Zagazig University

Faculty of Pharmacy

Pharmacogonosy Department

Program and Course Specifications

Master and Ph.D.

Degrees

2019-2020

Program and Course Specifications

of

Master Degree

Program Specification

Program Specification

A- Basic Information

1- Program title: M.Pharm. Sci Degree in **Pharmacognosy**

2- Program type: Single.

3- Faculty/ University: Faculty of Pharmacy, Zagazig University

4- Department: Pharmacognosy

5- Coordinator: Assis. Prof. Maged M.M. Abo-Hashem

6- Internal evaluator: Prof. Dr. Ehsan Abo-Zeid

7- External evaluator: Prof. Dr. Mona Gouda Zaghlool (Head of Pharmacognosy department – Faculty of Pharmacy – Mansoura University)

8- Date of program specification approval: 2019

9- Academic reference standard: ARS, 2009

10- The program courses were benchmarked with:

a) Department of Medicinal Chemistry and Pharmacognosy, College of Pharmacy, University of Illinois, Chicago, USA.

b) University of Science, Philadelphia, USA.

B- Professional Information

1- Program aims:

Master's program, Zagazig University is a 3-5 five years pharmacy education offering a Master's degree in pharmaceutical sciences

(Pharmacognosy). This Program aims at providing postgraduate students with knowledge, skills and abilities needed to practice the pharmacy profession effectively in various settings including Research Institutes, general Pharmacognosy topics (physical and chemical properties, formulas, obtaining, quantization of active compounds of natural products), research topics, contemporary education topics and enables them to work as self-researchers and participate in research projects.

The program aims are summarized as follows:

1. Develop the necessary knowledge and skills in areas related to Pharmacognosy, and plant biotechnology.

2. Illustrate various recent techniques in isolation, structure determination & of natural products and plant biotechnology.

3. Develop communication skills, time management, critical thinking, problem solving, decision making, team working, using modern information technology, design and conduct research.

4. Implement the sense of self learning for continuous improvement of professional knowledge and skills.

Graduate attributes:

The graduates should acquire the following attributes and skills:

1. Recognize the different types of information resources that have benefit in the natural products field.
2. Describe different plant herbarium and documentation.
3. Acquire the fundamental knowledge for the methods of isolation, and chromatographic purification as well as structure elucidation

of natural products using physicochemical and advanced spectral methods.

4. Plan, design and conduct research using the appropriate methodology and lead or participate in research and development activities.
5. Select the proper method for purification of natural products.
6. Possess interpersonal skills and concern for others.
7. Analyze issues logically, consider different options and viewpoints and make informed decisions.
8. Acknowledge ethics and ethical standards.

2-Intended Learning Outcomes (ILOs):

The Program provides excellent opportunities for students to demonstrate knowledge and understanding qualities and develop skills appropriate for Pharmacognosy master of sciences degree.

2-1- Knowledge and Understanding :

On successful completion of the Master degree Program, students will be able to:

A.1- Outline fundamental knowledge and basic principles of different spectroscopic techniques and their applications.

A.2- Outline the stability of secondary metabolites isolated from natural products.

A.3- Describe qualitative and quantitative analytical methods.

A.4- Classify different medicinal plants families according to their taxonomical categories.

A.5- Outline principle information on biotechnology, tissue culture and recent natural products biotechnology applications.

A.6- Mention different classes of natural products, their chemical conversions and biological activities.

A.7- Illustrate different traditional and modern techniques to predict structures of naturally isolated secondary metabolites obtained from different classes.

A.8- Identify different sources of information regarding medicinal plants including websites, flora, herbarium setting, extraction methods, chromatography and spectroscopy.

A.9- Illustrate moral and legal principle concerning scientific research.

A.10- Illustrate principles and fundamentals of professional practice in pharmacognosy, tissue culture and biotechnology.

A.11- Recognize ethics in all aspects of scientific research.

2-2 - Intellectual Skills:

On successful completion of the Master degree Program, students will be able to:

B.1- Appraise critically the quality of data and information offered from different sources to solve problems.

B.2- Identify gaps or weaknesses in existing knowledge and identify appropriate means of resolving them.

B.3- Identify risks during professional practice and suggest management strategy.

B.4- Generate a research question and hypothesis.

B.5- Interpret different experimental data.

2-3 - Professional and Practical Skills:

It is intended that, on successful completion of the Master degree Program, students will be able to:

C.1- Implement practical and laboratory skills in the field of pharmacognosy.

C.2- Review and summarize information in professional reports.

C.3- Conduct various methods and techniques of analysis related to pharmacognosy.

C.4- Write a scientific report in the form of published article.

3-4 - General and Transferable Skills:

On successful completion of the Master degree Program, students will be able to:

D.1- Apply effective communication skills recognizing the need for a variety of approaches.

D.2- Make effective use of information technology e.g. word processing, spread sheets, presentation soft ware, internet,….etc.

D.3- Practice self assessment and define learning needs.

D.4- Make effective use of library and other sources of information.

D.5- Establish rules for judging others performance.

D.6- Work with and motivate others.

D.7- Prioritize work and meet deadlines.

D.8- Develop the skills required for continuing professional development.

3- Academic Standards:

- ARS (Academic Reference Standards)

Matrix I: Comparison of M. Pharm. Sci. Degree in Pharmacognosy program with the Academic Reference Standard {ARS, 2009} developed by NAQAAE.

Attributes of the graduates (ARS, 2009)	**Attributes of the graduates (M. Pharm. Sci. Degree in Pharmacognosy)**
1. Apply the specialized knowledge he has acquired in his professional practice	2. Describe different plant herbarium and documentation. 3. Acquire the fundamental knowledge for the methods of isolation, and chromatographic purification as well as structure elucidation of natural products using physicochemical and advanced spectral methods.
2. Identify and solve professional problems	7. Analyze issues logically, consider different options and viewpoints and make informed decisions.
3. Show good communication and leadership skills	6. Possess interpersonal skills and concern for others

5. Take decisions using available information	5. Select the proper method for purification of natural products.
4. Use technology effectively in his professional practice 6. Use available resources efficiently	4. Plan, design and conduct research using the appropriate methodology and lead or participate in research and development activities.
7. Aware of his role in community service and development	8. Acknowledge ethics and ethical standards.
8. Reflect commitment to integrity, credibility and accountability	
9. Be a lifelong learner and able to develop himself	1. Recognize the different types of information resources that have benefit in the natural products field.

Matrix II: Comparison of M. Pharm. Sci. Degree in Pharmacognosy program with the Academic Reference Standard {ARS, 2009} developed by NAQAAE.

ARS vs. Program ILOs of Masters in Pharmacognosy		
ARS (2009)		**Program ILOs**
Knowledge and Understanding	2.1.1- Theories and fundamentals related to the field of learning as well as in related areas.	A.1- Outline fundamental knowledge and basic principles of different spectroscopic techniques and their applications. A.2- Outline the stability of secondary metabolites isolated from natural products.

		Note: this course is not related to pharmacognosy. A.3- Describe qualitative and quantitative analytical methods. A.4- Classify different medicinal plants families according to their taxonomical categories.
	2.1.2- Mutual influence between professional practice and its impact on the environment.	A.5- Outline principle information on biotechnology, tissue culture and recent natural products biotechnology applications.
	2.1.3- Scientific developments in the area of specialization.	A.6- Mention different classes of natural products, their chemical conversions and biological activities. A.7- Illustrate different traditional and modern techniques to predict structures of naturally isolated secondary metabolites obtained from different classes. A.8- Identify different sources of information regarding medicinal plants including websites, flora, herbarium setting, extraction methods, chromatography and spectroscopy.
	2.1.4- Moral and legal principles for professional practice in the area of specialization.	A.9- Illustrate moral and legal principle concerning scientific research.
	2.1.5- Principles and the basics of quality in professional practice in the area of specialization.	A.10- Illustrate principles and fundamentals of professional practice in pharmacognosy, tissue culture and biotechnology.
	2.1.6- The fundamentals and ethics of scientific research.	A.11- Recognize ethics in all aspects of scientific research.
Intellectual Skills	2.2.1- Analyze and evaluate information in the field of	B.1- Appraise critically the quality of data and information obtained from different sources in different forms.

	specialization and analogies to solve problems	
	2.2.2- Solve specified problems in the lack or missing of some information.	B.2- Suggest a significant solution for phytochemical problems based on a wide academic background.
	2.2.3- Evaluate and manage risks and potential hazards in professional practices in the area of specialization	B.3- Identify risks during professional practice and suggest management strategy.
	2.2.4- Plan to improve performance in the field of specialization.	B.4- Generate a research question and hypothesis
	2.2.5- Professional decision-making in the contexts of diverse disciplines.	B.5- Interpret different experimental data
Professional and Practical Skills	2.3.1- Master basic and modern professional skills in the area of specialization.	C.1- Implement a wide range of practical and laboratory skills in the field of pharmacognosy.
	2.3.2- Write and evaluate professional reports.	C.2- Evaluate different reports in the area of pharmacognosy.
	2.3.3- Assess methods and tools existing in the area of specialization.	C.3- Apply and use various methods and techniques of analysis related to pharmacognosy.
	2.3.4- Write scientific report on research specified topics.	C.4- Write a scientific report in the form of published article
General and Transferable Skills	2.4.1- Communicate effectively.	D.1- Apply effective communication skills recognizing the need for a variety of approaches.
	2.4.2- Effectively use information technology in professional practices	D.2- Make effective use of information technology e.g. word processing, spread sheets, presentation soft ware, internet,….etc.

	2.4.3- Self-assessment and define his personal learning needs.	D.3- Practice self assessment and define learning needs.
	2.4.4- Use variable sources to get information and knowledge.	D.4- Make effective use of library and other sources of information.
	2.4.5- Set criteria and parameters to evaluate the performance of others	D.5- Establish rules for judging others performance.
	2.4.6- Work in a team and lead teams carrying out various professional tasks.	D.6- Work with and motivate others.
	2.4.7- Manage time effectively.	D.7- Prioritize work and meet deadlines.
	2.4.8- Continuous and self learning.	D.8- Develop the skills required for continuing professional development.

Matrix III: Benchmarked with: Department of Medicinal Chemistry and Pharmacognosy, College of Pharmacy, University of Illinois, Chicago, USA and University of Science, Philadelphia, USA.

Program	Courses	Benchmarks
Master program (General courses)	Advanced Instrumental Analysis	**University of Illinois at Chicago, USA** Department of Medicinal Chemistry and Pharmacognosy (MCP) in the College of Pharmacy ▪ Advanced Pharmacognosy ▪ Structure Elucidation of Natural Products
	Biostatistics	
	Research Methodology and Scientific Writing	
Master program (Special courses)	Advanced Pharmacognosy	
	Structure Elucidation of Natural Products	

	Recent Application on Plant Tissue Culture	▪ Problem-Solving in Plant Taxonomy ▪ Seminar in Pharmacognosy **University of science at Philadelphia, USA** ▪ Biostatistical Methods ▪ Scientific Writing for Chemistry ▪ Applied Spectroscopy ▪ Advanced Pharmacognosy

4-Curriculum Structure and Contents:

a- Program duration: **3- 5** years

b- Program structure:

- The Master program can be completed in 3-5 years.
- The Faculty of pharmacy implements the credit hour system.
- The program is structured as:

1- Courses: General (1 year) and Special

No. of credit hours for program courses:

Compulsory: (4 x4)16

Elective: (1x4) 4

Special: (3x4) 12

2- Thesis: 30 hours

The candidate must complete a research project on an approved topic in the Pharmaceutical Sciences. To fulfill this requirement the student must present (written and orally) a research proposal and write a thesis.

3- General University Requirements: 10 credit hours including:

a- TOEFL (400 units)

b- Computer course

c- Program Curriculum:

Course Code	Course Title	Credit hours	Program ILOs Covered
	General Courses:		
M108	Advanced Taxonomy	4	A4, A8, A10, B1, D4.
M113	Natural Products Biotechnology	4	A5, A10, B1, B3, B7, D1, D6.
M107	Recent applications of plant tissue culture techniques	4	A5, A6, A10, B1, D1, D4
M101	Advanced Instrumental Analysis & chromatography I	4	A1, B1, D2
ME3	Elective A Good practice for analysis of drugs and quality control	4	A3, B1, B3, D2, D4
ME2	**Elective B:** Drug Stability	4	A2, B2, B5, D2, D4
	Special Courses:		
Gsp1	Advanced Chemistry of natural products	4	A1, A6, A10, B3, D1, D6.
Gsp2	Structure Determination of Natural Products	4	A1, A7, A10, B1, B3, D4.
Gsp3	Methods in natural products research	4	A4, A6, A7, A8, A10, B1, B3, D1 and D6.
	Thesis	30	A1, A2, A3, A4, A5, A6, A7, A8, A9, A10, A11, B1, B2, B3, B4, B5, C1, C2, C3, C4, D1, D2, D3, D4, D5, D6, D7, D8.

5-Program admission requirements:

General Admission Conditions

- The Applicant should finish or being permanently or temporarily exempted from the military service and temporary exemption should be valid for at least one year from the date of beginning of study. (Exceptions apply for demonstrators and assistant lecturers).
- The applicant admission to the M.Sc. program should be no later than ten years from the time of graduation.
- Acquisition of an approval from the Faculty Council following an approval of concerned Departmental Board as well as Graduate Studies and Research Committee recommendation within a maximum of one month for any conditions stated by the concerned Departmental Board.

Admission Conditions for M.Sc. degree

In addition to the general admission conditions stated before, applicants are admitted to M.Sc. degree upon fulfillment of the following:

The applicants should be holders of Bachelor in Pharmaceutical Sciences from any Faculty of Pharmacy with a general grade at least good affiliated to the Egyptian Universities or an equivalent degree granted by any institute recognized by the Supreme Council of Universities.

The Faculty council is allowed, on consent of the concerned Departmental Board as well as Graduate Studies and Research Committee, to accept student for registration of M.Sc. degree if he has got a diploma from one of the Egyptian Universities in one of the pharmaceutical sciences fields, Faculties, or Institutes that are recognized

by the Supreme Council of Universities with a general grade of Good regardless his grades in bachelor degree.

Students should fulfill all the admission requirements stated by the concerned Departmental Board (ICDL certificate, local TOEFL certificate with a grade at least 450).

Admission has to be done within the period announced by the university.

Candidate thesis discussion isn't before one calendar year from research point registration.

Regulations to complete the program:

Conditions of granting the degree

The Faculty Council, in compliance with the concerned Departmental Board as well as Graduate Studies and Research Committee recommendation awards the M.Sc. degree upon fulfillment of the following requirements:

- Carrying out a deep research in the area of specialization for at least one or two calendar years and at most three years from the time of registration.
- The student has to succeed in all courses examinations.
- Acceptance of the research thesis by the Jury Committee according to statement 104 of universities regulating law.

Cancellation of Registration

The Faculty Board is allowed to cancel registration for M. Sc. programs in the following circumstances

- Student's failure to pass the course examinations for two times.
- Student's nonattendance or unsatisfactory progress (at least two annual reports) in research work being reported by the advisors and chief supervisor to the Departmental Board and forwarded to the Graduate Studies and Research Committee recommendation for approval of cancellation.
- Dissertation refusal by the Jury Committee.
- Incapability of the student to graduate by the deadlines indicated.

6- Admission Policy:

The faculty complies with the admission regulations and requirements of the Egyptian Supreme Council of Universities (ESCU).

7-Student assessment methods:

Method	ILOS
Written exam	Knowledge and Understanding and Intellectual Skills
Oral exam	Knowledge and Understanding, Intellectual Skills and General and Transferable Skills
Activity	Intellectual Skills and General and Transferable Skills
Seminars	Knowledge and Understanding, Intellectual Skills & General and Transferable Skills

Follow up	Professional and practical Skills & General and Transferable Skills
Thesis and oral presentation	Knowledge and Understanding, Intellectual Skills, Professional and practical Skills & General and Transferable Skills

Grade Scale	Grade point average value (GPA)	Numerical scale
A+	5	≥ 95%
A	4.5	90- < 95%
B+	4	85- < 90%
B	3.5	80- < 85%
C+	3	75- < 80%
C	2.5	70- < 75%
D+	2	65- < 70%
D	1.5	60- < 65%

8-Failure in Courses:

Students who fail to get 60% (1 point)

9-Methods of program evaluation

Evaluator	Method	Sample
Internal evaluator: Prof. Dr. Ehsan Abo-Zeid	Program evaluation Courses evaluation	Program report Courses report
External evaluator: Prof. Dr. Mona Gouda Zaghlol	Program evaluation Courses evaluation	Program report Courses report
Others methods	Matrix with ARS Questionnaires	The Matrix Results of the questionnaires

Program coordinator: Ass. Prof. Dr. Maged M.M. Abou-Hashem

Head of Department: Prof. Dr. Amal Al-Gendy

Matrix I for master program

Program ILOs	Advanced Taxonomy	Natural Products Biotechnology	Recent applications of plant tissue culture techniques	Advanced Instrumental Analysis & chromatography I	Good practice for analysis of drugs and quality contro	Drug Stability	Advanced Advanced chemistry of natural products	Structure Determination of Natural Products	Methods in natural products research	thesis
. A.1-.				X			X	X		X
A.2-						x				X
A.3-					x					X
A.4-	X								X	X
A.5-		X	X							X
A.6-			X				X		X	X
A.7-								X		X
A.8-	X								X	X
A.9-										X
A.10-	x	x	x				x	x	x	X
A.11-										X
B.1-	X	X	X	x	x			X	X	X
B.2-						x				X
B.3-		X			x		x	X	X	X
B.4-										X
B.5-		X				x				X
C.1-										X
C.2-										X
C.3-										X

C.4-										X
D.1-		X	X				X		X	X
D.2-				x	x					X
D.3-										X
D.4-	X		X		x			X		X
D.5-										X
D.6-		X					X		X	X
D.7-										X
D.8-										X

General Courses

Advanced Taxonomy

Course specification of Advanced Taxonomy

Course specifications:

- Program on which the course is given: Master of Pharmaceutical Sciences
- Major or Minor element of program: Major
- Department offering the program: Pharmacognosy Dept.
- Department offering the course: Pharmacognosy Dept.
- Academic year / level: Postgraduate
- Date of specification approval: **2019**

1- Basic information:

Title: Advanced Taxonomy Code: M108

Lectures: 4 hrs/week Credit hours: 4

Total: 4hrs/week

2- Overall aim of the course:

On completion of the course, the students will be able to:

- Classify medicinal plants families according to the external morphology, anatomy, cytotaxonomy, palynology, chemotaxonomy and serotaxonomy.
- Recognize botanical library, herbarium, botanical grades and their importance.
- Implement the use of taxonomy in medicinal plant research and industry.

The course was benchmarked with course: Problem-Solving in PlantTaxonomy, delivered by University of Illinois at Chicago, USA, Department of MedicinalChemistry and Pharmacognosy(MCP) in the College of Pharmacy.

3. Intended learning outcomes (ILOs) of Advanced Taxonomy:

Knowledge and Understanding	
a1	Discuss the classification of the plant kingdom into phyta.
a2	List the plant families according to morphological and anatomical characters.
a3	Classify plants into families according to the composition of the flower.
a4	Understand the newer aspects of taxonomy based on chemical or genetic profiles.
Intellectual skills	
b1	Separate closely related species macroscopically and microscopically.
b2	Differentiate between closely related species by advanced taxonomy as serology, palynology, cytotaxonomy, and chemotaxonomy
General and Transferable Skills	
d1	Use modern technology in retrieving information

4. Course Content of Advanced Taxonomy:

Week number	Lecture contents (4hrs/week)

1	Introduction: Classification of plant kingdom
2	Classification of subphyla
3	Bryophytes and Pteridophyta
4	Gymnosperms and Angiosperms
5	Monocot and Dicot families Modern trends in plant taxonomy
6	Floral anatomy and Cytology Activity
7	Palynology.
8	Numerical taxonomy
9	Chemotaxonomy Activity
10	Serotaxonomy
11	Botanical library Activity
12	Botanical gardens and paleobotany
13	Floral diagram, floral formula and floral anatomy
14	Classification of plants according to pharmacology and medicinal uses
15	Final written exam

5- Teaching and Learning Methods:

- Lectures
- Self learning
- Open discussion
- Activities

6- Student Assessment methods:

Written exams to assess: a1, a2, a3, a4, b1and b2

Oral exam assess: a1, a2, a3, a4, b1and b2

Activity assess: d1

Assessment schedule:

Assessment (1): Activity	Week 5-11
Assessment (2): Written exam	Week 15
Assessment (3): oral exam	Week 15

Weighting of Assessment:

Assessment method	Marks	Percentage
• Activity	10	10 %
• Written exam	75	75 %
• Oral exam	15	15 %
TOTAL	**100**	**100%**

7- References and books:

A- Scientific papers

B- Essential books:

- Janice glimn-Lacy and Peter B. Kaufman (2006) “Botany illustrated, introduction to plants, major groups, flowering plant families” 2nd edition, springer
- Botany" by Dr. Ashok M. Bendre and Dr. P.C. Pande.(2008)
- Plant Systematics" by Walter S. Judd (2007).
- Trease and Evans Pharmacognosy" by William Charles Evans (2009).
- Students' Flora of Egypt by Vivi Täkholm (1974).
- Plant Taxonomy" by O.P. Sharma (1993).

C- Suggested books:

- Introductory Botany" by Linda R. Berg (2000).
- Common families of flowering plants" by Michael Hickey and Clive King (1997).

D- Websites:

www.organicworldwide.net

www.wikipedia.org

www.googlescholar.com

Facilities required for teaching and learning:

1. **For lectures:**Black (white) boards, computer, data show.

- **Course Coordinator: Prof Dr/ Fawkia Abbas**

- **Head of Department: Prof. Dr. Amal Al-Gendy**

- **تم اعتماد المقرر من مجلس القسم بتاريخ**
- **Date:**

Matrix I of Advanced Taxonomy course								
Week number	Course Contents	Knowledge and understanding				Intellectual skills		General and Transferable Skills
		a1	**a2**	**a3**	**a4**	**b1**	**b2**	**d1**
1	Introduction: Classification of plant kingdom	x						
2	Classification of subphyla	x						
3	Bryophytes and Pteridophyta	x						
4	Gymnosperms and Angiosperms	x						
5	Monocot and Dicot families Modern trends in plant taxonomy	x						x
6	Floral anatomy and Cytology Activity		x			X		
7	Palynology.			x			x	
8	Numerical taxonomy				x		x	
9	Chemotaxonomy Activity				x		x	
10	Serotaxonomy				x		x	
11	Botanical library Activity			x				x
12	Botanical gardens and paleobotany							
13	Floral diagram, floral formula and floral anatomy			x				
14	Classification of plants according to pharmacology and medicinal uses	x	x	x	x	X	x	
15	Classification of plants according to pharmacology and medicinal uses	x	x	x	x	X	x	

Matrix II of Advanced Taxonomy

ARS		Program ILOs	Course ILOs	Course content	Source	Teaching and learning methods		Method of Assessment		
						Lectures	Self learning	Written exam	Oral exam	Activity
Knowledge and Understanding	2.1.1- Theories and fundamentals related to the field of learning as well as in related areas.	A.4- Classify different medicinal plants families according to their taxonomical categories.	a1	Classification of plant kingdom, thallophyta	Scientific papers, text books and Internet	X	x	X	X	
				Classification of subphyla algae, fungi and lichens.	Scientific papers, text books and Internet	X	x	X	X	
				Pteridophyta: subphyla Filicinae and Lycopodinae. Differences between gymnsperms and angiosperms	Scientific papers, text books and Internet	X	x	X	X	
				Differences between monocots and dicots	Scientific papers, text books and Internet	X	x	X	X	

				Examples of monocot and dicot families.	Scientific papers, text books and Internet	X	x	X	X	
			a2	Modern trends in plant taxonomy: External morphology, vegetative anatomy	Scientific papers, text books and Internet	X	x	X	X	
			a3	Floral anatomy, cytology and palynology.	Scientific papers, text books and Internet	X	x	X	X	
				Botanical library (role, major ones in the world), herbarium (definition, modern herbarium, examples in the world, precautions for using herbarium)	Scientific papers, text books and Internet	X	x	X	X	
				Floral diagram and floral formula and activity	Scientific papers, text books and Internet	X	x	X	X	

	2.1.3- Scientific developments in the area of specialization.	A.8- Acquire full awareness about different sources of information regarding medicinal plants including websites, flora, herbarium setting, extraction methods, chromatography and spectroscopy.	a4	Numerical taxonomy (principles, advantages, applications)	Scientific papers, text books and Internet	X	x	X	X	
				Chemotaxonomy (definition, purpose, chemical classes)	Scientific papers, text books and Internet	X	x	X	X	
				Serotaxonomy (definition, general features, general purposes)	Scientific papers, text books and Internet	X	x	X	X	
Intellectual Skills	2.2.1- Analyze and evaluate information in the field of specialization and analogies to solve problems	B.1- Appraise critically the quality of data and obtained information from different sources in different forms.	b1	Modern trends in plant taxonomy: External morphology, vegetative anatomy	Scientific papers, text books and Internet	X	x	X	X	
			b2	Floral anatomy, cytology and palynology.	Scientific papers, text books and Internet	X	x	X	X	

				Numerical taxonomy (principles, advantages, applications)	Scientific papers, text books and Internet	X	x	X	X	
				Chemotaxonomy (definition, purpose, chemical classes)	Scientific papers, text books and Internet	X	x	X	X	
				Serotaxonomy (definition, general features, general purposes)	Scientific papers, text books and Internet	X	x	X	X	
General and Transferable Skills	2.4.4- Use variable sources to get information and knowledge.	D.4- Make effective use of library and other sources of information in the field of pharmacognosy	d1	Activity	Scientific papers, text books and Internet		x			x

Recent applications of plant tissue culture techniques

Recent applications of plant tissue culture techniques

A- Course specifications:

- Program on which the course is given: Master of Pharmaceutical Sciences
- Major or Minor element of program: Major
- Department offering the program: Pharmacognosy Dept.
- Department offering the course: Pharmacognosy Dept.
- Academic year level: Postgraduate
- Date of specification approval: 2019

1- Basic information:

Title: Recent applications of Plant Tissue Culture techniques

Code: M107 Credit hours: 4 hr/week

Lectures: 4 hr/week Total: 4 hr/week

2- Overall aim of the course:

The students, on completion of the course, will be able to:

- Use plant tissue culture techniques as a tool for producing new secondary metabolites in the plant and increasing the amount of already existing materials which have valuable medicinal uses.
- Apply different methodology as elicitation, immobilization and two phase system to increase the production of valuable metabolites.
- Save the medicinal plant flora through micropropagation and somatic embryogenesis techniques.

The course was benchmarked with course: Advanced Pharmacognosy, delivered by University of Illinois at Chicago, USA, Department of MedicinalChemistry and Pharmacognosy(MCP) in the College of Pharmacy and University of science at Philadelphia, USA.

3. Intended learning outcomes (ILOs):

Knowledge and Understanding	
a1	Identify recent tissue culture techniques and different factors affecting it.
a2	Describe different types of culture, phytohormones and media components.
a3	Explain plant regeneration, somatic embryogenesis and their applications.
a4	Recognize different techniques as elicitation, immobilization and two phase systems to increase the production of secondary metabolites *in vitro*.
Professional and Practical skills	
c1	Design tissue culture laboratory
c2	Prepare growth medium with different phytohormones
c3	Apply different techniques for production of secondary metabolites *in vitro* e.g. elicitation, immobilization and two phase system.
Intellectual skills	
b1	Create a protocol for plant tissue culture

b2	Design a protocol for plant regeneration using somatic embryogenesis
b3	Analyze the effect of different factors on the production of secondary metabolites using plant tissue culture techniques
General and Transferable Skills	
d1	Present data clearly in oral and written form
d2	Make use of different sources of information in the field of tissue culture
d3	Present the report in simple power point presentation

4. Course Content of Plant Tissue Culture Techniques:

Week number	Lecture contents (4hr/week)
1	Tissue culture overview Medium component, Macroelements, Microelements and other components
2	Plant growth regulators: hormones and applications
3	Culture types: Callus, cell suspension, hairy root cultures and protoplast
4	Plant regeneration and micropropagation
5	General plant tissue culture laboratory design

6	Application for production of the secondary metabolites by plant tissue culture. Activity.
7	Somatic embryogenesis.
8	Elicitation of plant tissue culture.
9	Immobilization of suspension culture. Activity.
10	Application of two phase system for collection of secondary metabolites
11	Activity discussion
12	presentation
13	Visit to tissue culture lab and practical application of different experiments which cover the course contents
14	practical application of different experiments
15	Final written exam

5- Teaching and Learning Methods:

- Lectures
- Practical
- Self learning: Internet and library activities
- Report
- Presentation

6- Student Assessment methods:

Written exams to assess: a1, a2, a3, a4, b1to b3

Oral exam assess: a1, a2, a3, a4, b1to b3

Activity assess: c3, d1, d2, b1, b2, b3

Assessment schedule:

Assessment (1): Activity	Week 11-12
Assessment (2): Written exam	Week 15
Assessment (3): Oral exam	Week 15

Weighting of Assessment:

Assessment method	Marks	Percentage
• Activity	10	10 %
• Written exam	75	75 %
• Oral exam	15	15 %
TOTAL	**100**	**100%**

7-Facilities required for teaching and learning:

- **For lectures:** Black (white) boards, data show.
- **For Labs:** Laminar flow, culture room, pH meter, autoclave, oven, digital balance, chemicals and glass wears

8- References and books:

A-Scientific papers

B- Essential books:

- *Anis, M, Ahmed N. (2016). Plant Tissue Culture*: *Propagation, Conservation and Crop Improvement*, Springer.
- Madhavi A., Nagar, S. *Practical Book of Biotechnology & Plant Tissue Culture* (2009) Chand LTD, New Delhi
- Trigiana RN and Gray D (2000) "Plant tissue culture concepts and laboratory exercises" CRC press, Florida, USA.
- Smith R. H. (2000) "Plant Tissue Culture, Second Edition: Techniques and Experiments" Acadimic press, Florida, USA.

C- Suggested books:

Ochoa-Alejo, N., Loyola-Vargas, V.M. *(2006). Plant Cell Culture Protocols*, Methods in molecular biology, second edition, Humana press & Totowa, New Jersey

D- Websites:

http://www.ncbi.nlm.nih.gov/

http://www.sciencedirect.com/

http://wokinfo.com/

http://thomsonreuters.com/products_services/science/science_products/a-z/web_of_science/

- **Course Coordinators: Prof Dr/ Ehsan Abo Zied**
- **Head of Department: Prof. Dr. Amal Al-Gendy**

- **Date:**

1

Matrix I of Plant tissue culture techniques

Week number	Courses Contents	ILOs of Plant tissue culture techniques course												
		Knowledge and understanding				Intellectual skills			Professional and practical skills			General and Transferable Skills		
		a1	a2	a3	a4	b1	b2	b3	c1	c2	c3	d1	d2	d3
1	Introduction: Tissue culture definition	**X**												
2	Medium component: Macroelements, Microelements and other components		**X**											
3	Plant growth regulators: hormones and applications		**X**			**X**								
4	Culture types: Callus, cell suspension and protoplast		**X**				**X**							
5	Culture types: Hairy root cultures		**X**											
6	Plant regeneration: somatic embryogenesis Activity			**X**										
7	Plant regeneration: organogenesis			**X**										
8	Micropropagation: definition and stages			**X**										
9	Micropropagation: applications Activity			**X**										

10	General plant tissue culture laboratory design								**X**	**X**	**X**			
11	Practical techniques used for plant tissue culture								**X**	**X**	**X**			
12	Production of the secondary metabolites by tissue culture: techniques used				**X**			**X**						
13	Application for production of the secondary metabolites by plant tissue culture (activities)				**X**			**X**				**X**	**X**	
14	Application for production of the secondary metabolites by plant tissue culture (activities)				**X**			**X**				**X**	**X**	
15	Exam	**X**	**X**	**X**	**X**							**X**	**X**	

Matrix II of Plant tissue culture techniques										
ARS		**Program ILOs**	**Course ILOs**	**Course content**	**Source**	**Teaching and learning methods**		**Method of Assessment**		
						Lectures	**Self learning**	**Written exam**	**Oral**	**Activity**
Knowledge and Understanding	2.1.2- Mutual influence between professional practice and its impact on the environment.	A.5-Outline principle information on biotechnology, tissue culture and recent natural products biotechnology applications.	a1	Introduction: Tissue culture definition	Scientific papers, text books and Internet	x	x	x	x	
			a2	Medium component: Macroelements, Microelements and other components	Scientific papers, text books and Internet	x	x	x	x	
				Plant growth regulators: hormones and applications	Scientific papers, text books and Internet	x	x	x	x	
				Culture types: Callus, cell suspension and protoplast	Scientific papers, text	x	x	x	x	

					books and Internet					
				Culture types: Hairy root cultures	Scientific papers, text books and Internet	x	x	x	x	
			a3	Plant regeneration: somatic embryogenesis	Scientific papers, text books and Internet	x	x	x	x	
				Plant regeneration: organogenesis	Scientific papers, text books and Internet	x	x	x	x	
				Micropropagation: definition and stages	Scientific papers, text books and Internet					
				Micropropagation: applications						

	2.1.3- Scientific developments in the area of specialization.	A.6- Mention different classes of natural products, their chemical conversions and biological activities.	a4	Production of the secondary metabolites by tissue culture: techniques used	Scientific papers, text books and Internet	x	x	x	x	
				Application for production of the secondary metabolites by plant tissue culture (activities)	Scientific papers, text books and Internet	x	x	x	x	
Intellectual skills	2.2.1- Analyze and evaluate information in	B.1- Appraise critically the quality of data and	b1	Plant growth regulators: hormones and applications	Scientific papers, text books and Internet	x	x	x	x	

	the field of specialization and analogies to solve problems	information offered from different sources to solve problems.	b2	Culture types: Callus, cell suspension and protoplast	Scientific papers, text books and Internet	x	x	x	x	
			b3	Production of the secondary metabolites by tissue culture: techniques used	Scientific papers, text books and Internet	x	x	x	x	
				Application for production of the secondary metabolites by plant tissue culture (activities)	Scientific papers, text books and Internet	x	x	x	x	x
General and		D.1- Apply effective communication skills recognizing the need for a variety of approaches.	d1	Application for production of the secondary metabolites by plant tissue culture (activities)	activity	x	x			x

		D.4- Make effective use of library and other sources of information in the field of pharmacognosy.	d2	Application for production of the secondary metabolites by plant tissue culture (activities)	activity					x
			d3	Present the report in simple power point presentation						

Natural Products Biotechnology

Course specification of Natural Products Biotechnology

Course specifications:

- Program on which the course is given: Master of Pharmaceutical Sciences
- Major or Minor element of program: Major
- Department offering the program: Pharmacognosy Dept.
- Department offering the course: Pharmacognosy Dept.
- Date of specification approval: 2019

1- Basic information:

Title: Natural Products Biotechnology **Code:**M113

Lectures: 4 hrs/week **Credit hours:** 4 hrs

Total:4hrs/week

2- Overall aim of the course:

On completion of this course, the student is expected to:

- Have the necessary knowledge, understanding and gain the competent skills about the fundamentals and advanced applications in the field of tissue culture.

- Memorize the basic concepts in biotransformation and molecular biology that affect the production of pharmaceutical products.

The course was benchmarked with course: Advanced Pharmacognosy, delivered by University of Illinois at Chicago, USA, Department of MedicinalChemistry and Pharmacognosy(MCP) in the College of Pharmacy and University of science at Philadelphia, USA.

3. Intended learning outcomes (ILOs) of Natural Products Biotechnology:

Knowledge and Understanding	
a1	Recall the principles and core concepts of tissue culture , biocatalysis, and genetic engineering
a2	Define the technical terms used in advanced genetic engineering ,biocatalysis and tissue culture applications .
a3	Memorize the basic concepts in nucleic acids, genes and enzymes
a4	Recognize how to manage and exploit knowledge of DNA cloning, recombinant DNA, and related applications.
a5	Mention the mechanisms regulating of gene expression biotechnology and understanding the functions of specific gene products
Intellectual skills	

b1	Predict the mechanism of actions behind the biocatalysis of natural products.
b2	Create an appropriate procedures for isolation, purification of specified gene and plasmid..
b3	Interpret the molecule-DNA interaction and its application in modifying or production of novel active components.
b4	Analyze and interpret qualitative data in a suitable form
General and Transferable Skills	
d1	Work effectively as a member of a team.
d2	Develop internet communications skills.

4. Course Content of Natural Products Biotechnology:

Weeks	Lecture
1	General introduction to natural products biotechnology
2	Recent advances in tissue cultures
3	Selected types of enzymatic bioconversions of pharmaceutically important natural products.
4	Methods of biocatalyst immobilization.
5	Bioreactors.
6	Applications of bioconversions in the field of nat. prod.

	Activity
7	Applications of bioconversions in the field of nat. prod. *(cont.)*
8	Concept maps of genetic engineering
9	Plant breeding versus genetically modified ones Horizontal and vertical gene transfer. Activity
10	Insertion of gene into medicinal (recipient organism) plant
11	Synthetic seeds
12	Molecular markers and their impact on medicinal- plants bioactive products.
13	Application of genetic engineering in the field of natural products.
14	Application of genetic engineering in the field of natural products (*cont*.)
15	Final written exam

5- Teaching and Learning Methods:

- Lectures
- Self learning
- Open discussion

6- Student Assessment methods:

Written exams to assess: a1, a2, a3, a4, a5, b1to b4

Oral exam assess:a1, a2, a3, a4, a5, b1to b4

Activity assess: d1, d2

Assessment schedule:

Assessment (1): Activity	Week 5-11
Assessment (2): Written exam	Week 15
Assessment (3): oral exam	Week 15

Weighting of Assessment:

Assessment method	Marks	Percentage
• Activity	10	10 %
• Written exam	75	75 %
• Oral exam	15	15 %
TOTAL	**100**	**100%**

7- References and books:

A-Scientific papers

B- Essential books:

- Plant Biotechnology; P. Fasella and A. HussainScientifgic International PVT .LTD 1St Ed (2014).

- Molecular Biology; Robert F. Weaver; McGraw-Hill; Fifth Ed. (2012).
- Textbook of Industrial Pharmacognosy; A.N.Kalia;CBS(2009).
- Pharmaceutical Biotechnology; S.S.Purohit,H.N.Kakrani and A.K.Saluja; Agrobios (2006)
- Pharmaceutical Biotechnology. Crommelin, D.A.; and Sindeler, R.D. Hartwood Academic Publishers. The Netherlands. (1997)
- Pharmacognosy and Pharmacobiotechnology. J.E. Robbers, Marilyn K.Speeddi and VarrE.Taylor;William&Wilkins(1996)
- Plant Gene Isolation; principles and practice; Gary D. Foster and David Twell; John Wiley & Sons Ltd. (1996).

C- Suggested books:

- Pharmacognosy and Pharmacobiotechnology. J.E.Robbers,Marilyn K.Speeddi and Varr. E.Taylor;William &Wilkins(1996).
- Plant gene isolation; principles and practice; Gary. D.Foster and David Twell; John Wilew& Sons Ltd. (1996).

D- Websites:

Facilities required for teaching and learning:

For lectures: Computerand data show with internet connection white boards.

Course Coordinators: Asst. Prof . Maged M.M. Abou-Hashem

Head of Department : Prof. Dr. : Amal Al-Gendy

Date:

Matrix I of Natural Product Biotechnology												
Course Contents		**ILOs of Natural Product Biotechnology**										
		Knowledge and understanding					Intellectual skills				General and Transferable Skills	
		a1	**a2**	**a3**	**a4**	**a5**	**b1**	**b2**	**b3**	**b4**	**d1**	**d2**
1	General introduction to natural products biotechnology	X										
2	Recent advances in tissue cultures	X										
3	Selected types of enzymatic bioconversions of pharmaceutically important natural products.	X					X					
4	Methods of biocatalyst immobilization.		X									
5	Bioreactors.		X								X	X
6	Applications of bioconversions in the field of nat. prod. Activity.		X									
7	Applications of bioconversions in the field of nat. prod.(cont)	X							X			
8	Concept maps of genetic engineering	X										
9	Plant breeding versus genetically modified ones Horizontal and vertical gene transfer. Activity.	X	X					X	X			
10	Insertion of gene into medicinal (recipient organism) plant		X									

11	Synthetic seeds			X	X						X	X
12	Molecular markers and their impact on medicinal- plants bioactive products.				X	X		X	X			
13	Application of genetic engineering in the field of natural products.					X		X		X		
14	Application of genetic engineering in the field of natural products (cont.)					X		X		X		
15	Final exam	X	X	X	X	X	X	X	X	X	X	X

Matrix II of Natural Product Biotechnology

ARS		Program ILOs	Course ILOs	Course content	Source	Teaching and learning methods		Method of Assessment		
						Lectures	Self learning	Written exam	Oral exam	Activity
Knowledge and Understanding	2.1.2- Mutual influence between professional practice and its impact on the environment.	A.5-Outline principle information on biotechnology, tissue culture and recent natural products biotechnology applications.	a1	General introduction to NB Biotechnology	Scientific papers, text book and Internet	x	x	x	x	
				Fundamentals of NB biotransformations and green biocatalysis Introduction to enzymes selectivity	Scientific papers, text book and Internet	x	x	x	x	
				Enzymes selectivity Pathways and non-specific conversions Selected types of enzymatic	Scientific papers, text book and Internet	x	x	x	x	

				bioconversions involving natural products						
				Applications of bioconversions in the field of nat. prod.	Scientific papers, text book and Internet	x	x	x	x	
				General introduction to genetic engineering (concept maps)	Scientific papers, text book and Internet	x	x	x	x	
				Plant genetic engineering, basic concepts Plant breeding versus genetically modified ones.	Scientific papers, text book and Internet	x	x	x	x	
			a2	Enzyme immobilization	Scientific papers, text book	x	x	x	x	

					and Internet					
				Cell permealization and viability Bioreactors.	Scientific papers, text book and Internet	x	x	x	x	
				Phytoremediation and enzyme debittering	Scientific papers, text book and Internet	x	x	x	x	
				Plant genetic engineering ,basic concepts Plant breeding versus genetically modified ones.	Scientific papers, text book and Internet	x	x	x	x	
				Horizontal and vertical gene transfer	Scientific papers, text book	x	x	x	x	

					and Internet					
			a3	introduction of gene into medicinal (recipient organism) plant	Scientific papers, text book and Internet	x	x	x	x	
			a4	introduction of gene into medicinal (recipient organism) plant	Scientific papers, text book and Internet	x	x	x	x	
				Components and procedures of a typical cloning experiment. Markers in molecular biology and impact on medicinal plants bioactive products.	Scientific papers, text book and Internet	x	x	x	x	

			a5	Components and procedures of a typical cloning experiment. Markers in molecular biology and impact on medicinal plants bioactive products.	Scientific papers, text book and Internet	x	x	x	x	
				Application of genetic engineering in the field of natural products	Scientific papers, text book and Internet	x	x	x	x	
Intellectual Skills	2.2.1- Analyze and evaluate information in the field of specialization and analogies to solve problems	B.1- Appraise critically the quality of data and information obtained from different sources in	b1	Enzymes selectivity Pathways and non-specific conversions Selected types of enzymatic bioconversions	Scientific papers, text book and Internet	x	x	x	x	

		different forms.		involving natural products						
	2.2.3-Correlate and integrate different pharmaceutical knowledge to solve professional problems.	. B.3- Specify the knowledge of different phytochemical aspects to solve research problems	b3	Plant genetic engineering, basic concepts Plant breeding versus genetically modified ones.	Scientific papers, text book and Internet	x	x	x	x	
				Components and procedures of a typical cloning experiment. Markers in molecular biology and impact on medicinal plants bioactive products. Applications of bioconversions in	Scientific papers, text book and Internet	x	x	x	x	

				the field of nat. prod.						
	2.2.6- Plan to improve performance in the field of specialization.	B.6- Design all suitable laboratory protocols for a requested phytochemical issues	b2	Plant genetic engineering, basic concepts Plant breeding versus genetically modified ones.	Scientific papers, text book and Internet	x	x	x	x	
				Components and procedures of a typical cloning experiment. Markers in molecular biology and impact on medicinal plants bioactive products.	Scientific papers, text book and Internet	x	x	x	x	

				Application of genetic engineering in the field of natural products	Scientific papers, text book and Internet	x	x	x	x	
	2.2.7- Professional decision-making in the contexts of diverse disciplines.	B.7- Take professional decisions and respond to experience and circumstances.	b4	Application of genetic engineering in the field of natural products	Scientific papers, text book and Internet	x	x	x	x	
General and Transferable Skills	2.4.1- Communicate effectively.	D.1- Apply effective communication skills recognizing the need for a variety of approaches.	d1	Activities	Scientific papers, text book and Internet		x			x

	2.4.6- Work in a team and lead teams carrying out various professional tasks.	D.6- Work with and motivate others.	d2	Activities	Scientific papers, text book and Internet		x			x

Advanced Instrumental Analysis & chromatography I

Course specification of Advanced Instrumental Analysis & chromatography I

Course specifications:

- Program on which the course is given: Master of Pharmaceutical Sciences (Pharmacognosy)
- Major or Minor element of program: Major
- Department offering the program: pharmacognosy Dept.
- Department offering the course: Medicinal chemistry Dept.
- Date of specification approval: 2019

1- Basic information:

Title: **Advanced Instrumental Analysis & chromatography I**

Code: M101

Lectures: 4 hrs/week Credit hours: 4 hrs/week

Total: 4 hrs/week

2- Overall aim of the course:

On completion of the course, the students will be able to demonstrate fundamental knowledge and basic theories in instrumental analysis, the concepts of diagnosing cardiac diseases, G.I.T diseases and infections through IR, HNMR and UV spectrophotometry **as well as** new aspects of (HPLC), HPLC/Mass, Gas Chromatography (GC) and GC/Mass and their medicinal applications.

3. Intended learning outcomes (ILOs) of Advanced Instrumental Analysis & chromatography I

Knowledge and Understanding	
a1	Illustrate theories for separation of different components in combined therapy and their determination quantitatively using different instrumental techniques.
a2	State medicinal and pharmaceutical applications of spectroscopy , HPLC and GC
Intellectual skills	
b1	Analyze & interpret qualitative & quantitative data obtained from instrumental analysis
General and Transferable skills	
d1	Write reports and present it.

4. Course Content of Advanced Instrumental Analysis & chromatography I:

Week number	Lecture contents (4hrs/week)
1	Advanced Ultra-violet spectroscopy
2	New aspects in vibrational spectroscopy (IR spectroscopy)

3	Application of Nuclear magnetic resonance (NMR)
4	Application of Mass spectrometry(MS)
5	Medicinal application of spectroscopy in diagnosis of diseases
6	Raman spectroscopy.
7	Advanced HPLC. **Activity (Reports)**
8	HPLC & its medicinal and pharmaceutical application
9	High performance thin layer chromatography (HPTLC).
10	Advanced Gas chromatography.
11	GC & its medicinal and pharmaceutical application
12	New aspects of Supercritical fluid chromatography (SFC) and ion exchange chromatography (IEC).
13	Capillary electrophoresis(CE)
14	Analytical application of dimeric and polymeric molecules.

	Activity (Reports)
15	Written exam

5- Teaching and Learning Methods:

- Lectures
- Self learning
- Open discussion

6- Student Assessment methods:

Written exams to assess: a1,a2&b1

Oral exams to assess: a1,a2&b1

Activities to asses: b1&d1

Assessment schedule:

Assessment (1): Activity	Week 7-14
Assessment (2): Written exam	Week 15
Assessment (3): oral exam	Week 15

Weighting of Assessment:

Assessment method	**Marks**	**Percentage**

• Activity	10	10 %
• Written exam	75	75 %
• Oral exam	15	15 %
TOTAL	**100**	**100%**

7- References and books:

A-Scientific papers

B- Essential books:

-Chemical stability of pharmaceuticals, Kenneth A. Connors, Kenneth Antonio Connors, Gordon L. Amidon, Valentino J. Stella

-Pharmaceutical process validation Robert A. Nash, Alfred H. Wachter (2006)

C- Suggested books:

-Photostability of drugs and drug formulations, Hanne Hjorth Tønnesen (2004)

-U.S.P. & B.P (2010)

D- Websites:

http://www.ncbi.nlm.nih.gov/sites/entrez

http://journals.tubitak.gov.tr/chem/index.php

http://www.pharmacopoeia.co.uk/

www.Pubmed.Com

www.sciencedirect.com

Facilities required for teaching and learning:

1. **For lectures:** Black (white) boards, computer and data show.

- **Head of Department:**
- **Date:** تم اعتماد التوصيف بمجلس القسم بتاريخ

Matrix I of Advanced Instrumental Analysis & chromatography I

Course Contents		ILOs of Advanced Instrumental Analysis & chromatography I course			
		Knowledge and understanding		Intellectual skills	General and Transferable skills
		a1	**a2**	**b1**	**d1**
1	Advanced Ultra-violet spectroscopy	x	x	X	
2	New aspects of Vibrational spectroscopy (IR spectroscopy)	x	x	X	
3	Application of Nuclear magnetic resonance (NMR)	x	x	X	
4	Application of Mass spectrometry(MS)	x	x	X	
5	Medicinal application of spectroscopy in diagnosis of diseases		x	X	
6	Raman spectroscopy.	x			
7	Advanced HPLC. **Activity (Reports)**	x		X	X
8	HPLC & its medicinal and pharmaceutical application		x		
9	High performance thin layer chromatography (HPTLC)	x		X	
10	Advanced Gas chromatography	x			
11	GC & its medicinal and pharmaceutical application		x	X	
12	New aspects of Supercritical fluid chromatography (SFC) and ion exchange chromatography (IEC)	x	x		
13	Capillary electrophoresis(CE)	x	x		

14	Analytical application of dimeric and polymeric molecules. **Activity (Reports)**		x	X	x
15	Revision and open discussion	x	x	X	

Matrix II of Advanced Instrumental Analysis & chromatography I

NARS		Program ILOs	Course ILOs	Course contents	Sources	Teaching and learning methods		Method of assessment		
						Lecture	Self learning	Written exam	Oral exam	Activities
2.1	2.1.1- Theories and fundamentals related to the field of learning as well as in related areas.	. A.1- Outline fundamental knowledge and basic principles of different spectroscopic techniques and their applications	a1 a2	Advanced Ultra-violet spectroscopy New aspects of Vibrational spectroscopy (IR spectroscopy) Application of Nuclear magnetic resonance (NMR) Application of Mass spectrometry(MS) Raman spectroscopy Advanced HPLC High performance liguid chromatography HPTLC	Textbooks, Scientific papers and self learning	X	x	X	X	

				Advanced Gas chromatography New aspects of Supercritical fluid chromatography (SFC) Capillary electrophoresis(CE)						
2.2	2.2.1- Analyze and evaluate information in the field of specialization and analogies to solve problems	B.1- Appraise critically the quality of data and information obtained from different sources in different forms.	b1	Advanced Ultra-violet spectroscopy New aspects of Vibrational spectroscopy (IR spectroscopy) Application of Nuclear magnetic resonance (NMR) Application of Mass spectrometry(MS) Medicinal application of spectroscopy in diagnosis of diseases Advanced HPLC & its medicinal and pharmaceutical application Advanced GC & its medicinal and pharmaceutical application	Textbooks, Scientific papers and self learning	X	x	X	X	

2.4	2.4.2- Effectively use information technology in professional learning needs	D.2- Make effective use of information technology e.g. word processing, spread sheets, presentation soft ware, internet,….etc	d1	Activity (Reports)	Internet Textbooks		x			x

Good practice for analysis of drugs and quality control

Course specification of Good practice for analysis of drugs and quality control

Course specifications:

- Program on which the course is given: Master of Pharmaceutical Sciences (pharmacognosy)
- Major or Minor element of program: Major
- Department offering the program: pharmacognosy Dept.
- Department offering the course: Medicinal chemistry Dept.
- Date of specification approval: 2019

1- Basic information:

Title: **Quality in Instrumental Analysis and Quality Control**

Code: ME3

Lectures: 4 hrs/week Credit hours: 4 hrs/week

Total: 4 hrs/week

2- Overall aim of the course:

On completion of the course, the students will be able to: choose & develop suitable analytical methodology and find an effective solution for a given complex problem.

3. Intended learning outcome s (ILOs) of Good practice for analysis of drugs and quality control

Knowledge and Understanding	
a1	Outline the new aspects in drug analysis & quality control
a2	Express up-to-date information in the field of drug analysis
a3	Illustrate the applications of quality control & quality assurance
Intellectual skills	
b1	Analyze & evaluate obtained results qualitatively & quantitatively
b2	Evaluate GMP to avoid any hazards
General and Transferable Skills	
d1	Improve professional abilities by evaluation of information from different sources.
d2	Write reports and present it.

4. Course Content :

Week number	**Lecture contents (4hrs/week)**
1	Validation parameters in analysis
2	Application of quantitative analysis for different drugs.

3	Quality control and how to minimize the synthesis errors.
4	Quality assurance and basic requirement.
5	Applications of Spectrophotometric analysis for dosage forms **Activity**
6	H^{1},C^{13},N^{15},F^{19}- NMR
7	Advanced techniques in mass spectroscopy
8	Atomic absorption
9	Fluorimetric analysis
10	Radioimmune Assay
11	Electrophoresis
12	Advanced GC-MS chemistry **Activity**
13	Spectrodenistometric (TLC scanner)
14	Forensic chemistry
15	Written exam

5- Teaching and Learning Methods:

- Lectures
- Self learning
- Open discussion

6- Student Assessment methods:

Written exams to assess: a1, a2, a3,b1,b2,d1&d2

Oral exams to assess: a1, a2, a3,b1,b2,d1&d2

Activities to assess: d1&d2

Assessment schedule:

Assessment (1): Activity	Week 5-12
Assessment (2): Written exam	Week 15
Assessment (3): oral exam	Week 15

Weighting of Assessment:

Assessment method	Marks	Percentage
• Activity	10	10 %
• Written exam	75	75 %
• oral exam	15	15 %
TOTAL	**100**	**100%**

7- References and books:

A-Scientific papers

B- Essential books:

Halpern,A in "Experimental physical chemistry"(2007)

Oxtoby,D and Nachtrieb, N in "Principles of Modern chemistry"(2009)

C- Suggested books:

Garfied, F .M., Klesta ,E and Hirsch, J in" Quality Assurance Principles for Analytical Laboratories"(2011)

D- Websites:

http://www.ncbi.nlm.nih.gov/sites/entrez

http://journals.tubitak.gov.tr/chem/index.php

http://www.pharmacopoeia.co.uk/

www.Pubmed.Com

www.sciencedirect.com

Facilities required for teaching and learning:

For lectures: Black (white) boards, data show.

- **Course Coordinators:**
- **Head of Department**
- **Date** تم اعتماد توصيف المقرر بمجلس القسم بتاريخ

Matrix I of Good practice for analysis of drugs and quality control

Course Contents		ILOs of Quality in Instrumental Analysis and Quality Control course						
		Knowledge and understanding			Intellectual skills		General and Transferable skills	
		a1	**a2**	**a 3**	**b1**	**b 2**	**d1**	**d 2**
1	Validation parameters in analysis	x		x				
2	Application of quantitative analysis for different drugs.	x	x	x				
3	Quality control and how to minimize the systemic errors.	x		x	X			
4	Quality assurance and basic requirements of GMP	x		x				
5	Application of Spectrophotometric analysis(UV-VIS-IR) **Activity**		x		X	x	x	X
6	H^{1},C^{13},N^{15},F^{19}- NMR	x	x			x		
7	Advanced techniques in mass spectroscopy		x			x		
8	Atomic absorption			x		x		
9	Fluorimetric analysis		x			x		

10	Radioimmune Assay		x					
11	Electrophoresis		x					
12	Advanced GS-MS chemistry. **Activity**	x		x			x	X
13	Spectrodenistometric (TLC scanner)	x		x	X			
14	Forensic chemistry.	x	x					

Matrix II of Good practice for analysis of drugs and quality control

NARS		Program ILOs	Course ILOs	Course contents	Sources	Teaching and learning methods		Method of assessment		
						Lecture	Self learning	Written exam	Oral exam	Activities
2.1	2.1.1- Theories and fundamentals related to the field of learning as well as in related areas.	A.3- Describe qualitative and quantitative analytical methods.	a1,a2	Validation parameters in analysis Application of quantitative analysis for different drugs H^{1},C^{13},N^{15},F^{19}- NMR Forensic chemistry Spectrodenistometric (TLC scanner)	Textbooks, Scientific papers and self learning	X	x	X	X	

				Advanced GC-MS Techniques Application of quantitative analysis for different drugs Applications of Spectrophotometric analysis for dosage forms H1,C13,N15,F19 NMR Advanced techniques in mass spectroscopy Fluorimetric analysis Radioimmune Assay Electrophoresis Forensic chemistry						

	2.1.5- Principles and the basics of quality in professional practice in the area of specialization.	A.10- Illustrate principles and fundamentals of professional practice in pharmacognosy, tissue culture and biotechnology	a3	Spectrodenistometric (TLC scanner) Atomic absorption GC-MS Techniques Validation parameters in analysis Application of quantitative analysis Quality control and how to minimize systemic erros. Quality assurance and basic requirements of GMP	Textbooks, Scientific papers and self learning	X	x	X	X	

	2.2.1- Analyze and evaluate information in the field of specialization and analogies to solve problems	B.1- Appraise critically the quality of data and information obtained from different sources in different forms	b1	Application of quantitative analysis for different drugs H^{1},C^{13},N^{15},F^{19}- NMR	Textbooks, Scientific papers and self learning	x	x	x	x	

	2.2.3- Evaluate and manage risks and potential hazards in professional practices in the area of specialization	B.3- Identify risks during professional practice and suggest management strategy	b2	Quality control and how to minimize systemic erros. Quality assurance and basic requirements of GMP	Textbooks, Scientific papers and self learning	x	x	x	x	

	2.4.4- Use variable sources to get information and knowledge.	D.4- Make effective use of library and other sources of information.	d1	Activity (Reports)	Internet Textbooks		x			X
	2.4.2- Effectively use information technology in professional practices	D.2- Make effective use of information technology e.g. word processing, spread sheets, presentation soft ware, internet,….etc.	d2	Activity (Reports)	Internet Textbooks		x			

										x

Drug Stability

Course specification of Drug stability

Course specifications:

- **Program on which the course is given:** Master of Pharmaceutical Sciences (pharmacognosy)
- **Major or Minor element of program:** Major
- **Department offering the program:** pharmacognosy Dept.
- **Department offering the course:** Pharmaceutics Dept.
- **Date of specification approval:**

1- Basic information:

Title: **Drug stability** Code: ME2

Lectures: 4 hrs/week Credit hours: 4 hrs/week

Total: 4 hrs/week

2- Overall aim of the course:

On completion of the course, the students will be able to describe the degradation of drugs and the methods to determine the order of reaction, illustrate the stability programs for pharmaceutical products and the latest regulations for stability testing and ability to predict the degradation pathways of a drug design a stabilization protocol and predict a product shelf-life and discuss regulations and methodologies for drug stability program.

3- Intended learning outcome s (ILOs) of Drug stability:

Knowledge and Understanding	
a1	Illustrate the principles drug stability
a2	Describe the regulations for drug stability program
a3	Describe the methodologies for drug stability program
Intellectual skills	
b1	Suggest suitable stability methods for drugs in the various dosage forms.
b2	Design in a self-directed and original research investigations on drug stability in dosage forms from degradation pathways
General and Transferable skills	
d1	Use computer skills to present information
d2	Collect information from a variety of sources

4. Course Content of Drug stability:

Week number	Lecture content (4 hr/w)
1	• Drug stability (Overview – importance)
2	• Stability regulations (overview)
3	• Critical regulatory requirements for a stability program
4	• Global stability practices
5	• Understanding and predicting pharmaceutical product shelf life
6	• Stability methodologies (overview)

7	• Development of stability indicating methods • **(Presentation)**
8	• Overview of USP-NF requirements for stability
9	• Non chromatographic methods for stability program
10	• Vibrational spectroscopic methods for quantitative analysis
11	• Evaluation of stability data
12	• Qualification, calibration and maintenance of stability chambers
13	• **Stability operation practices**
14	• Stability studies in biologics • **(Final Presentation)**
15	• Written exam

5- Teaching and Learning Methods:

- Lectures
- Self learning
- Open discussion
- Problem solving

6- Student Assessment methods:

Written exams to assess: a1, a2, a3, b1, b2

Oral exam to assess: a1, a2, a3, b1, b2

Activities to assess: d1, d2

Assessment schedule:

Assessment (1): Activity	Week 7-15

Assessment (2): Written exam	Week 15
Assessment (3): oral exam	Week 15

Weighting of Assessment:

Assessment method	Marks	Percentage
• Activity	10	10 %
• Written exam	75	75 %
• Oral exam	15	15 %
TOTAL	**100**	**100%**

7- References and books:

A- Essential books: Drug Stability: Principles and Practices (Drugs and the Pharmaceutical Sciences) by Jens T. Carstensen and Christopher Rhodes (2000).

B- Suggested books:

1- Handbook of Stability Testing in Pharmaceutical Development: Regulations, Methodologies, and Best Practices, Kim Huynh-Ba, 389 (2008).
2- Extended Stability for Parenteral Drugs, 5th Edition (Extended Stability of Parenteral Drugs), Fifth Edition, Caryn Dellamorte Bing R.PH. M.S. FASHP and Anna Nowobilski-Vasilios , American Society of Health-System Pharmacists; (2013)

C- Websites: Pubmed, Sciencedirect, Weilyinterscience

Facilities required for teaching and learning:

1. **For lectures:** Black (white) boards, data show.

- **Course Coordinators:**
- **Head of Department:**
- **Date:** تم اعتماد التوصيف بمجلس القسم

Matrix I of Drug Stability								
Course Contents		**ILOs of drug stability course**						
		Knowledge and understanding			Intellectual skills		Transferable and general skills	
		a1	a2	a3	b1	b2	d1	d2
1	Drug stability (Overview – importance)	X						
2	Stability regulations (overview)		x					
3	Critical regulatory requirements for a stability program		x					
4	Global stability practices		x					
5	Understanding and predicting pharmaceutical product shelf life		x			x		
6	Stability methodologies (overview)			x				
7	Development of stability indicating methods **(Presentation)**			x			x	x
8	Overview of USP-NF requirements for stability			x				
9	Non chromatographic methods for stability program			x	x			
10	Vibrational spectroscopic methods for quantitative analysis			x	x			
11	Evaluation of stability data			x	x			
12	Qualification, calibration and maintenance of stability chambers			x				
13	Stability operation practices			x				

14	Stability studies in biologics			x				
15	Open discussion **(Final Presentation)**	x	x	x	x	x	X	x

Matrix II of Drug stability

NARS		Program ILOs	Course ILOs	Course contents	Sources	Teaching and learning methods		Method of assessment		
						Lecture	Self learning	Written exam	Oral Exam	Activity
2.1	2.1.1- Theories and fundamentals related to the field of learning as well as in related areas	A.2- Outline the stability of secondary metabolites isolated from natural products.	a1	Drug stability (Overview – importance)	Textbooks, Scientific papers and self learning	x	xx	x	x	
			a2	Stability regulations (overview) Critical regulatory requirements for a stability program Global stability practices Understanding and predicting pharmaceutical product shelf life	Textbooks, Scientific papers and self learning	x	x	X	x	

			a3	Stability methodologies (overview) Development of stability indicating methods Overview of USP-NF requirements for stability Non chromatographic methods for stability program Vibrational spectroscopic methods for quantitative analysis Evaluation of stability data Qualification, calibration and maintenance of stability chambers Qualification, calibration and maintenance of stability chambers Stability operation practices Stability studies in biologics	Textbooks, Scientific papers and self learning	x	X	X	x	

	2.2.6- Plan to improve performance in the field of specialization.	B.7- Design a laboratory protocol for a requested analytical issue.	b1	Understanding and predicting pharmaceutical product shelf life	Textbooks, Scientific papers and self learning	x	x	x	x	
2.2	2.2.2- Solve specified problems in the lack or missing of some information	B.2- Suggest a significant solution for phytochemical problems based on a wide academic background.	b2	Non chromatographic methods for stability program Vibrational spectroscopic methods for quantitative analysis Evaluation of stability data	Textbooks, Scientific papers and self learning	x	x	x	x	
2.4	2.4.2- Effectively use information technology in professional practices	D.2- Make effective use of information technology e.g. word processing, spread sheets, presentation soft ware, internet,….etc	d1	Activity	Textbooks, Scientific		x			**X**

					papers and self learning					
	2.4.4- Use variable sources to get information and knowledge.	D.4- Make effective use of library and other sources of information.	d2	Activity	Textbooks, Scientific papers and self learning		x			**x**

Master courses

Advanced Chemistry of natural products

Course specification of Advanced Chemistry of natural products

Course specifications:

- Program on which the course is given: Master of Pharmaceutical Sciences
- Major or Minor element of program: Major
- Department offering the program: Pharmacognosy Dept.
- Department offering the course: Pharmacognosy Dept.
- Date of specification approval: **2019**

1- Basic information:

Title: Biosynthesis and Advanced Chemistry of natural products

Code: GSP1

Lectures: 4 hrs/week **Credit hours:** 4 hrs

Total: 4hrs/week

2- Overall aim of the course:

By the end of course, the student will:

- Acquire the knowledge and understanding of different chemical classes of naturally occurring secondary metabolites e.g.: basic nitrogenous compounds, terpene compounds, phenylpropanonids, nutraceuticals,.....etc.
- Describe chemical conversions on the natural product metabolites and their biological activates.

3. Intended learning outcomes (ILOs) Biosynthesis and Advanced Chemistry of natural products

A- Knowledge and Understanding	
a1	Describe the general physical and chemical characters of different natural products.
a2	Mention different classes of natural products, their chemical conversions and biological activities.
B- Intellectual skills	
b1	Comprehend and apply GLP,GPMP, GSP and GCP guidelines in pharmacy practice concerning with natural product research.
b2	Select the appropriate methods of isolation, purification, identification and standardization of active substances from different origins.
D- General and Transferable skills	
d1	Apply effective communication skills recognizing the need for a variety of approaches.
d2	Work with and motivate others.

4. Course Content of Biosynthesis and Advanced Chemistry of natural products:

Week number	Lecture contents (4hrs/week)
1	The origin and the nature of natural products

2	Plant-derived natural products as a source of drug discovery and development
3	Chemistry of natural narcotics
4	Bioactive marine metabolite from red sea water
5	Toxins of marine invertebrates and microorganisms
6	Activities
7	Chemistry of irregular monoterpenes
8	Chemistry of diterpenes
9	Activities
10	Natural products for pest management
11	Recent advances in the chemistry of insectpheromones and their applications.
12	Natural sweeting agents
13	Plant endophytes& exophytes: Interactions, metabolites and biological activities
14	Phytochemicals as nutraceuticals
15	Final exam

Then replace these contents in matrix

5- Teaching and Learning Methods:

- Lectures
- Self learning

- Open discussion

6- Student Assessment methods:

Written exams to assess: a1, a2, b1and b2

Oral exam assess: a1, a2, b1 and b2

Activity assess: d1, d2

Assessment schedule:

Assessment (1): Activity	Week 6-9
Assessment (2): Written exam	Week 15
Assessment (3): oral exam	Week 15

Weighting of Assessment:

Assessment method	Marks	Percentage
• Activity	10	10 %
• Written exam	75	75 %
• Oral exam	15	15 %
TOTAL	**100**	**100%**

7- References and books:

A-Scientific papers

B- Essential books:

- Studies in Natural product chemistry ,UtaElrahman , Elsevier press,

(2012)

- Introduction To Natural product Chemistry,R.Xu Yang Ye,W. Zhao., CRC. Press,(2011)
- Selected Topics in the Chemistry of Natural products,P.Ikan,World Scientific Press. (2008)
- Comprehensive Natural Products Chemistry; Barton, D and Nakanishi, K, El sevier Science Ltd. (1999).
- Natural Products Chemistry; Torssel, K. B. G. :Apotekars.press (1997).
- Natural Products from Plants; Kaufmann, P. B et al; CRC Press (1999). iv-Pharmacognosy and Pharmacobiotechnology; Robbers, J. E., Speed ie, M. K. and Tyler. V.E.; Williams &Wilkins (1996).

C- Suggested books:

- The Hand Books of Natural Flavonoids; Harborne, J. B. and Baxter, H.; John Wiley &Sons Ltd. (1999).
- Natural Products Isolation; Canell,R.J. P ,Humana Press. (1998).
- Phytochemical Resourses for Medicine and Agriculture; Nigg, H. N. and Seigler, D.; Plenum Press (1992).
- Medicinal Natural Products; A Biosynthetic Approach. Dewick, P.M.; John Wiley & Sons.

D- Periodicals and Websites:

- Fitotherapia, Die Pharmazie, Journal of Natural Products, Phytochemistry, Plantamedica, Egyptian Knowledge Bank (EKB).

Facilities required for teaching and learning:

1. **For lectures:** white boards, computer and data show.

- **Course Coordinator: Prof. Dr. Mahmoud Abdel Aal**

Head of Department: Prof. Dr. Amal Al-Gendy

- **Date:**

Matrix I of Biosynthesis and Advanced Chemistry of natural products course							
Week number	Course Contents	Knowledge and understanding		Intellectual skills		General and Transferable Skills	
		a1	**a2**	**b1**	**b2**	**d1**	**d2**
1	The origin and the nature of natural products	x					
2	Plant-derived natural products as a source of drug discovery and development		x	x	x		
3	Natural narcotics (chemistry & biosynthesis)	x	x	x	x		
4	Bioactive marine metabolite from red sea water	x	x	x	x		
5	Toxins of marine invertebrates and microorganisms	x					
6	Activities					x	x
7	Chemistry of irregular monoterpenes		x	x	x		
8	Chemistry of diterpenes	x					
9	Activities					x	x
10	Natural products for pest management	x	x	x	x		
11	Recent advances in the chemistry of	x	x	x	x		

	insectpheromones and their applications.						
12	Natural sweeting agents		x	x	x		
13	Plant endophytes& exophytes: Interactions, metabolites and biological activities		x	x	x		
14	Phytochemicals as nutraceuticals		x	x	x		
15	Final exam						

Matrix II of Biosynthesis and Advanced Chemistry of natural products course										
ARS		Program ILOs	Course ILOs	Course content	Source	Teaching and learning methods		Method of Assessment		
						Lectures	Self learning	Written exam	Oral exam	Activity
Knowledge and Understanding	2.1.1- Theories and fundamentals related to the field of learning as well as in related areas.	A.1- Demonstrate fundamental knowledge and basic principles of different spectroscopic techniques and their applications.	a1	• The origin and the nature of natural products • Plant-derived natural products as a source of drug discovery and development • Natural narcotics (chemistry & biosynthesis) • Chemistry & biosynthesis of the irregular monoterpenes • Chemistry & biosynthesis of diterpenes	Scientific papers, text books and Internet	x	x	x	x	

				• Natural products for pest management & their biosynthetic pathways • Recent advances in the chemistry of insect pheromones and their applications. • Natural sweeting agents • Plant endophytes&exophytes: Interactions, metabolites and biological activities • Phytochemicals as nutraceuticals						
	2.1.3-Scientific developments in the area of	A.6-Mention different classes of	a6	• Biosynthesis (introduction) • Biosynthetic pathways	Scientific papers, textboo	x	x	x		

	speciali zation.	natural product s, their chemic al convers ions and biologi cal activiti es.		of natural products • The origin and the nature of natural products • Plant-derived natural products as a source of drug discovery and developmen t • Natural narcotics (chemistry & biosynthesis) • Chemistry & biosynthesis of the irregular monoterpen es • Chemistry & biosynthesis of diterpenes • Natural products for pest managemen t & their biosynthetic pathways • Recent advance s in the chemistr y of	ks and Inter net				x	

				insect pheromones and their applications. • Natural sweeting agents • Plant endophytes&exophytes: Interactions, metabolites and biological activities • Phytochemicals as nutraceuticals					
Intellectual Skills	2.2.3-Correlate and integrate different pharmaceutical knowledge to solve professional problems.	B.3-Synthesise information from disparate sources and use to inform complex problem solving.	b1	• Biosynthesis (introduction) • Biosynthetic pathways of natural products • The origin and the nature of natural products • Plant-derived natural products as a source of drug discovery and	Scientific papers, text books and Internet	x	x	x	x	

				development • Natural narcotics (chemistry & biosynthesis) • Chemistry & biosynthesis of the irregular monoterpenes • Chemistry & biosynthesis of diterpenes • Natural products for pest management & their biosynthetic pathways • Recent advances in the chemistry of insect pheromones and their applications. • Natural sweeting agents • Plant endophyt						

				es&exophytes: Interactions, metabolites and biological activities • Phytochemicals as nutraceuticals						
			b2	• Biosynthesis (introduction) • Biosynthetic pathways of natural products • The origin and the nature of natural products • Plant-derived natural products as a source of drug discovery and development • Natural narcotics (chemistry & biosynthesis) • Chemistry & biosynthesis of the irregular monoterpenes	Scientific papers, text books and Internet	x	x	x	x	

				• Chemistry & biosynthesis of diterpenes • Natural products for pest management & their biosynthetic pathways • Recent advances in the chemistry of insect pheromones and their applications. • Natural sweeting agents • Plant endophytes&exophytes: Interactions, metabolites and biological activities • Phytochemicals as nutraceuticals						

General and Transferable Skills	2.4.1-Communicate effectively.	D.1-Apply effective communication skills recognizing the need for a variety of approaches.	d1	activity		X				x
	2.4.6-Work in a team and lead teams carrying out various professional tasks.	D.6-Work with and motivate others.	d6	activity		X				x

Methods in natural products research

Course specification of methods in natural products research

Course specifications:

- Program on which the course is given: Master of Pharmaceutical Sciences
- Major or Minor element of program: Major
- Department offering the program: Pharmacognosy Dept.
- Department offering the course: Pharmacognosy Dept.
- Date of specification approval: **2019**

1- Basic information:

Title: Methods in natural products research Code: GSP3

Lectures: 4 hrs/week Credit hours: 4 hrs

Total: 4hrs/week

2- Overall aim of the course:

On completion of the course, the students will:

- Acquire the proper knowledge and awareness of different searching sources of information, websites, different flora of medicinal plants and herbarium setting.
- Have a good background about extraction methods, chromatographic techniques and preparation of sample for analysis followed by interpretation the obtained data.

3. Intended learning outcomes (ILOs) of methods in natural products research

:

Knowledge and Understanding	
a1	Recognize the different types of information resources that have benefit in the natural products field
a2	Describe different plat herbarium and documentation
a3	Summarize different methods for extraction of plant materials
a4	classify different chromatographic techniques
Intellectual skills	
b1	Select the proper method for purification of natural products
b2	Apply the knowledge of different resources of natural products information in research
General and Transferable Skills	
d1	Develop communication skills
d2	Use the library and other sources of information

4. Course Content of methods in natural products research

:

Week number	Lecture contents (4hrs/week)

1	Information sources: Chemical abstract, text book
2	Information sources: internet resources
3	Information sources: flora books
4	Herbarium setting and structure
5	Authorization of identified plants: plant authors and binomial system
6	Activities
7	Preparation of a plant sample for herbarium
8	Extraction: methods and solvents
9	Activities
10	Isolation: blind phytochemical versus biological guiding, fractionation and purification Activity
11	Chromatography: classical methods
12	Chromatography: new techniques for analysis and isolation
13	Crystallization: methodology
14	Derivatization: reasons and different types, reactions , different mechanisms and case studies
15	Final exam

5- Teaching and Learning Methods:

- Lectures
- Self learning
- Open discussion

6- Student Assessment methods:

Written exams to assess: a1, a2, a3, a4, b1and b2

Oral exam assess: a1, a2, a3, a4, b1and b2

Activity assess: d1, d2

Assessment schedule:

Assessment (1): Activity	Week 6,9
Assessment (2): Written exam	Week 15
Assessment (3): oral exam	Week 15

Weighting of Assessment:

Assessment method	Marks	Percentage
• Activity	10	10 %
• Written exam	75	75 %
• Oral exam	15	15 %
TOTAL	**100**	**100%**

7- References and books:

A-Scientific papers

B- Essential books:

- Comprehensive Natural Products Chemistry; Barton, D and Nakanishi, K, El sevier Science Ltd. (1999)
- Natural Products Chemistry; Torssel, K. B. G.: Apotekars.press (1997).
- Natural Products from Plants; Kaufmann, P. B et al; CRC Press (1999).

C- Websites:

- Egyptian Knowledge Bank (EKB).

Facilities required for teaching and learning:

1. **For lectures:** Black (white) boards, computer, data show.

- **Course Coordinators: Prof Dr/ Afaf El-Sayed**
- **Head of Department: Prof. Dr./ Amal Al-Gendy**
- **Date:**

Matrix I of Methods in natural products research									
Week number	Course Contents	Knowledge and understanding				Intellectual skills		General and Transferable Skills	
		a1	**a2**	**a3**	**a4**	**b1**	**b2**	**d1**	**d2**
1	Information sources: Chemical abstract, text book	x				x			

2	Information sources: internet resources	x				x			
3	Information sources: flora books	x				x			
4	Herbarium setting and structure	x				x			
5	Authorization of identified plants: plant authors and binomial system		x			x		x	x
6	Activities							x	x
7	Preparation of a plant sample for herbarium		x			x			
8	Extraction: methods and solvents			x			x		
9	Activities							x	x
10	Isolation: blind phytochemical versus biological guiding, fractionation and purification Activity			x			x		
11	Chromatography: classical methods			x			x	x	x
12	Chromatography: new techniques for analysis and isolation				x		x		
13	Crystallization: methodology				x		x		
14	Derivatization: reasons and different types, reactions , different mechanisms and case studies			x			x		
15	Final exam								

Matrix II of Methods in natural products research										
ARS		Program ILOs	Course IL Os	Course content	Source	Teaching and learning methods		Method of Assessment		
						Lectures	Self learning	Written exam	Oral exam	Activity
Knowledge and Understanding	2.1.1-Theories and fundamentals related to the field of learning as well as in related areas.	A.4-Classify different medicinal plants families according to their taxonomical categories.	a1	Information sources: Chemical abstract, text book Information sources: internet resources Information sources: flora books Herbarium setting and structure	Scientific papers, text books and Internet	X	x	x	x	
	2.1.1-Theories and fundamentals related to the field of	A.4-Classify different medicinal plants families according to their	a2	Authorization of identified plants: plant authors and binomial system Activity	Scientific papers, text books and	X	x	x	x	

	learning as well as in related areas.	taxonomical categories. A.6- Mention different classes of natural products, their chemical conversions and biological activities. A.8- Acquire full awareness about different sources of information regarding medicinal plants including websites, flora, herbarium setting, extractio		Preparation of a plant sample for herbarium	Internet					
			a3	Extraction: methods and solvents Isolation: blind phytochemical versus biological guiding Isolation: fractionation and purification Activity	Scientific papers, text books and Internet	X	x	x	x	

		n methods, chromatography and spectroscopy.								
	2.1.3- Scientific developments in the area of specialization.	A.7- Illustrate different traditional and modern techniques to predict structures of naturally isolated secondary metabolites obtained from different classes.	a4	Chromatography: classical methods Chromatography: new techniques for analysis and isolation	Scientific papers, text books and Internet	x	x	x	x	
Intellectual Skills	2.2.1- Analyze and evaluate information in the field of specialization and analogies to solve	B.1- Appraise critically the quality of data and information obtained from different sources in	b1	Information sources: Chemical abstract, text book Information sources: internet resources Information	Scientific papers, text books and Internet	x	x	x	x	

	problems.	different forms.		sources: flora books Herbarium setting and structure Authorization of identified plants: plant authors and binomial system Activity Preparation of a plant sample for herbarium						
	2.2.3- Correlate and integrate different pharmaceutical knowledge to solve professional problems.	B.3- Specify the knowledge of different phytochemical aspects to solve research problems	b2	Extraction: methods and solvents Isolation: blind phytochemical versus biological guiding Isolation: fractionation and purification Activity Chromatography:	Scientific papers, text books and Internet	x	x	x	x	

				classical methods Chromatography: new techniques for analysis and isolation						
General and Transferable Skills	2.4.1- Communicate effectively.	D.1- Apply effective communication skills recognizing the need for a variety of approaches.	d1	Activity	Scientific papers, text books and Internet		x			x
	2.4.6- Work in a team and lead teams carrying out various professional tasks.	D.6- Work with and motivate others.	d2	Activity	Scientific papers, text books and Internet		x			x

Structure Determination of Natural Products

Course specification of Structure Determination of Natural Products

Course specifications:

- Program on which the course is given: Master of Pharmaceutical Sciences
- Major or Minor element of program: Major
- Department offering the program: Pharmacognosy Dept.
- Department offering the course: Pharmacognosy Dept.
- Date of specification approval: 2019

1- Basic information:

Title: **Structure Determination of Natural Products** Code: GSP2

Lectures: 4 hrs/week Credit hours: 4 hrs/week

Total: 4hrs/week

2- Overall aim of the course:

On completion of the course, the students will be able to:

- Acquire the knowledge of different traditional and modern technique of UV, IR, and MS, NMR, H1, C13, H-HCOSY, Hsquc, Hmpc, ATP, Dept. GC and GC-MS.

- Interpret the obtained data to get chemical structure of each secondary metabolites isolated from Natural products.

3. Intended learning outcome s (ILOs) of Structure Determination of Natural Products:

Knowledge and Understanding	
a1	Outline the basic theories of different spectroscopic techniques.
a2	Describe the applications of different spectroscopic techniques in the structure elucidation of natural products.
Intellectual skills	
b1	Judge the quality of the recorded spectra.
b2	Correlate different spectroscopic data for the purpose of structure elucidation of natural products.
General and Transferable Skills	
d1	Use the library and other sources of information

4. Course Content of Structure Determination of Natural Products:

Week number	Lecture contents (4hrs/week)
1	UV: theory, sample handling.
2	Characteristic absorption of chromophores
3	Application of UV on different Natural Products

4	Infrared : theory, sample handling
5	Characteristic group absorb. Applications on IR
6	Activities.
7	MS, GC and GC-MS: theory, sample handling, instrumentation. Parent ion characteristic
8	NMR: theory, sample handling, instrumentation. ^{1}HNMR and ^{13}CNMR and other types of NMR. Two dimensional NMR Application of some simple spectra.
9	Activities.
10	Structure elucidation of different natural product classes: Flavonoids.
11	Structure elucidation of different natural product classes: Alkaloids.
12	Structure elucidation of different natural product classes: Terpene.
13	Structure elucidation of different natural product classes: Coumarins.
14	Structure elucidation of different natural product classes: Sugar and glycosides.

15	Final exam

5- Teaching and Learning Methods:

- Lectures
- Self learning
- Open discussion

6- Student Assessment methods:

Written exams to assess: a1, a2, b1and b2

Oral exam assess: a1, a2, b1and b2

Activity assess: d1

Assessment schedule:

Assessment (1): Activity	Week 6-9
Assessment (2): Written exam	Week 15
Assessment (3): oral exam	Week 15

Weighting of Assessment:

Assessment method	Marks	Percentage
• Activity	10	10 %
• Written exam	75	75 %
• Oral exam	15	15 %

TOTAL	**100**	**100%**

7- References and books:

A-Scientific papers

B- Essential books:

- Comprehensive Natural Products Chemistry; Barton, D and Nakanishi, K, El sevier Science Ltd. (1999)
- Natural Products Chemistry; Torssel, K. B. G.: Apotekars.press (1997).
- Natural Products from Plants; Kaufmann, P. B et al; CRC Press (1999).

C- Websites:

- Egyptian Knowledge Bank (EKB).

Facilities required for teaching and learning:

1. **For lectures:** Black (white) boards, computer, data show.

- **Course Coordinators: Prof Dr/ Assem El-Shazly**
- **Head of Department: Prof. Dr./ Amal Al-Gendy**
- **Date of approval:**

Matrix I of Structure Determination of Natural Products course

Week number	Course Contents	Knowledge and understanding		Intellectual skills		General and Transferable Skills
		a1	**a2**	**b1**	**b2**	**d1**
1	UV: theory, sample handling.	x				
2	Characteristic absorption of chromophores	x				
3	Application of UV on different Natural Products		x	x		
4	Infrared : theory, sample handling	x				x
5	Characteristic group absorb. Applications on IR	x	x	x		
6	Activities.					x
7	MS: theory, sample handling, instrumentation. Parent ion characteristic	x				
8	NMR: theory, sample handling, instrumentation. ^{1}HNMR and ^{13}CNMR and other types of NMR. Two dimensional NMR Application of some simple spectra.					
9	Activities.					
10	Structure elucidation of different natural product classes: Flavonoids	x				
11	Structure elucidation of different natural product classes: Alkaloids	x	x	x		

12	Structure elucidation of different natural product classes: Terpenes Activity		x	x	x	
13	Structure elucidation of different natural product classes: Coumarins		x	x	x	
14	Structure elucidation of different natural product classes: Sugar and glycosides		x	x	x	x
15	Final exam					

Matrix II of Structure Determination of Natural Products										
ARS		Program ILOs	Course ILOs	Course content	Source	Teaching and learning methods		Method of Assessment		
						Lectures	Self learning	Written exam	Oral exam	Activity
Knowledge and Understanding	2.1.1- Theories and fundamentals related to the field of learning as well as in related areas.	A.1- Achieve advanced knowledge in pharmacognosy and a strong background in major academic areas of natural products chemistry and plant biotechnology.	a1	UV: theory, sample handling. Characteristic absorption of chromophores Infrared: theory, sample handling Characteristic group absorb. MS: theory, sample handling, instrumentation. Parention characteristic NMR: theory,	Scientific papers, text books and Internet	x	x	x	x	

				sample handling , instrumentation. 1HNMR and 13CNMR and other types of NMR. Two dimensional NMR						
	2.1.3- Scientific developments in the area of specialization.	A.7- Illustrate different traditional and modern techniques to predict structures of naturally isolated secondary metabolites obtained from different classes.	a2	Application of UV on different Natural Products Applications on IR Application of some simple spectra. Structure elucidation of different natural product classes using IR, UV, MS, HNMR, , C13, H-	Scientific papers, text books and Internet	x	x	x	x	

				HCOSY, Hsquc, Hmpc, ATP, Dept, GC and GC-MS,….. etc: Flavonoids Structure elucidation of different natural product classes: Alkaloids Structure elucidation of different natural product classes: Terpenes Structure elucidation of different natural product classes: Coumarins						

				Structure elucidation of different natural product classes: Sugar and glycosides						
Intellectual Skills	2.2.1- Analyze and evaluate information in the field of specialization and analogies to solve problems.	B.1- Appraise critically the quality of data and information obtained from different sources in different forms.	b1	Application of UV on different Natural Products Applications on IR Application of some simple spectra. Structure elucidation of different natural product classes: Flavonoids Structure elucidation of different natural product classes: Alkaloids	Scientific papers, text books and Internet	x	x	x	x	

				Structure elucidation of different natural product classes: Terpenes Structure elucidation of different natural product classes: Coumarins Structure elucidation of different natural product classes: Sugar and glycosides						
	2.2.3- Correlate and integrate different pharmaceutical knowledge to solve professional	B.3- Synthesize information from disparate sources and use to inform complex problem solving.	b2	Structure elucidation of different natural product classes: Flavonoids Structure elucidation of different natural product	Scientific papers, text books and Internet	x	x	x	x	

	problems.			classes: Alkaloids Structure elucidation of different natural product classes: Terpenes Structure elucidation of different natural product classes: Coumarins Structure elucidation of different natural product classes: Sugar and glycosides						

General and Transferable Skills	2.4.4- Use variable sources to get information and knowledge.	D.4- Make effective use of library and other sources of information in the field of pharmacognosy	d1	Activity	Scientific papers, text books and Internet		x			x

Thesis of Master Degree specifications

Thesis of Master Degree

A- Thesis specifications:

- **Program on which the course is given:** Master of Pharmaceutical sciences (Pharmacognosy)
- **Major or Minor element of program:** Major
- **Department offering the program:** Pharmacognosy
- **Department offering the thesis:** Pharmacognosy
- **Date of specification approval:** 2019

1- Basic information:

Title: Master Thesis in Pharmacognosy

Credit hours: 30 hrs

2- Overall aim of the thesis:

On completion of the thesis, the students will be able to:

- Design a robust study to answer the research question
- Identify and perform different techniques and methods used in the experimental work according to the designed protocol
- Collect all the data needed to answer the research question using the developed study design
- Analyze the results of the study in the light of prior knowledge
- Draw conclusions about the contribution to knowledge made by the study.

3- Intended learning outcomes (ILOs):

Knowledge and Understanding	
a1	Have a strong background to start work in the thesis.
a2	Select the point of the thesis according to the problems present in the community.
a3	Identify advanced techniques and developments that can be used during study.
a4	Abide to values, moral, legal and religious issues of professional practice and research.
a5	Demonstrate quality during practical work.
a6	Identify and apply scientific experimental ethics.
Intellectual skills	
b1	Analyze and interpret the experimental data in a suitable form to solve the suggested problem.
b2	Apply different techniques to solve problems.
b3	Integrate all required knowledge to solve problems that may rise during practical work.
b4	Conduct a research project and write scientific reports.
b5	Reduce and eliminate risks during professional practice.
b6	Plan to improve performance before and during practical work.

b7	Make decisions related to recent and future studies.
Professional and practical skills	
c1	Perform practical experiments related to the point understudy.
c2	Review and summarize information in professional reports.
c3	Conduct various methods and techniques of analysis related to pharmacognosy.
General and Transferable skills	
d1	Communicate effectively with professionals.
d2	Use information technology in review and thesis preparation.
d3	Evaluate the work and learning needs.
d4	Use various sources to get information about the subject understudy.
d5	Set rules for evaluation and judging others performance.
d6	Work effectively as a member of a team.
d7	Prioritize work and meet deadlines.
d8	Study independently and plan research studies.

4. Thesis Content:

Steps	Content

1st	• Suggest the possible points/ problems of research that the candidate can work on in the frame of the aim of work and choose proper point related to the problems of the community and surrounding environment. • Collect all available information about this subject by all possible means. • Use internet, journals, books and other trusted sources of information to get previous and recent data and information about the subject understudy. • Design protocol including the steps of work following a proper schedule. • Increase the awareness of the recent techniques that can be used during practical work and determined by the protocol. • Integrate different knowledge required to solve suggested problem. • Continuous evaluation to the thesis outcome according to the schedule.
2nd	• Apply different practical techniques for separation and purification of different classes of natural products. • Use different spectroscopic techniques for structure elucidation of natural products (1HNMR, 13CNMR, Mass spectroscopy, IR, UV) • Apply modern methods for production of secondary metabolites including plant tissue culture and plant biotechnology. • Modify methods for production of active constituents using plant tissue culture.

	• Evaluate and manage hazards throughout the whole practical work. • Organize the experimental work according to the designed protocol. • Apply ethical recommendations in all aspects of scientific research e.g. citation, publication……
3rd	• Select some of the compounds for their pharmacological or microbiological activities. • Interpret the biological results. • Perform statistical analysis and biological correlation for the results. • Present and describe the results graphically. • Understand any legal aspects related to the thesis work.
4th	• Communicate with supervisors to discuss results. • Work effectively as a member of a team (e.g. Supervisors and various professionals). • Present the results periodically in seminars. • Write scientific reports on the obtained results with conclusive significance. • Discuss obtained results in comparison with pervious literatures. • Suggest possible recommendations based on the outcome of the thesis and decide future plans. • Present the thesis in a written form. • Summarize the thesis in an understandable Arabic language for non professionals.

	• Write references in the required form (Thesis, Paper…….). • Demonstrate the thesis in a final power point presentation. • Continue self-learning throughout the experimental work and writing scientific papers.

5- Teaching and Learning Methods:

- Self learning (Activities, Research….)
- Open discussion

6- References:

- Websites: Pubmed, Sciencedirect, Weilyinterscience

Facilities required for:

1. **For practical work:** Rotary evaporator, UV lamp, UV spectrophotometer, IR spectrophotometer, NMR spectrophotometer, Mass spectrophotometer, pH meter, Hot plate stirrer, condensation unit, oil isolation unit, incubators, microscopes, shakers.

Head of Department: Prof. Dr. Amal Al-Gendy

PhD Degree

Program Specification

Program Specification

A- Basic Information

1- Program title: PhD. Pharm. Sci Degree in **Pharmacognosy**

2- Program type: Single.

3- Faculty/ University: Faculty of Pharmacy, Zagazig University

4- Department: Pharmacognosy

5- Coordinator: Prof. Dr. Maged Abou-Hashem

6- External Evaluator: Prof. Dr. Mona Gouda Zaghlol (Head of Pharmacognosy department – Faculty of Pharmacy – Mansoura University)

7- Internal Evaluator: Prof. Dr. Afaf El-Sayed

8- Date of program specification approval: 2019

9- Academic Reference Standards:

a. The program ILOs were compared to the general guideline for postgraduate studies, 1st Edition, February 2009 issued by (NAQAA) (National Authority for Quality Assurance and Accreditation).

b. The program ILOs were compared to the Ph.D program in Department of Medicinal Chemistry and Pharmacognosy, College of Pharmacy, University of Illinois, Chicago, USA and University of science at Philadelphia, USA.

B- Professional Information

1- Program aims:

The PhD program, Zagazig University is a 4-5 five years pharmacy education offering a PhD degree in pharmaceutical sciences (pharmacognosy). The program aims to providing postgraduate students who enroll in this program with the principles of general Pharmacognosy topics (physical and chemical properties, formulas, obtaining, Isolation, identification ,quantization of active compounds and biotechnology of natural products), research topics, contemporary education topics and enables them to work as self-researchers and participate in research projects.

The program aims are summarized as follows:

1. Have the advanced and in-depth knowledge and skills in areas related to Pharmacognosy topics, biotechnology and gene expression

2. Provide information regarding the safe, economic and effective use of natural medications.

3. Apply various recent and modern techniques in isolation , structure determination of natural products , plant biotechnology &gene therapy strategies

4-Plan study, develop innovate methods and tools in the field of pharmacognosy for the conduct of scientific research

5- Effectively use information technology for the preparation and submission of a detailed literature review

2-Graduate attributes:

1. Have recent scientific and in-depth knowledge related to plant Secondary metabolites, their biosynthesis and the mechanism of their production.

2. Demonstrate knowledge in identification of rate limiting genes and enzyme activities that lead to controlled metabolite level.
3. Summarize different methods for extraction of plant materials, classify different chromatographic techniques and the different spectral analysis of the bioactive constituents and apply the knowledge of different resources of natural products information in research .
4. Provide information regarding the safe, economic and effective use of natural medications.
5. Demonstrate practical skills in modification of structures that full fill market need of natural products.
6. Specify gene and enzymes involved in biosynthesis and regulations.
7. Communicate information, arguments and analyses effectively.
8. Consistency of the program aims with mission of the faculty.
9. Analyze with consideration of different options and viewpoints.
10. Demonstrate comittement to social responsibilities, professionalism, and ethical standards.
11. Demonstrate life long learning, probable solving and team working skills.
12. The ability to work effectively as both a team leader and a team member.

3-Intended Learning Outcomes (ILOs):

The Program provides excellent opportunities for students to demonstrate knowledge and understanding qualities and develop skills appropriate for **Pharmacognosy** PhD of sciences degree.

3-1- Knowledge and Understanding :

On successful completion of the PhD degree Program, students will be able to:

A.1-Outline basic theories of natural products chemistry, biosynthesis, biochemistry, enzymology and tissue culture.

A.2- Illustrate sufficient knowledge on sophisticated methods of isolation, and chromatographic purification as well as structure elucidation of natural products using physicochemical and advanced spectral methods.

A.3-Mention applications of plant tissue culture, biotransformation and genetic engineering of plants .

A.4- Describe Fundamental methods, techniques, tools and ethics concerning advanced spectroscopic methods and natural products biotechnology.

A.5-Illustrate the basic methods and tools of natural products biosynthesis.

A.6- State the ethical and legal principles in pharmacy and academic practices

A.7- Illustrate the principles and bases of quality assurance in professional practice in the field of isolation and elucidation of natural products and in biotransformation and genetic engineering techniques.

A.8- Comperhend the impact of professional practice of the field of natural product research on society and environment.

3-2 - Intellectual Skills:

On successful completion of the PhD degree Program, students will be able to:

B1- Suggest new structures and proper identification of natural products by spectroscopic means and genius interpretation of the physicochemical and spectroscopic data of natural products.

B2- Identify new natural products with few available spectral data.

B3- Predict byproducts, mechanism of biosynthetic ways and how to enhance the formation of bioactive metabolites in tissue cultures and biotransformation techniques.

B4- Develop and modify the methods arise from instrumental techniques in the field of biotechnology.

B5- Assess hazards and risks in Pharmacognosy field.

B6- Plan to improve performance in the Pharmacognosy field.

B7-Generate research questions to solve different problems inrelated to natural product.

B8- Manage discussions and arguments based on evidence and logic.

3-3 - Professional and Practical Skills:

It is intended that, on successful completion of the PhD degree Program, students will be able to:

C1- Identify and make taxonomical citation of crude drugs.

C2- Extract, isolate, purify and identify natural constituents using physical, chemical and chromatographic techniques.

C3- Select proper media and adjust the conditions for tissue culture.

C4- Design and efficiently perform genetic engineering and biotechnology experiments for plant products in analytical and preparative scales.

C5- Write and critically evaluate professional reports in the field of natural product and other related fields.

C6- Construct a critical review of existing literature or other scholarly output.

C7- Evaluate and develop methods and tools existing in the field of natural product.

C8- Properly use technological means in a better professional practice.

C.9- Plan to improve professional practices as well as performance of other scholars.

3-4 - General and Transferable Skills:

On successful completion of the PhD degree Program, students will be able to:

D1- Communicate effectively, with colleagues and a wider audience, in a variety of media.

D2- Use the information technologies (IT) in improving the professional practices efficiently.

D3- Help others to learn and evaluate their performance.

D4- Continue to learn independently and to develop professionally.

D5- Use various sources to get information and knowledge.

D6- Implement tasks as a member and lead a team of workers.

D7- Manage time effectively.

4- Academic Standards:

a. The program ILOs were compared to the general guideline for postgraduate studies, 1st Edition, February 2009 issued by (NAQAA) (National Authority for Quality Assurance and Accreditation).

c. b. The program ILOs were compared to the Ph.D program in University of science at Philadelphia, USA and University of Illinois at Chicago, USA.

Matrix1: Comparison of graduate attributes of Pharmacogonosy Ph-D program with the Academic Reference Standards {ARS, 2009} developed by NAQAAE

Attributes of the graduates (ARS, 2009)	Attributes of the graduates (Ph-D Degree in Pharmacogonosy)
1.Apply the specialized knowledge he has acquired in his professional practice	1. Have recent scientific and in-depth knowledge related to plant Secondary metabolites, their biosynthesis and the mechanism of their production. 2. Demonstrate knowledge in identification of rate limiting genes and enzyme activities that lead to controlled metabolite level. 3. Summarize different methods for extraction of plant materials, classify different chromatographic techniques and the different spectral analysis of

Attributes of the graduates (ARS, 2009)	Attributes of the graduates (Ph-D Degree in Pharmacogonosy)
	the bioactive constituents and apply the knowledge of different resources of natural products information in research .
2. Identify and solve professional problems 5. Take decisions using available information	4. Provide information regarding the safe, economic and effective use of natural medications. 5. Demonstrate practical skills in modification of structures that full fill market need of natural products.
9. Be a lifelong learner and able to develop himself 3.Show good communication and leadership skills 4. Use technology effectively in his professional practice	6. Specify gene and enzymes involved in biosynthesis and regulations. 7. Communicate information, arguments and analyses effectively. 8. Consistency of the program aims with mission of the faculty.

Attributes of the graduates (ARS, 2009)	Attributes of the graduates (Ph-D Degree in Pharmacogonosy)
6. Use available resources efficiently	9. Analyze with consideration of different options and viewpoints. 10. Demonstrate comittement to social responsibilities, professionalism, and ethical standards.
7. Aware of his role in community service and development	11. Demonstrate life long learning, probable solving and team working skills. 12. The ability to work effectively as both a team leader and a team member.

Matrix 2: Comparison between PhD degree program ILOs and the Academic Reference Standards, 2009.

ARS vs. Program ILOs (PhD in Pharmacognosy)		
ARS		**Program ILOs**
Knowledge and Understanding	2.1.1- Fundamental and in-depth knowledge and basic theories in the field of specialty and the closely related areas of pharmaceutical sciences.	A.1- Outline basic theories of natural products chemistry, biosynthesis, biochemistry, enzymology and tissue culture.
		A.2- Illustrate sufficient knowledge on sophisticated methods of isolation, and chromatographic purification as well as structure elucidation of natural products using physicochemical and advanced spectral methods.
		A.3-Mention applications of plant tissue culture, biotransformation and genetic engineering of plants .
	2.1.2- Fundamentals, methods, techniques, tools and ethics of scientific research.	A.4- Describe Fundamental methods, techniques, tools and ethics concerning advanced spectroscopic methods and natural products biotechnology. A.5- Illustrate the basic methods and tools of natural products biosynthesis.

	2.1.3- The ethical and legal principles in pharmacy and academic practices.	A.6- State the ethical and legal principles in pharmacy and academic practices
	2.1.4- The principles and bases of quality assurance in professional practice in the field of specialization.	A.7- Illustrate the principles and bases of quality assurance in professional practice in the field of isolation and elucidation of natural products and in biotransformation and genetic engineering techniques.
	2.1.5- All relevant knowledge concerning the impact of professional practice on society and environment and the ways of their conservation and development.	A.8- Comperhend the impact of professional practice of the field of natural product research on society and environment.
Intellectual Skills	2.2.1- Analyze and evaluate the data in his\her specified area and utilize them in logical inference processes (induction/deduction).	B.1-Suggest new structures and proper identification of natural products by spectroscopic means and genius interpretation of the physicochemical and spectroscopic data of natural products.
		B.2- Identify a new natural products with few available spectral data.
		B.3-Predict bioproducts, mechanism of biosynthetic ways and how to enhance the formation of bioactive metabolites in tissue cultures and biotransformation techniques.

	2.2.2- Propose solutions to specified problems in the light of the available data (information).	B.4- Develop and modify methods arise from instrumental techniques on field of biotechnology.
	2.2.3- Asses hazards and risks in professional practice in his \ her areas of specialization.	B.5- Assess hazards and risks in Pharmacognosy field.
	2.2.4- Plan to improve performance in the pharmaceutical area of interest.	B.6- Plan to improve performance in the Pharmacognosy field.
	2.2.5- Take Professional decisions and bears responsibility in wide array of pharmaceutical fields.	B.7- Generate research questions to solve different problems inrelated to natural product..
	2.2.6- Be creative and innovative.	B.8- Manage discussions and arguments based on evidence and logic.
Professional and Practical Skills	2.3.1- Master basic and modern professional skills in the area of specialization.	C.1- Identify and make taxonomical citation of crude drugs.
		C.2- Extract, isolate, purify and identify natural constituents using physical, chemical and chromatographic techniques.
		C.3- Select proper media and adjust the conditions for tissue culture.
		C.4- Design and efficiently perform genetic engineering and biotechnology experiments for plant products in analytical and preparative scales.

	2.3.2- Write and critically evaluate professional reports.	C.5- Write and critically evaluate professional reports in the field of natural product and other related fields.
		C.6- Construct a critical review of existing literature or other scholarly output.
	2.3.3- Evaluate and develop methods and tools existing in the area of specialization.	C.7- Evaluate and develop methods and tools existing in the field of natural product.
	2.3.4- Properly use technological means in a better professional practice.	C.8- Properly use technological means in a better professional practice.
	2.3.5- Plan to improve professional practice and to improve the performance of other scholars.	C.9- Plan to improve professional practices as well as performance of other scholars.
General and Transferable Skills	2.4.1- Effective Communication in its different forms.	D.1-Communicate effectively, with colleagues and a wider audience, in a variety of media.
	2.4.2- Effective use of information technologies to improve professional practices.	D.2- Use the information technologies (IT) in improving the professional practices efficiently.
	2.4.3- Help others to learn and evaluate their performance.	D.3- Evaluate learning needs and professional performances of juniors.
	2.4.4- Self-assessment and continuous learning.	D.4- Continue to learn independently and to develop professionally.

	2.4.5- Use various sources to get information and knowledge.	D.5- Use various sources to get information and knowledge.
	2.4.6- Work as a member and lead a team of workers.	D6- Implement tasks as a member and lead a team of workers.
	2.4.7- Direct scientific meetings and to manage time effectively.	D7- Manage time effectively.

Matrix3: program courses were bench marked with the Ph. D program in Department of Medicinal Chemistry and Pharmacognosy, College of Pharmacy, University of Illinois, Chicago, USA and University of Science, Philadelphia, USA.

Program	Courses	Benchmarks
PhD program (Special courses)	Advanced Chemistry and Biosynthesis of Natural Products	**University of science at Philadelphia, USA** ▪ Analytical and Natural Products Chemistry ▪ Proteomics ▪ Biotechnology **University of Illinois at Chicago, USA** ▪ Marine Natural Products
	Biotechnology of Natural Products	
	Marine Natural Products	

5-Curriculum Structure and Contents:

a- Program duration: **3- 5** years

b- Program structure:

- The PhD program can be completed in 3-5 years.
- The Faculty of pharmacy implements the credit hour system.
- The program is structured as:

1- Courses:

No. of credit hours for program courses:

Special: (3x4) 12

2- Thesis: 30 hours

The candidate must complete a research project on an approved topic in the Pharmaceutical Sciences. To fulfill this requirement the student must present (written and orally) a research proposal and write a thesis.

3- General University Requirements: 10 credit hours including:

Course Code	Course Title	Credit hours	Program ILOs Covered
	Special Courses:		
GSP4	Advanced Spectroscopy	4	A2, B1, B4, D1, D2
GSP5	Biosynthesis of natural products	4	A1, B3 and D4
GSP6	Advanced Natural Products Biotechnology	4	A3, B3, D1 and D6
	Thesis	30	A1, A2, A3, A4, A5, A6, A7, A8 B1, B2, B3, B4, B5, B6, B7, B8, B9, B10, B11, C1,

			C2, C3,C4, C5, C6, C7, C8, C9, D1, D2, D3, D4, D5, D6, D7

a- TOEFL (500 units)

b- Computer course

c- Program Curriculum:

6-Program admission requirements:

Applicants are admitted to PhD degree any time throughout the academic year upon fulfillment of the following:

1. The applicants should be holders of Bachelor in Pharmaceutical Sciences from any Faculty of Pharmacy and also finish M.Sc. degree affiliated to the Egyptian Universities affiliated to the Egyptian Supreme Council of Universities (ESCU).
2. Students should fulfill all the admission requirements stated by the concerned Departmental Board.

Regulations to complete the program:

Conditions of granting the degree

The Faculty Council, in compliance with the concerned Departmental Board as well as Graduate Studies and Research Committee recommendation awards the PhD degree upon fulfillment of the following requirements:

1. Carrying out a deep research in the area of specialization for at least two calendar years from the time of registration.
2. The student has to succeed in all courses examinations.
3. Acceptance of the research thesis by the judges Committee according to statement 104 of universities regulating law.

Cancellation of Registration

The Faculty Board is allowed to cancel registration for PhD programs in the following circumstances:

1. Student's failure to pass the course examinations for two times.
2. Student's nonattendance or unsatisfactory progress in research work being reported by the advisors to the Departmental Board and forwarded to the Graduate Studies and Research Committee for approval of cancellation.
3. Dissertation refusal by the Jury Committee.

Incapability of the student to graduate by the deadlines indicated

7- Admission Policy:

The faculty complies with the admission regulations and requirements of the Egyptian Supreme Council of Universities (ESCU).

8-Student assessment methods:

Method	ILOS
Written exam	Knowledge and Understanding and Intellectual Skills
Oral exam	Knowledge and Understanding ,Intellectual Skills and General and Transferable Skills
Activity	Intellectual Skills and General and Transferable Skills

Seminars	Knowledge and Understanding ,Intellectual Skills & General and Transferable Skills
Follow up	Professional and practical Skills & General and Transferable Skills
Thesis and oral presentation	Knowledge and Understanding, Intellectual Skills, Professional and practical Skills & General and Transferable Skills

Grade Scale	Grade point average value (GPA)	Numerical scale
A+	5	≥ 95%
A	4.5	90- < 95%
B+	4	85- < 90%
B	3.5	80- < 85%
C+	3	75- < 80%
C	2.5	70- < 75%
D+	2	65- < 70%
D	1.5	60- < 65%

9-Failure in Courses:

Students who fail to get 60% (1 point)

10-Methods of program evaluation

Evaluator	Method	Sample
Internal evaluator: Professor Dr. Afaf El-Sayed	Program evaluation Courses evaluation	Program report Courses report
External evaluator: Prof. Dr. Mona Gouda Zaghloul	Program evaluation Courses evaluation	Program report Courses report
Others methods	Matrix with ARS Questionnaires	The Matrix Results of the questionnaires

Program coordinator: Ass. Prof. Dr. Maged Abou-Hashem

Head of Department: Prof. Dr. Amal Al-Gendy

Matrix for PhD program

Program ILOs	Advanced Spectroscopy	Biosynthesis of natural products	Advanced Natural Products Biotechnology	Thesis
A.1-		X		X
A.2-	X			X
A.3-			X	X
A.4-				X
A.5-				X
A.6-				X
A.7-				X
A.8-				X
B.1-	X			X
B.2-				X
B.3-		X	X	X
B.4-	X			X
B.5-				X
B.6-				X
B.7-				X
B.8-				X
C.1-				X
C.2-				X
C.3-				X
C.4-				X
C.5-				X
C.6-				X
C.7-.				X
C.8-				X
C.9-				X
D.1-	X		X	X
D.2-	X			X
D.3-				X
D.4-		X		X
D.5-				X
D6-			X	X
D7-				X

Advanced Spectroscopy

Course specification of Advanced Spectroscopy

A- Course specifications:

Program on which the course is given: PhD of Pharmaceutical Sciences

Major or Minor element of program: Major

Department offering the program: Pharmacognosy Dept.

Department offering the course: Pharmacognosy Dept.

Date of specification approval: **2019**

The course was benchmarked with course: Analytical and Natural Products Chemistry delivered by **University of science at Philadelphia, USA.**

1- Basic information:

Title: Advanced Spectroscopy Code: GSP4

Lectures: 4 hrs/week Credit hours: 4 hrs/week

Total: 4hrs/week

2- Overall aim of the course:

On completion of the course, the students will be able to:

- Acquire recent and advanced education in the field of the identification of the isolated compounds by using all the spectroscopic methods.

- Gain the ability of creativity required for innovative and responsible practice of research in the new area of the field.

3. Intended learning outcome s (ILOs) of Advanced Spectroscopy:

Knowledge and Understanding	
a1	Outline the uses of ^{1}H and ^{13}C NMR in the identification and structural elucidation of the natural compounds.
a2	Illustrate the instrumentation and sample handling.
a3	State the coupling of proton to other nuclei, chemical shift equivalence and magnetic equivalence.
a4	Point out various the long range coupling, spin decoupling and the shift reagents.
a5	Outline the uses of different mass spectrum , determination of molecular formula and recognition of the molecular ion peak.
a6	Illustrate the fragmentation of the different compounds.
Intellectual skills	
b1	Propose ^{1}H and ^{13}C NMR in the identification and structural elucidation of the natural compounds
b2	Recognize the mass spectrum and their application
b3	Suggest new structures and proper identification of natural products by spectroscopic means.
b4	Elucidate new natural products with few available spectral data

General and transferable skills	
d1	Present data effectively
d2	Utilize database, word processing, statistical analysis and other IT facilities

4. Course Content of Advanced Spectroscopy:

Week number	Lecture contents (4hrs/week)
1	Introduction of ^{1}H, ^{13}C NMR and advanced techniques related to NMR as H-H cosy, Hmpc, APTand Dept.
2	Instrumentation and sampling
3	Chemical shift
4	Simple spin coupling
5	Proton in hetero atom, coupling of proton on hetero atoms
6	AMX, ABX and ABC systems with three coupling constant. Activity
7	Effect of chiral centre ,vicinal and germinal coupling in rigid system and spin decoupling
8	Introduction and instrumentation of mass spectrometry as EI, CI, FAB and ESI techniques.
9	Determination of molecular formula and their uses

	Activity
10	Recognition of the molecular ion peak
11	Fragmentation of flavonoids
12	Fragmentation of representative examples of alkaloids
13	Fragmentation pathways of phenolic acids and tannins
14	Fragmentation of sterols and triterpenes
15	Final exam

5- Teaching and Learning Methods:

- Lectures
- Self learning
- Open Discussion

6- Student Assessment methods:

Written exams to assess: a1- a6 and b1- b4

Oral exam assess: a1- a6 and b1- b4

Activity assess: d1 and d2

Assessment schedule:

Assessment (1): Activity	Week 6,9
Assessment (2): Written exam	Week 15

Assessment (3): oral exam	Week 15

Weighting of Assessment:

Assessment method	Marks	Percentage
• Activity	10	10 %
• Written exam	75	75 %
• Oral exam	15	15 %
TOTAL	**100**	**100%**

7- References and books:

A-Scientific papers

B- Essential and suggested books:

- Spectroscopic identification of organic compounds; Silverstein, R.; Webster, F. and Kiemle, D., Wiley and sons (2005).
- Spectroscopic methods in organic chemistry; Williams, D.H. and Fleming I. (6th edition), McGraw-Hill Higher Education(2007).
- One-dimensional and Two-dimensional NMR Spectra by Modern Pulse Techniques; Koji Nakanishi, University science books,California,USA(1990).

C- Periodicals:

- Phytochemistry
- Journal of Natural Products
- Plants medica

- Ethnopharmacology

Facilities required for teaching and learning:

For lectures: Black (white) boards, computer, data show.

Course Coordinators: Prof. Dr. : Assem El-Shazly

Head of Department: Prof. Dr. : Amal Al-Gendy

Date:

Matrix I of Advanced Spectroscopy course													
Week number	**Course Contents**	**Knowledge and understanding**						**Intellectual skills**				**General and Transferable Skills**	
		a1	**a2**	**a3**	**a4**	**a5**	**a6**	**b1**	**b2**	**b3**	**b4**	**d1**	**d2**
1	Introduction of ^{1}H, ^{13}C NMR and advanced techniques related to NMR as H-H cosy, Hmpc, APTand Dept.	x								x	x		
2	Instrumentation and sampling		x							x	x		
3	Chemical shift			x				x		x	x		
4	Simple spin coupling				x			x		x	x		
5	Proton in hetero atom, coupling of proton on hetero atoms Activity				x			x		x	x	x	x
6	AMX, ABX and ABC systems with three coupling constant.				x			x		x	x		

7	Effect of chiral centre ,vicinal and germinal coupling in rigid system and spin decoupling				x			x		x	x		
8	Introduction and instrumentation of mass spectrometry as EI, CI, FAB and ESI techniques.					x			X	x	x		
9	Determination of molecular formula and their uses Activity					x			x	x	x	x	x
10	Recognition of the molecular ion peak					x			x	x	x		
11	Fragmentation of flavonoids						x		x	x	x		
12	Fragmentation of representative examples of alkaloids						x		x	x	x		
13	Fragmentation pathways of phenolic acids and tannins						x		x	x	x		
14	Fragmentation of sterols and triterpenes						x		x	x	x		

Matrix II of Advanced Spectroscopy										
ARS		Program ILOs	Course ILOs	Course content	Source	Teaching and learning methods		Method of Assessment		
						Lectures	Self learning	Written exam	Oral exam	Activity
Knowledge and Understanding	2.1.1- Fundamental and in-depth knowledge and basic theories in the field of specialty and the closely related areas of pharmaceutical sciences.	A.2- Illustrate sufficient knowledge on sophisticated methods of isolation, and chromatographic purification as well as structure elucidation of natural products using physicochemical	a1	Introduction of ^{1}H, ^{13}C NMR and advanced techniques related to NMR as H-H cosy, Hmpc, APTand Dept.	Scientific papers, text books and Internet	x	x	x	x	
			a2	Instrumentation and sampling						
			a3	Chemical shift	Scientific papers, text books and Internet	x	x	x	x	
			a4	Simple spin coupling						
				Proton in hetero atom, coupling of proton on hetero atoms	Scientific papers, text	x	x	x	x	

		and advanced spectral methods.		AMX, ABX and ABC systems with three coupling constant.	books and Internet					
				Effect of chiral centre ,vicinal and germinal coupling in rigid system and spin decoupling	Scientific papers, text books and Internet	x	x	x	x	
			a5	Introduction and instrumentation of mass spectrometry as EI, CI, FAB and ESI techniques.						
				Determination of molecular formula and their uses	Scientific papers, text books and Internet	x	x	x	x	
				Recognition of the molecular ion peak						
			a6	Fragmentation of flavonoids	Scientific papers, text books and Internet	x	x	x	x	
				Fragmentation of representative examples of alkaloids						
				Fragmentation pathways of phenolic acids and tannins	Scientific papers, text	x	x	x	x	

				Fragmentation of sterols and triterpenes	books and Internet					
Intellectual Skills	2.2.1- Analyze and evaluate the data in his\her specified area and utilize them in logical inference processes (induction/deduction).	B.1-Suggest new structures and proper identification of natural products by spectroscopic means and genius interpretation of the physicochemical and spectroscopic	b1	Simple spin coupling	Scientific papers, text books and Internet	x	x	x	x	
				Proton in hetero atom, coupling of proton on hetero atoms						
				AMX, ABX and ABC systems with three coupling constant.						
				Effect of chiral centre ,vicinal and germinal coupling in rigid system and spin decoupling						
			b2	Introduction and instrumentation of mass spectrometry as EI, CI, FAB and ESI techniques.	Scientific papers, text books and Internet	x	x	x		
				Determination of molecular formula and their uses						

		data of natural products.		Recognition of the molecular ion peak						
				Fragmentation of flavonoids						
				Fragmentation of representative examples of alkaloids						
				Fragmentation pathways of phenolic acids and tannins					x	
				Fragmentation of sterols and triterpenes						
			b3	All topics	Scientific papers, text books and Internet	x	x	x	x	

	2.2.2- Propose solutions to specified problems in the light of the available data (information).	B.4- Develop and modify methods arise from instrumental techniques on field of biotechnology.	b4	All topics	Scientific papers, text books and Internet	x	x	x	x	

General and Transferable Skills	2.4.1- Effective Communication in its different forms.	D.1- Communicate effectively, with colleagues and a wider audience, in a variety of media.	d1	Activity	Scientific papers, text books and Internet		x		x	

	2.4.2- Effective use of information technologies to improve professional practices.	D.2- Use the information technologies (IT) in improving the professional practices efficiently.	d1	Activity		x				

Biosynthesis of natural products

Course specification of Biosynthesis of natural products

A- Course specifications:

Program on which the course is given: PhD of Pharmaceutical Sciences

Major or Minor element of program: Major

Department offering the program: Pharmacognosy Dept.

Department offering the course: Pharmacognosy Dept.

Date of specification approval: 2019

The course was benchmarked with course: Analytical and Natural Products Chemistry delivered by **University of science at Philadelphia, USA.**

1- Basic information:

Title: Biosynthesis Code: GSP5

Lectures: 4 hrs/week Credit hours: 4 hrs/week

Total: 4hrs/week

2- Overall aim of the course:

On completion of the course, the students will be able to:

- Acquire the knowledge of general aspects for biosynthesis of different classes of natural products as alkaloids, glycosides, volatile oils, and carbohydrates.
- Have basic information in the biosynthetic pathways of different secondary metabolites to facilitate biotransformation and plant tissue culture.

3. Intended learning outcomes (ILOs):

Knowledge and Understanding	
a1	Acquire the fundamentals of plant physiology and enzymology and also knows the roles of enzymes in biosynthesis processes.
a2	Know the Important chemical reactions of biosynthetic processes.
a3	Acquires the fundamentals of photosynthesis and both 1^{ry} and 2^{ry} metabolites.
a4	Describe the uses of stable and radiolabelled isotopic precursors.
a5	Gain knowledge on the biosynthetic pathways of different classes of alkaloids, terpeniods, aromatic compounds, flavonoids.
Intellectual skills	
b1	Identify scientifically the metabolic products.
b2	Recognize and detect the biosynthetic path ways of different classes of natural products e.g. alkaloids, flavonoids, terpenoids and sesquiterpenes.

b3	Design a practical biosynthetic experiment for a specific natural compounds.
b4	Increase the yield and modify the final products.
General and transferable skills	
d1	Use the library and other sources of information

4. Course Content of Biosynthesis:

Week number	Lecture contents (4hrs/week)
1	Plant Cell, Plant Physiology, Types of Enzymes and Mechanism of Enzymes
2	Photosynthesis, 1^{ry} and 2nd metabolites, Isotopes Labeling, The building blocks and Construction Mechanisms
3	Acetate Pathway: Fatty Acids and Polyketides, Acetate-Acetate

4	Acetate Pathway: Acetate-malonate, Irregular acetates
5	Acetate Pathway: Oxidative phenol coupling, Applications
6	Shikimate Pathway: Aromatic Amino Acids and Phenylpropanoids, Simple Phenols, Coumarins. activity
7	Shikimate Pathway : Flavonoids and anthocyanins
8	Shikimate Pathway : Anthraquinones
9	Shikimate Pathway : Other aromatics, Mixed Origin Compounds. activity
10	The Mevalonate and Deoxyxylulose Phosphate pathways: Terpenoids and Steroids
11	Alkaloids Pathway : General aspects, Oxidative phenol coupling in alkaloid biosynthesis, Alkaloids of mixed amino acids
12	Alkaloids Pathway: Mevalonate origin, Terpenoid Alkaloids
13	Carbohydrates
14	Open discussion about the course

15	Final exam

5- Teaching and Learning Methods:

- Lectures
- Self-learning
- Open discussion

6- Student Assessment methods:

- Written exams to assess: a1- a5 and b1- b4
- Oral exam assess: a1- a5 and b1- b4
- Activity assess: d1

Assessment schedule:

Assessment (1): Activity	Week 6,9
Assessment (2): Written exam	Week 15
Assessment (3): oral exam	Week 15

Weighting of Assessment:

Assessment method	Marks	Percentage
• Activity	10	10 %
• Written exam	75	75 %
• Oral exam	15	15 %
TOTAL	**100**	**100%**

7- References and books:

A-Scientific papers

B- Essential books:

- Dewick, P. M. Medicinal natural products: a biosynthetic approach. John Wiley & Sons, (2002).
- Comprehensive Natural Products Chemistry; Barton, D and Nakanishi, K, Elsevier Science Ltd. (1999).
- Nat. Prod. Chemistry; Torssel, K. B. G.: Apotekars.press (1997).
- Natural Products from Plants; Kaufmann, P. B et al; CRC Press (1999).
- Medicinal Natural Products; A Biosynthetic Approach. Dewick, P.M.; John Wiley & Sons (1998).

C- Suggested books:

- Organic Chemistry of Secondary Plant Metabolism; TA Geissman and D.H.G. Crout; Freeman, Cooper & Co. (1969).
- Biosynthesis of Isoprenoid Compounds; John W. Porter and Sandra L. Spurgeon; vol. 1, John Wiley- Interscience Publication, (1981).
- Introduction to Alkaloids: A Biogenetic Approach; Geofferey A. Cordell; JohnWiley- Interscience Publication, (1981).
- The Biosynthesis of Aromatic Compounds; Ulrich Weis and J. Michael Edwards; JohnWiley- Interscience Publication, (1980).
- The Hand Books of Natural Flavonoids; Harborne, J. B. and Baxter, H.; John Wiley &Sons Ltd. (1999).

D- Periodicals and Websites:

Fitotherapia, Die Pharmazie, Journal of Natural Products, Phytochemistry, Planta medica, The Egyptian Knowledge Bank (EKB)

Facilities required for teaching and learning:

For lectures: Black (white) boards, computer, data show.

Course Coordinators: Prof Dr/ Wafaa Hassan Badr

Head of Department: Prof Dr/ Amal Al-Gendy

Date:

Matrix I of Biosynthesis course

Week number	Course Contents	Knowledge and understanding					Intellectual skills				General and transferable skills
		a1	a2	a3	a4	a5	b1	b2	b3	b4	d1
1	Plant Cell,Plant Physiology Types of Enzymes and Mechanism of Enzymes	x	x	x	x		x				
2	Photosynthesis 1ry and 2nd metabolites Isotopes Labeling	x	x	x	x		x				
3	Acetate Pathway : Polyketides Acetate-Acetate					x		x	x	x	
4	Acetate Pathway : Acetate-malonate Irregular acetates Avtivity					x		x	x	x	X

5	Acetate Pathway: Oxidative phenol coupling Applications					x		x	x	x	
6	Shikimate Pathway: Simple Phenols Coumarins.					x		x	x	x	
7	Shikimate Pathway : Flavonoids					x		x	x	x	
8	Shikimate Pathway : Anthraquinones					x		x	x	x	
9	Shikimate Pathway : Other aromatics Mixed Origin Compounds :					x		x	x	x	
10	Alkaloids Pathway : General aspects Oxidative phenol coupling in alkaloid biosynthesis					x		x	x	x	
11	Alkaloids Pathway : Alkaloids of mixed amino acids					x		x	x	x	

12	Alkaloids Pathway : Mevalonate origin. Activity					x		x	x	x	X
13	Alkaloids Pathway : Terpenoid alkaloids					x		x	x	x	
14	Open discussion about the course	x	x	x	x	x	x	x	x	x	
15	Final exam	x	x	x	x	x	x	x	x	x	

Matrix II of Biosynthesis

ARS		Program ILOs	Course ILOs	Course content	Source	Teaching and learning methods		Method of Assessment		
						Lectures	Self learning	Written exam	Oral exam	Activity
Knowledge and Understanding	2.1.1- Fundamentals and in-depth knowledge and basic theories in the field of specialty and the closely related areas of pharmaceutical sciences.	A.1-Outline basic theories of botany, natural products chemistry, biosynthesis, biochemistry , enzymology and cell culture.	a1,a2,a3,a4	Plant Physiology Plant Cell Types of Enzymes Mechanism of Enzymes Photosynthesis 1ry and 2nd metabolites Isotopes Labeling	Scientific papers, text books and Internet	x	x	x	x	
			a5	Acetate-Shikimate-Alkaloids pathways	Scientific papers, text books and Internet	x	x	X	x	

Intellectual Skills	2.2.1- Analyze and evaluate the data in his\her specified area and utilize them in logical inference processes (induction/deduction)	B.3-Predict bioproducts, mechanism of biosynthetic ways and how to enhance the formation of bioactive metabolites in tissue cultures and biotransformation techniques.	b1	Plant Physiology Plant Cell Types of Enzymes Mechanism of Enzymes Photosynthesis 1ry and 2nd metabolites Isotopes Labeling	Scientific papers, text books and Internet	x	x	x	x	
			b2, b3, b4	Acetate-Shikimate-Alkaloids pathways	Scientific papers, text books and Internet	x	x	X	x	

General and Transferable Skills	2.4.4- Use variable sources to get information and knowledge.	D.4- Continue to learn independently and to develop professionally.	d1	Activity	Scientific papers, text books and Internet		x			x

Advanced Natural Products Biotechnology

Course specification of Advanced Natural Products Biotechnology

A- Course specifications:

Program on which the course is given: PhD of Pharmaceutical Sciences

Major or Minor element of program: Major

Department offering the program: Pharmacognosy Dept.

Department offering the course: Pharmacognosy Dept.

Date of specification approval: **2019**

The course was benchmarked with courses: Proteomics and Biotechnology delivered by **University of science at Philadelphia, USA.**

1- Basic information:

Title: Advanced Natural Products Biotechnology Code: GSP6

Lectures: 4 hrs/week Credit hours: 4 hrs/week

Total: 4hrs/week

2- Overall aim of the course:

On completion of the course, the students will be able to:

- Have the necessary knowledge about the fundamentals and applications of NPB in the field of biotransformation and molecular biology.
- Gain the skills in the field of biotransformation and molecular biology that affects the production of pharmaceutical products.

3. Intended learning outcome s (ILOs) of Advanced Natural Products Biotechnology:

Knowledge and Understanding	
a1	Illustrate the principle information about, gene expression , heterologous expression , **metabolomics and proteomics**.
a2	Illustrate the basics of bioinformatics including the use of Gene banks.
a3	Outline the various techniques for plant transformation.
a4	Define plant vectors and recognize new vector-related technologies
a5	Illustrate the applications on plant gene expression , metabolomics and proteomics .
Intellectual skills	
b1	Recognize herbicide tolerance and pest resistance.
b2	Differentiate between different plant disease resistance.
b3	Recognize molecular pharming.
b4	Explain metabolic engineering, **metabolomics and proteomics**
General and transferable skills	
d1	Retreive information from a variety of sources
d2	Solve different cases related to gene expression
d3	Work effectively as a member of a team.

4. Course Content of Advanced Natural Products Biotechnology:

Week number	Lecture contents (4hrs/week)
1	Introduction to plant gene expression
2	Regulation of gene expression and protein targeting
3	Heterologous expression **metabolomics and proteomics**
4	Introduction to bioinformatics and Gene banks
5	Applications on the use of gene banks
6	Techniques for plant transformation A) *Agrobacterium*- based techniques Activity
7	Techniques for plant transformation B) Non- *Agrobacterium*- based techniques
8	Plant vectors and new vector-related technologies
9	Plant vectors and new vector-related technologies Activity
10	Applications on plant gene expression Herbicide tolerance and pest resistance
11	Applications on plant gene expression (cont) Plant disease resistance
12	Applications on plant gene expression (cont)

	Molecular pharming
13	Applications on plant gene expression(cont) Metabolic engineering
14	Practical applications and problem solving
15	Final exam

5- Teaching and Learning Methods:

- Lectures
- Self-learning
- Open discussion

6- Student Assessment methods:

Written exams to assess: a1- a5 and b1- b5

Oral exam assess: a1- a5 and b1- b5

Activity assess: d1 and d2

Assessment schedule:

Assessment (1): Activity	Week 6,9
Assessment (2): Written exam	Week 15
Assessment (3): oral exam	Week 15

Weighting of Assessment:

Assessment method	Marks	Percentage

• Activity	10	10 %
• Written exam	75	75 %
• Oral exam	15	15 %
TOTAL	**100**	**100%**

7- References and books:

A-Scientific papers

B- Essential books:

1. Plant Biotechnology ; P.Fasella and A.HussainScientifgic International PVT .LTD 1St Ed (2014).
2. Molecular Biology; Robert F. Weaver; Mc Graw-Hill; Fifth Ed. (2012).
3. Textbook of Industrial Pharmacognosy ;A.N.Kalia ;CBS(2009).
4. Pharmaceutical Biotechnology ;S.S.Purohit,H.N.Kakrani and and A.K.Saluja; Agrobios (2006)
5. Pharmaceutical Biotechnology. Crommelin, D.A.; and Sindeler, R.D..Hartwood Academic Publishers. The Netherlands. (1997)
6. Pharmacognosy and Pharmacobiotechnology. J.E.Robbers,Marilyn K.Speeddi and VarrE.Taylor;William &Wilkins(1996)
7. Plant gene isolation; principles and practice; GaryD.Foster and David Twell; John Wilew & Sons Ltd. (1996).

Facilities required for teaching and learning:

For lectures:, Computer and data show with internet connection
white boards.

Course Coordinator : Asst. Prof . Maged M.M. Abou-Hashem

Head of Department: Prof. Dr. : Amal Al-Gendy

Date :

Matrix I of Advanced Natural Products Biotechnology course													
Week number	Course Contents	Knowledge and understanding					Intellectual skills				General and transferable skills		
		a1	a2	a3	a4	a5	b1	b2	b3	b4	d1	d2	d3
1	Introduction to plant gene structure	x											
2	Introduction to plant gene expression Regulation of gene expression and protein targeting	x											
3	Heterologous expression	x											
4	Introduction to bioinformatics Gene banks		x										
5	Practical applications on the use of gene banks		x									x	X
6	Techniques for plant transformation A) Agrobacterium- based techniques Activity			x									

7	Techniques for plant transformation B) Non- Agrobacterium- based techniques			x									
8	Plant vectors and new vector-related technologies				x								
9	Plant vectors and new vector-related technologies Activity				x							x	x
10	Applications on plant gene expression Herbicide tolerance and pest resistance					x	x						
11	Applications on plant gene expression Plant disease resistance					x		x					
12	Applications on plant gene expression Molecular pharming					x			x				
13	Applications on plant gene expression Metabolic engineering					x				x			
14	Practical applications and problem solving						x	x	x	x	X		
15	Final exam						x	x	x	x	X		

Matrix II of Advanced Natural Products Biotechnology										
ARS		Program ILOs	Course ILOs	Course content	Source	Teaching and learning methods		Method of Assessment		
						Lectures	Self learning	Written exam	Oral exam	Activity
Knowledge and Understanding	2.1.1- Fundamentals and in-depth knowledge and basic theories in the field of specialty and the closely related areas of pharmaceutical sciences.	A.3- Mention applications of plant tissue culture, biotransformation and genetic engineering of plants .	a1	Introduction to plant gene structure - Introduction to plant gene expression Regulation of gene expression and protein targeting - Heterologous expression	Scientific papers, text books and Internet	x	X	x	x	

			a2	Introduction to bioinformatics Gene banks Practical applications on the use of gene banks	Scientific papers, text books and Internet	x	X	x	x	
			a3	Techniques for plant transformation A) Agrobacterium- based techniques - B) Non-Agrobacterium- based techniques	Scientific papers, text books and Internet	x	X	x	x	
			a4	Plant vectors and new	Scientific papers, text	x	X	x		

				vector-related technologies	books and Internet				x	
			a5	Applications on plant gene expression Herbicide tolerance and pest resistance- Plant disease resistance- Molecular pharming- Metabolic engineering	Scientific papers, text books and Internet	x	X	x	x	
Intellectual Skills	2.2.1- Analyze and evaluate the data in his\her specified area and utilize them in logical inference	B.3- Predict byproducts, mechanism of biosynthetic ways and how to enhance the formation of	b1	Herbicide tolerance and pest resistance- Practical applications	Scientific papers, text books and Internet	x	X	x	x	

	processes (induction/deduction)	bioactive metabolites in tissue cultures and biotransformation techniques.		and problem solving						
			b2	Plant disease resistance-Practical applications and problem solving	Scientific papers, text books and Internet	x	X	x	x	
			b3	Molecular pharming-Practical applications and problem solving	Scientific papers, text books and Internet	x	X	x	x	
			b4	Metabolic engineering-Practical applications and problem solving	Scientific papers, text books and Internet	x	X	x	x	

			b5	Practical applications and problem solving	Scientific papers, text books and Internet	x	X	x	x		
General and Transferable Skills	2.4.1- Communicate effectively.	D.1- Communicate effectively, with colleagues and a wider audience, in a variety of media.	d1	activity	Scientific papers, text books and Internet	x				x	
	2.4.6- Work as a member and lead a team of workers.	D.6- Implement tasks as a member and lead a team of workers.	d2	activity	Scientific papers, text books and Internet	x				x	

Thesis Specification of PhD Degree

Thesis Specification of PhD Degree

A- Course specifications:

Program on which the course is given: PhD of Pharmaceutical sciences (Pharmacognosy)

Major or Minor element of program: Major

Department offering the program: Pharmacognosy Dept.

Department offering the thesis: Pharmacognosy Dept.

Date of specification approval: **2018/2019**

1- Basic information:

Title: PhD Thesis in Pharmacognosy

Credit hours: 30 hrs

2- Overall aim of the thesis:

On completion of the thesis, the students will be able to:

- Outline the possible protocol for solving harsh problem that the candidate can work after integrating suitable knowledge about this point of research
- Identify and perform different techniques and methods used in the experimental work according to the designed protocol
- Derive and present the results of the study from the data collected

- Analyze the results of the study in the light of prior knowledge
- Draw conclusions about the contribution to knowledge made by the study which may be concerned with the problem under investigation, the methods deployed or the student as researcher

3- Intended learning outcome's (ILOs):

Knowledge and Understanding	
a1	Determine methods, techniques and ethics of scientific research.
a2	Understand the legal aspects for professional and academic practices.
a3	Be aware with the requirements of quality to apply them during practical work.
a4	Determine the influence of the research on the society and community problems.
Intellectual skills	
b1	Advance, develop and modify the methods arise from instrumental techniques in the field of biotechnology.
b2	Conduct research studies that add to the current knowledge.
b3	Write scientific papers on the research results.
b4	Manage hazards that may rise during practical work.
b5	Apply and evaluate techniques that improve the performance.

b6	Take professional decisions and bears responsibility.
b7	Demonstrate creativity and innovation in modifying techniques.
b8	Manage discussions during presenting the results.
Professional and practical skills	
c1	Identify and make taxonomical citation of crude drugs.
c2	Extract, isolate, purify and identify natural constituents using physical, chemical and chromatographic techniques.
c3	Select proper media and adjust the conditions for tissue culture.
c4	Design and efficiently perform genetic engineering and biotechnology experiments for plant products in analytical and preparative scales.
c5	Write and critically evaluate professional reports in the field of natural product and other related fields.
c6	Construct a critical review of existing literature or other scholarly output.
c7	Modify the work through continuous evaluation to the used methods and tools.
c8	Use IT skills in collecting information, presenting results and writing thesis
c9	Modify laboratory techniques.

General and Transferable skills	
d1	Interact effectively with supervisors, team members and various professionals.
d2	Use information technology in review and thesis preparation.
d3	Set rules for evaluation and judge others performance.
d4	Study independently and evaluate learning needs in pharmacognosy field.
d5	Collect required information from various sources.
d6	Work effectively as a member of a team.
d7	Direct scientific meetings and use time effectively to achieve goals.

4. Thesis Content:

Steps	Content
1st	Suggest the possible points/ problems of research that the candidate can work on in the frame of the aim of work and choose proper point related to the problems of the community and surrounding environment. Collect all available information about this subject by all possible means. Use internet, journals, books and other trusted sources of information to get previous and recent data and information about the subject understudy.

	Design protocol including the steps of work following a proper schedule. Increase the awareness of the recent techniques that can be used during practical work and determined by the protocol. Integrate different knowledge required to solve suggested problem. Continuous evaluation to the thesis outcome according to the schedule.
2nd	Apply different practical techniques for separation and purification of different classes of natural products. Use different spectroscopic techniques for structure elucidation of natural products (1HNMR, 13CNMR, Mass spectroscopy, IR, UV) Apply modern methods for production of secondary metabolites including plant tissue culture and plant biotechnology. Modify methods for production of active constituents using plant tissue culture. Evaluate and manage hazards throughout the whole practical work. Organize the experimental work according to the designed protocol. Apply ethical recommendations in all aspects of scientific research e.g. citation, publication……
3rd	Select some of the compounds for their pharmacological or microbiological activities. Interpret the biological results.

	Perform statistical analysis and biological correlation for the results. Present and describe the results graphically. Understand any legal aspects related to the thesis work.
4th	Communicate with supervisors to discuss results. Work effectively as a member of a team (e.g. Supervisors and various professionals). Present the results periodically in seminars. Write scientific reports on the obtained results with conclusive significance. Discuss obtained results in comparison with pervious literatures. Suggest possible recommendations based on the outcome of the thesis and decide future plans. Present the thesis in a written form. Summarize the thesis in an understandable Arabic language for non professionals. Write references in the required form (Thesis, Paper…….). Demonstrate the thesis in a final power point presentation. Continue self-learning throughout the experimental work and writing scientific papers.

5- Teaching and Learning Methods:

- Self learning (Activities, Research….)
- Open discussion

6- References:

- Websites: Pubmed, Sciencedirect, Weilyinterscience

Facilities required for:

For practical work: Rotary evaporator, UV lamp, UV spectrophotometer, IR spectrophotometer, NMR spectrophotometer, Mass spectrophotometer, PHmeter, Hot plate stirrer, condensation unit, oil isolation unit, incubators, microscopes

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Head of Department: Prof. Dr. Amal El-Gendy