official B1 exam according to the CEFR and use a variety of strategies to overcome obstacles while solving said exam and all its components.

Prerequisites: GERL202B1

GERL302REG: German VI Regular **3 Cr Hr (6,0)** **6 ECTS**

By the end of this module, the student will be able to:

- Successfully manage the application process for a six months internship in Germany which is part of the obligatory 'German Year' for all GJU students. The process consists of finding and understanding a suitable add in accordance with the students' major, writing a convincing CV and cover letter, and mastering an effective and mostly fluent interview, departing spontaneously, taking initiatives, expanding ideas with little help or prodding from the interviewer.
- Successfully manage the most significant situations which the student, in accordance with the currently studied major, encounters during her/his theoretical and practical semester in Germany. This process is being achieved within a technical language training focussing on action orientated and communicative scenarios like following lectures, taking notes, summarizing academic and technical texts, writing official emails and texts related to academic and vocational encounters, holding presentations, communicating both verbally and in writing with professors, university staff, students as well as with colleagues and customers during an internship.
- Understand the concept of general intercultural phenomena, reflect and understand the differences between culture and cultural standards in Jordan and in Germany, understand the concept of 'culture shock' and potentially cope with its different stages, reflect about appropriate and inappropriate behaviour in Germany as well as understand the concepts of open-mindedness and 'culture clash'.

Prerequisites: GERL301B1

GERL302INT: German VI Intensive **3 Cr Hr (9,0)** **6 ECTS**

By the end of this module, the student will be able to:

- Successfully manage the application process for a six months internship in Germany which is part of the obligatory 'German Year' for all GJU students. The process consists of finding and understanding a suitable add in accordance with the students' major, writing a convincing CV and cover letter, and mastering an effective and mostly fluent interview, departing spontaneously, taking initiatives, expanding ideas with little help or prodding from the interviewer.
- Successfully manage the most significant situations which the student, in accordance with the currently studied major, encounters during her/his theoretical and practical semester in Germany. This process is being achieved within a technical language training focussing on action orientated and communicative scenarios like following lectures, taking notes, summarizing academic and technical texts, writing official emails and texts related to academic and vocational encounters, holding presentations, communicating both verbally and in writing with professors, university staff, students as well as with colleagues and customers during an internship.
- Understand the concept of general intercultural phenomena, reflect and understand the differences between culture and cultural standards in Jordan and in Germany, understand the concept of 'culture shock' and potentially cope with its different stages, reflect about appropriate and inappropriate behaviour in Germany as well as understand the concepts of open-mindedness and 'culture clash'.
- Understand all characteristics of the official B1 exam according to the CEFR and use different strategies to overcome obstacles while solving said exam and its different components.

Prerequisites: GERL301B1

GERL102B2: German II B2 track **3 Cr Hr (9,0)** **6 ECTS**

By the end of this module, the student will be able to:

- Understand and use familiar, everyday expressions and simple sentences and structures related to areas of most immediate relevance according to the discretionary standards in the *Common European Framework of Reference for Languages* (CEFR) at the level A1.2 and, partially, A2.1 (basic users).
- Talk about their academic and/or professional background, describe their living conditions, express likes and dislikes, ask questions and give answers in present and past tense, ask for help and support, make suggestions and give advice, express pity, sorrow and hopes, express frequency and quantity in a basic way both orally and in writing.
- Introduce herself/himself and others, express likes and dislikes, fill out a personal form, ask questions and give answers in present and past tense, set private and official appointments, describe people and things, ask for directions, express frequency and quantity in a basic way both orally and in writing.
- Communicate with native speakers on a basic level if those involved in the conversation speak slowly and clearly and, if need be, are willing to support the non-native speaker.

Prerequisites: GERL101B1

GERL201B2: German III B2 track **3 Cr Hr (6,0)** **4 ECTS**

By the end of this module, the student will be able to:

- Distinguish between familiar expressions, sentences and structures related to areas of immediate relevance and more elaborated components like the main points of clear standard input on familiar matters regularly encountered in work, school, leisure etc. according to the discretionary standards in the *Common European Framework of Reference for Languages* (CEFR) at the level A2.1 and A2.2 (basic users).
- Talk about their academic and/or professional background, describe their living conditions, express likes and dislikes, ask questions and give answers in present and past tense, ask for help and support, make suggestions and give advice, describe health problems and talk with medical doctors and nurses, express pity, sorrow and hopes, describe simple statistics, express frequency and quantity in a basic way both orally and in writing, express feelings of happiness, joy and discomfort and write personal emails and letters, understand and produce comments, blogs and reports.
- Communicate with native speakers in simple and familiar tasks requiring a simple and direct exchange of essential information on familiar and routine matters.

Prerequisites: GERL102B2

GERL202B2: German IV B2 track **3 Cr Hr (9,0)** **6 ECTS**

By the end of this module, the student will be able to:

- Understand the main points of clear standard input on familiar matters regularly encountered in work, school, leisure etc. according to the discretionary standards in the *Common European Framework of Reference for Languages* (CEFR) at the level B1.1 and B1.2 (independent user).
- Deal with most situations likely to arise whilst traveling in an area where German is spoken, produce simple connected texts on topic which are familiar or of personal interest, describe experiences and events, dreams, hopes and ambitions and briefly give reasons and explanations for opinions and plans.
- Understand the main point of many radio or TV programmes on current events and topics, understand the description of events, feelings and wishes in personal letters, write personal letters/texts describing experiences and impressions, write straightforward connected texts on topics which are familiar or of personal interest.
- Communicate with native speakers about essential points and ideas in familiar contexts and about topics of personal or partially professional interest.
- Follow a lecture or talk within her/his field, provided the subject matter is familiar and the presentation straightforward and clearly structured.
- Understand simple technical information, such as operating instructions for everyday equipment.
- Understand all characteristics of the official B1 exam according to the CEFR and use different strategies to overcome obstacles while solving said exam and all its components.

Prerequisites: GERL201B2

GERL301B2: German V B2 track **3 Cr Hr (9,0)** **6 ECTS**

By the end of this module, the student will be able to:

- Largely understand and produce rather complex texts on both concrete and abstract topics, including technical discussions in her/his field of specialisation and according to the discretionary standards in the *Common European Framework of Reference for Languages* (CEFR) at the level B2.1 (independent user).
- Interact with an initial degree of fluency and spontaneity that makes regular interaction with native speakers quite possible without strain for either party.
- Largely understand standard spoken language, live or broadcast, on both familiar and unfamiliar topics normally encountered in personal, social, academic or vocational life.
- Show a relatively high controlled degree of grammatical control without making errors which cause misunderstanding and with the growing ability to correct most of her/his mistakes.
- Largely follow essentials of lectures, talks, reports and other forms of academic/professional presentation which are propositionally and linguistically complex.
- Understand announcements and messages on concrete and abstract topics spoken in standard dialect at normal speed.
- Scan quickly through long texts, locating relevant details and understand and exchange complex information and advice on the full range of matters related to her/his occupational role.
- Understand the main characteristics of the official B2 exam according to the CEFR and use different strategies to overcome obstacles while solving said exam and its different components.

Prerequisites: GERL202B2

GERL302B2: German VI B2 track **3 Cr Hr (6,0)** **6 ECTS**

By the end of this module, the student will be able to:

- Understand and produce rather complex texts on both concrete and abstract topics, including technical discussions in her/his field of specialisation and according to the discretionary standards in the *Common European Framework of Reference for Languages* (CEFR) at the level B2.2 (independent user).
- Interact with a degree of fluency and spontaneity that makes regular interaction with native speakers quite possible without strain for either party.
- Understand standard spoken language, live or broadcast, on both familiar and unfamiliar topics normally encountered in personal, social, academic or vocational life.
- Show a highly controlled degree of grammatical control without making errors which cause misunderstanding and with the growing ability to correct most of her/his mistakes.
- Follow essentials of lectures, talks, reports and other forms of academic/professional presentation which are propositionally and linguistically complex.
- Understand announcements and messages on concrete and abstract topics spoken in standard dialect at normal speed.
- Scan quickly through long texts, locating relevant details and understand and exchange complex information and advice on the full range of matters related to her/his occupational role.
- Understand all characteristics of the official B2 exam according to the CEFR and use different strategies to overcome obstacles while solving said exam and its different components.
- Successfully manage the application process for a six months internship in Germany which is part of the obligatory 'German Year' for all GJU students. The process consists of finding and understanding a suitable add in accordance with the students' major, writing a convincing CV and cover letter, and mastering an effective and mostly fluent interview, departing spontaneously, taking initiatives, expanding ideas with little help or prodding from the interviewer.
- Successfully manage the most significant situations which the student, in accordance with the currently studied major, encounters during her/his theoretical and practical semester in Germany. This process is being achieved within a technical language training focussing on action orientated and communicative scenarios like following lectures, taking notes, summarizing academic and technical texts, writing official emails and texts related to academic and vocational encounters, holding presentations, communicating both verbally and in writing with professors, university staff, students as well as with colleagues and customers during an internship.
- Understand the concept of general intercultural phenomena, reflect and understand the differences between culture and cultural standards in Jordan and in Germany, understand the concept of 'culture shock' and potentially cope with its different stages, reflect about appropriate and inappropriate behaviour in Germany as well as understand the concepts of open-mindedness and 'culture clash'.

Prerequisites: GERL301B2

BE302: Business Entrepreneurship **3 Cr Hr (3,0)** **3 ECTS**

The course focuses on critical skills necessary to develop appropriate financing strategies for new venture creation and growth. Students will use case studies and team projects in course studies. Three primary topics are covered: first, an overview of the entrepreneurial finance process and involved players; second, performing business valuations; and third, securities law with emphasis on developing term sheets and private placement memorandums. Student teams will complete a valuation and mock securities offering for an existing small to mid-size business. Financial valuations and terms sheets developed by student teams will be presented to a panel of venture capital professionals for evaluation and critique

Prerequisites: ENGL101

DES101: Arts Appreciation **3 Cr Hr (3,0)** **3 ECTS**

An introductory course designed for non-art students to give them the basic knowledge of arts and simple approaches to the understanding of the history, development, elements, criticism, esthetics and materials of different art forms (visual, aural and performing arts). A comparative approach between the different arts is given to enhance the students' global understanding of arts and to give them the ability to look at art works and form their own opinions. The course is combined with examples of audio and visual arts.

Prerequisites: ARB099

IC101: Intercultural Communication **3 Cr Hr (3,0)** **3 ECTS**

This course is designed to provide prospective students (whose majors have an international flavor) with tools that offer powerful possibilities for improving the communication process. We will examine the process of sending and receiving messages between people whose cultural background could lead them to interpret verbal and nonverbal signs differently. We will learn about the diversity of these cultural differences and at the same time learn how we might overcome them. Our efforts to recognize and surmount cultural differences will hopefully open up business opportunities throughout the world and maximize the contribution of all the employees in a diverse workforce

Prerequisites: ENGL101

MILS100: Military Science **3 Cr Hr (3,0)** **3 ECTS**

History of the Jordanian Arab Army. United Nations Peace Keeping Forces. Preparation of the nation for defense and liberation. History of the Hashemite Kingdom of Jordan and its development

Prerequisite:-

NE101: National Education **3 Cr Hr (3,0)** **2 ECTS**

In a context of striving towards democracy like the one Jordan enjoys today, the meaning and practice of active and responsible citizenship becomes more crucial. It is often argued that democracy requires "democrats" to flourish, and become well established. Democrats are those women and men who recognize pluralism, inclusion, positive engagement, and participation as the main values that govern their interaction with the state as citizens and with each other as diverse people of different interests. In this course you will be able to understand your rights and responsibilities as Jordanian citizen expand your knowledge about the frameworks, and processes that regulates citizen-state relationships as well as the basic necessary skills for you to practice your citizenship rights in a civic manner.

Prerequisites:-

SE301: Social Entrepreneurship and Enterprises **3 Cr Hr (3,0)** **3 ECTS**

This course will serve as an introduction to the field of social entrepreneurship and social enterprises. Through lectures, field visits, analyses of relevant literature, case studies and exercises, this course will explore social entrepreneurship's potentials, opportunities and limitations. The topics will cover Defining Social Entrepreneurship. Contextualizing Social Entrepreneurship (need, motives, forms, criteria). Role of Leadership, Creativity and Innovation. Locating SE on the profit/non-profit continuum. SE in the larger fields of development, social change, community activism. Social Enterprises (Missions, Markets, Finances). Ethical business and corporate social responsibility.

Prerequisites: ENGL101

SFTS101: Soft Skills **3 Cr Hr (3,0)** **3 ECTS**

This course is designed to help develop strong oral and written communication skills. The student will be given opportunities to practice writing and editing professional correspondence and technical reports. Additionally, the student will compose and deliver oral presentations. Assignments will include the use of inductive and deductive approaches to conveying a variety of messages. The course emphasis the use of software tools to prepare presentations, stress management, confidence, and sensitivity to others. It also stresses on resume writing and conducting interviews.

Prerequisites: ENGL101

PE101: Sports and Health **3 Cr Hr (3,0)** **3 ECTS**

The course focuses on providing students with information related to Sport, fitness and health culture, Voluntary work Nutrition, First Aid. It covers also Special physical preparation and general sports cultural issues.

Prerequisites: ARB099

EI101: Leadership and Emotional Intelligence **3 Cr Hr (3,0)** **3 ECTS**

In this course, students will be introduced to the concept of Emotional Intelligence as a means to improve self-management and relationship management. The operative concepts are applied to social, family, academic and professional relationships with an emphasis on leadership implications. The majority of the curriculum is based upon the book by Daniel Goleman entitled: "Leadership: The Power of Emotional Intelligence," and covers leadership styles and their appropriate applications, the emotional intelligence model, and neurological aspects of the limbic system. The class is a lecture format which encourages student participation.

Prerequisites: ENGL101