



Zagazig University
Faculty of Pharmacy
Pharmacognosy Department

Program and Course Specifications
Master and Ph.D.
Degrees

2017/2018

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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:** Maged M.M. Abo-Hashem
- 6- **Date of program specification approval:** 2017 /2018

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. Provide the community with highly qualified and professionals with skills and ethical values based on National Academic Reference Standards (ARS).
2. Help acquire the necessary knowledge and skills in areas related to Pharmacognosy, and plant biotechnology.
3. Apply various recent techniques in isolation, structure determination & of natural products and plant biotechnology.

4. Develop communication skills, time management, critical thinking, problem solving, decision making, team working, using modern information technology, design and conduct research.
5. 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. Analyse issues logically, consider different options and viewpoints and make informed decisions.
8. Acknowledge of 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- Develop 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- Explain suitable analytical method and evaluate results qualitatively and quantitatively.
- 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- Recognize different traditional and modern techniques to predict structures of naturally isolated secondary metabolites obtained from different classes.
- A.8- Acquire full awareness about different sources of information regarding medicinal plants including websites, flora, herbarium setting, extraction methods, chromatography and spectroscopy.
- A.9- Develop 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 full awareness of 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- Evaluate gaps or weaknesses in existing knowledge and identify appropriate means of resolving them.
- B.3- Use information gained from different sources to solve complex problem.
- B.4- Conduct research either individually or as a part of team through research design, data collection, analysis, synthesis and reporting.
- B.5- Reduce and eliminate risks during professional practice.
- B.6- Reflect critically on own performance and that of others and then take appropriate action to improve subsequent actions.
- B.7- Take professional decisions and respond to experience and circumstances.

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- Apply a wide range of 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.

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 in the field of pharmacognosy.
- D.4- Make effective use of library and other sources of information in the field of pharmacognosy.
- D.5- Establish rules for judging others performance related to the pharmacognosy.
- 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:

Faculty is committed to the Academic References Standards for postgraduate studies (March 2009).

Matrix I: Comparison between Master degree program ILOs with with the Academic Reference Standard {ARS, 2009} developed by NAQAAE

ARS vs. Program ILOs of Masters in Pharmacognosy		
ARS		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- Develop 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- Explain suitable analytical method and evaluate results qualitatively and

		quantitatively. 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- Recognize different traditional and modern techniques to predict structures of naturally isolated secondary metabolites obtained from different classes. A.8- Acquire full awareness about 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- Develop 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 full awareness of ethics in all aspects of scientific research.
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.
	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- Correlate and integrate different pharmaceutical knowledge to solve professional problems.	B.3- Specify the knowledge of different phytochemical aspects to solve research problems

	2.2.4- Conduct research and write scientific report on research specified topics.	B.4- Conduct research either individually or as a part of team through research design, data collection, analysis and reporting.
	2.2.5- Evaluate and manage risks and potential hazards in professional practices in the area of specialization	B.5- Reduce and eliminate risks during professional practice.
	2.2.6- Plan to improve performance in the field of specialization.	B.6- Design all suitable laboratory protocols for a requested phytochemical issues.
	2.2.7- Professional decision-making in the contexts of diverse disciplines.	B.7- Take professional decisions and respond to experience and circumstances.
Professional and Practical Skills	2.3.1- Master basic and modern professional skills in the area of specialization.	C.1- Acquire a wide range of practical and laboratory skills in the field of pharmacognosy.
	2.3.2- Write and evaluate professional reports.	C.2- Review and summarize information from 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.
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 in the field of pharmacognosy.
	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
	2.4.5- Set criteria and parameters to evaluate the performance of others	D.5- Establish rules for judging others performance related to the pharmacognosy.

	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.

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: 12

Elective: (2x4) 8

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- Number of semesters: 2 semester

c- Study plan:

Course Code	Course Title	Credit hours	Program ILOs Covered
	General Courses:		
M108	Advanced Taxonomy	4	A4, A8, B1 D4
M113	Natural Products Biotechnology	4	A5, B1, B3, B6, B7, D1 and D6
M107	Recent applications of plant tissue culture techniques	4	A5, A6, B1, D1 and D4
M101	Advanced Instrumental Analysis & chromatography I	4	A1, A3, A7, A8, C3.
ME3	Elective A Good practice for analysis of drugs and quality control	4	A2
ME2	Elective B Drug Stability	4	A3, B4, B5, C1.
	Special Courses:		
Gsp1	Advanced Chemistry of natural products	4	A1, A6, B3, D1 and D6
Gsp3	Structure Determination of Natural Products	4	A1, A7, B1, B3 and D4
Gsp2	Methods in natural products research	4	A4, A6, A7, A8, B1, B3, D1 and D6

	Thesis	30	A1, A2, A3, A4, A5, A6, A7, A8, A9, A10, A11, B1, B2, B3, B4, B5, B6, B7, C1, C2, C3, D1, D2, D3, D4, D5, D6, D7 and D8
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d. Learning Outcomes in Domains of Teaching Strategies & Assessment Methods:

ILOs	teaching method	assessment method
Knowledge and Understanding	Lectures	Written and oral Exam
Intellectual Skills	Case study Self learning	
Professional and practical Skills	Case study Problem solving Thesis	Practical Exam Case discussion Rubric
Intellectual Skills	presentation	Oral Exam and activities
General and Transferable Skills	Thesis	Rubric

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
SemiARS	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%
F	1	< 60%

8-Failure in Courses:

Students who fail to get 60% (1 point)

9-Methods of program evaluation

Evaluator	Method	Sample
Internal evaluator: Professor Dr. Ehsan Abo-Zeid	Program evaluation Courses evaluation	Program report Courses report
External evaluator: Professor Dr. Hasan Al-Rady Saad	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. Azza El-Shafae

MatrixI for master program

ARS		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	Chemistry of natural products	Structure Determination of Natural Products	Methods in natural products research	thesis
Knowledge and Understanding	2.1.1- Theories and fundamentals related to the field of learning as well as in related areas.	A.1- Develop fundamental knowledge and basic principles of different spectroscopic techniques and their applications.							X	X		X
		A.2- Outline the stability of secondary metabolites isolated from natural products.										X
		A.3- Explain suitable analytical method and evaluate results qualitatively and quantitatively.										X
		A.4- Classify different medicinal plants families according to their taxonomical categories	X								X	X

	2.1.3- Scientific developments in the area of specialization.	A.5- Outline principle information on biotechnology, tissue culture and recent natural products biotechnology applications.		X	X							X
	2.1.3- Scientific developments in the area of specialization.	A.6- Mention different classes of natural products, their chemical conversions and biological activities.			X				X		X	X
		A.7- Recognize different traditional and modern techniques to predict structures of naturally isolated secondary metabolites obtained from different classes.								X	X	X
		A.8- Acquire full awareness about different sources of information regarding medicinal plants including websites, flora, herbarium setting, extraction methods, chromatography and spectroscopy.	X								X	X

	2.1.4- Moral and legal principles for professional practice in the area of specialization.	A.9- Develop moral and legal principle concerning scientific research.										X
	. 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										X
	2.1.6- The fundamentals and ethics of scientific research.	A.11- Recognize full awareness of ethics in all aspects of scientific research.										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 different forms	X	X	X					X	X	X

	. 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										X
	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		X					X	X	X	X
	. 2.2.4- Conduct research and write scientific report on research specified topics.	B.4- Conduct research either individually or as a part of team through research design, data collection, analysis and reporting										X
	2.2.5- Evaluate and manage risks and potential hazards in professional practices in the area of specialization	B.5- Reduce and eliminate risks during professional practice.										X

	. 2.2.6- Plan to improve performance in the field of specialization.	B.6- Design all suitable laboratory protocols for a requested phytochemical issues		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		X								X
Professional and Practical Skills	2.3.1- Master basic and modern professional skills in the area of specialization.	C.1- Acquire a wide range of practical and laboratory skills in the field of pharmacognosy.										X
	2.3.2- Write and evaluate professional reports.	C.2- Review and summarize information from different reports in the area of pharmacognosy.										X
	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.										X

General and Transferable Skills	2.4.1- Communicate effectively.	D.1- Apply effective communication skills recognizing the need for a variety of approaches.		X	X				X		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.										X
	2.4.3- Self-assessment and define his personal learning needs.	D.3- Practice self assessment and define learning needs in the field of pharmacognosy.										X
	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	X		X					X		X
	2.4.5- Set criteria and parameters to evaluate the performance of others	D.5- Establish rules for judging others performance related to the pharmacognosy.										X
	2.4.6- Work in a team and lead	D.6- Work with and motivate others.		X					X		X	X

	teams carrying out various professional tasks.											
	2.4.7- Manage time effectively.	D.7- Prioritize work and meet deadlines.										X
	2.4.8- Continuous and self learning.	D.8- Develop the skills required for continuing professional development.										X

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: **2017/2018**

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.

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 the library and other sources of 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 Activity
6	Modern trends in plant taxonomy: Floral anatomy and Cytology

7	Palynology.
8	Numerical taxonomy
9	Chemotaxonomy
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	Classification of plants according to pharmacology and medicinal uses

5- Teaching and Learning Methods:

- Lectures
- Self learning
- Open discussion
- Activities
- Field trip to medicinal plant experimental farm.

6- Student Assessment methods:

Written exams to assess: a1, a2, a3, a4, b1 and b2

Oral exam assess: a1, a2, a3, a4, b1 and b2

Activity assess: d1

Assessment schedule:

Assessment (1): Activity	Week 5-11
Assessment (2): Written exam	Week 16

Assessment (3): oral exam	Week 16
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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 Täckholm (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.google scholar.com

Facilities required for teaching and learning:

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

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- **Course Coordinator: Prof Dr/ Fawkia Abbas**
 - **Head of Department: Prof. Dr. Azza El-Shafae**
تم اعتماد المقرر من مجلس القسم بتاريخ
 - **Date: 9/2017**

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 Activity	x						x
6	Modern trends in plant taxonomy: Floral anatomy and Cytology		x			X		
7	Palynology.			x			x	
8	Numerical taxonomy				x		x	
9	Chemotaxonomy				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

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	

Intellectual Skills				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 & 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	
	2.2.1- Analyze and evaluate information in	B.1- Appraise critically the quality of data and obtained information from	b1	Modern trends in plant taxonomy: External morphology, vegetative anatomy	Scientific papers, text books and Internet	X	x	X	X	

	the field of specialization and analogies to solve problems	different sources in different forms.	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	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

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: 2017-2018

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.

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.
7	Applications of bioconversions in the field of nat. prod.(<i>cont</i>)
8	Concept maps of genetic engineering
9	Plant breeding versus genetically modified ones Horizontal and vertical gene transfer.
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 (<i>cont.</i>)
15	Revision

5- Teaching and Learning Methods:

- Lectures
- Self learning
- Open discussion

6- Student Assessment methods:

Written exams to assess: a1, a2, a3, a4, a5, b1 to b4

Oral exam assess: a1, a2, a3, a4, a5, b1 to b4

Activity assess: d1, d2

Assessment schedule:

Assessment (1): Activity	Week 5-11
Assessment (2): Written exam	Week 16
Assessment (3): oral exam	Week 16

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. Hussain Scientific 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:, Computer and data show with internet connection
white boards.

Library and tissue culture lab

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

Head of Department : Prof : Azza El-Shafae

Date: 9 / 2017

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.		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.	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	Revision	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 bioconversions involving natural products	Scientific papers, text book and Internet	x	x	x	x	
				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 and Internet	x	x	x	x	
				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 and Internet	x	x	x	x	

			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 different forms.	b1	Enzymes selectivity Pathways and non-specific conversions Selected types of enzymatic bioconversions involving natural products	Scientific papers, text book and Internet	x	x	x	x	
	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 the field of nat. prod.	Scientific papers, text book and Internet	x	x	x	x	
	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

Recent applications of plant tissue culture techniques 2017 - 2018

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: 2017/2018

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.

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	Apply different techniques as elicitation, immobilization and two phase systems to increase in production of secondary metabolites <i>in vitro</i> .
Professional and Practical skills	
b1	Design tissue culture laboratory
b2	Prepare growth medium with different phytohormones
b3	Practice different techniques for production of secondary metabolites <i>in vitro</i> e.g. elicitation, immobilization and two phase system.
Intellectual skills	
c1	Design a protocol for plant tissue culture
c2	Design a protocol for plant regeneration using somatic embryogenesis
c3	Analyze the effect of different factors on the production of secondary metabolites using plant tissue culture techniques
General and Transferable Skills	
d1	Write report and interpret data
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
7	Somatic embryogenesis (lecture + activity)
8	Elicitation of plant tissue culture (lecture + activity)
9	Immobilization of suspension culture (lecture + activity)
10	Application of two phase system for collection of secondary metabolites (lecture + activity)
11	Activity discussion + presentation
12	Visit to tissue culture lab and practical application of different experiments which cover the course contents

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, c1to c3

Oral exam assess: a1, a2, a3, a4, c1to c3

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

Assessment schedule:

Assessment (1): Activity	Week 11-12
Assessment (2): Written exam	Week 14
Assessment (3): Oral exam	Week 14

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
- **Library.**

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” Academic 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. Azza El-Shafae**

Date:9 /2017

Matrix I of Plant tissue culture techniques											
Week number	Courses Contents	ILOs of Plant tissue culture techniques course									
		Knowledge and understanding					Intellectual skills			General and Transferable Skills	
		a1	a2	a3	a4	a5	b1	b2	b3	d1	d2
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			X							
7	Plant regeneration: organogenesis			X							
8	Micropropagation: definition and stages			X							
9	Micropropagation: applications			X							
10	General plant tissue culture laboratory design					X					
11	Practical techniques used for plant tissue culture					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	Open discussion	X	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 books and Internet	x	x	x	x	
				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:	Scientific papers,					

				definition and stages	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	
			a5	General plant tissue culture laboratory design	Scientific papers, text books and Internet	x	x	x	x	
				Practical techniques used for plant tissue culture	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 offered from different sources to	b1	Plant growth regulators: hormones and applications	Scientific papers, text books and Internet	x	x	x	x	
			b2	Culture types: Callus, cell suspension and protoplast	Scientific papers, text books and Internet	x	x	x	x	

	problems	solve problems.	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 Transferable Skills		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

Courses offered by other departments

- **Instrumental Analysis & chromatography I**
- **Drug stability**
- **Good practice for analysis of drugs and quality control**

Special 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: 2017/2018

1- Basic information:

Title: 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 the Chemistry of natural products course, the student will:

- Acquire the knowledge and understanding of different classes of the natural products.
- Describe chemical conversions on the natural product metabolites and their biological activates.

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

A- Knowledge and Understanding	
a1	Describe the general physical and chemical characters of different natural products.
a2	Outline the principle of isolation, purification and identification of different natural products.
a3	Mention the pharmacological activity of different natural products.
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	Work effectively as a member of a team.
d2	Develop internet communications skills.

4. Course Content of 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	Plant and Brain Cannabinoids: The Chemistry of phytocannabinoids

4	Bioactive marine metabolite from red sea water
5	Toxins of Marine Invertebrates and Microorganisms Activities
6	Chemistry of the irregular monoterpenes
7	Chemistry of diterpenes
8	Natural Products for Pest Management
9	Recent Advances in the Chemistry of Insect Pheromones and their applications.
10	Recent Trends of Some Natural Sweet Substances from Plants
11	Natural Antioxidant (NAO) of plants acting as scavengers of free radicals
12	Potential Anticancer Natural Products from Plant-Associated Fungi
13	Plant Fungal Endophytes: Interactions, Metabolites and Biosyntheses
14	Nature Derived Antibiotics
15	Activities

5- Teaching and Learning Methods:

- Lectures
- Self learning
- Open discussion

6- Student Assessment methods:

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

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

Activity assess: d1, d2

Assessment schedule:

Assessment (1): Activity	Week 5-15
Assessment (2): Written exam	Week 16
Assessment (3): oral exam	Week 16

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 ,Uta Elrahman , 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 Resources 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, Planta medica

Facilities required for teaching and learning:

1. **For lectures:** white boards, computer, data show.
2. **For Labs:** Pharmacognosy department research labs (Rotary evaporators, distillation units, Columns and chemicals for natural product isolation.

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

Head of Department: Prof. Dr. Azza El-Shafae

- **Date: 9/2017**

Matrix I of Advanced Chemistry of natural products course								
Week number	Course Contents	Knowledge and understanding			Intellectual skills		General and Transferable Skills	
		a1	a2	a3	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	x		
3	Plant and Brain Cannabinoids: The Chemistry of phytocannabinoids	x	x	x	x	x		
4	Bioactive marine metabolite from red sea water	x	x	x	x	x		
5	Toxins of Marine Invertebrates and Microorganisms Activities	x	x	x	x	x	x	x
6	Chemistry of the irregular monoterpenes	x	x	x	x	x		
7	Chemistry of diterpenes	x						
8	Natural Products for Pest Management		x	x	x	x		
9	Recent Advances in the Chemistry of Insect Pheromones and their applications.	x						
10	Recent Trends of Some Natural Sweet Substances from plants		x	x	x	x		
11	Natural Antioxidant (NAO) of plants acting as scavengers of free radicals	x	x	x	x	x		
12	Potential Anticancer Natural Products from Plant-Associated Fungi	x	x	x	x	x		
13	Plant Fungal Endophytes: Interactions, Metabolites and Biosyntheses	x	x	x	x	x		
14	Nature Derived Antibiotics	x	x	x	x	x		
15	Activities	x	x	x	x	x	x	x

Matrix II of 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	<ul style="list-style-type: none"> • The Origin and the Nature of Natural Products • Plant-Derived Natural Products As a Source of Drug Discovery and Development • Plant and Brain Cannabinoids: • The Chemistry of phytocannabinoids • Bioactive marine metabolite from red sea water • Toxins of Marine Invertebrates and Microorganisms • Chemistry of the irregular monoterpenes • Chemistry of diterpenes • Natural Products for Pest Management • Recent Advances in the Chemistry of Insect Pheromones and their 	Scientific papers, text books and Internet	x	x	x	x	

				applications. • Recent Trends of Some Natural Sweet Substances from Plants • Natural Antioxidant (NAO) of plants acting as scavengers of free radicals • Potential Anticancer Natural Products from Plant-Associated Fungi • Plant Fungal Endophytes: Interactions, Metabolites and Biosyntheses • Nature Derived Antibiotics						
	2.1.3- Scientific developments in the area of specialization.	A.6- Mention different classes of natural products, their chemical conversions and biological activities.	a3	• The Origin and the Nature of Natural Products • Plant-Derived Natural Products As a Source of Drug Discovery and Development • Plant and Brain Cannabinoids: • The Chemistry of phytocannabinoids • Bioactive marine metabolite from red sea	Scientific papers, text books and Internet	x	x	x	x	

				<p>water</p> <ul style="list-style-type: none"> • Toxins of Marine Invertebrates and Microorganisms • Chemistry of the irregular monoterpenes • Chemistry of diterpenes • Natural Products for Pest Management • Recent Advances in the Chemistry of Insect Pheromones and their applications. • Recent Trends of Some Natural Sweet Substances from Plants • Natural Antioxidant (NAO) of plants acting as scavengers of free radicals • Potential Anticancer Natural Products from Plant-Associated Fungi • Plant Fungal Endophytes: Interactions, Metabolites and Biosyntheses <p>Nature Derived Antibiotics</p>						
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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	<ul style="list-style-type: none"> • The Origin and the Nature of Natural Products • Plant-Derived Natural Products As a Source of Drug Discovery and Development • Plant and Brain Cannabinoids: • The Chemistry of phytocannabinoids • Bioactive marine metabolite from red sea water • Toxins of Marine Invertebrates and Microorganisms • Chemistry of the irregular monoterpenes • Chemistry of diterpenes • Natural Products for Pest Management • Recent Advances in the Chemistry of Insect Pheromones and their applications. • Recent Trends of Some Natural Sweet Substances from Plants 	Scientific papers, text books and Internet	x	x	x	x	
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				<ul style="list-style-type: none"> • Natural Antioxidant (NAO) of plants acting as scavengers of free radicals • Potential Anticancer Natural Products from Plant-Associated Fungi • Plant Fungal Endophytes: Interactions, Metabolites and Biosyntheses <p>Nature Derived Antibiotics</p>						
			b2	<ul style="list-style-type: none"> • The Origin and the Nature of Natural Products • Plant-Derived Natural Products As a Source of Drug Discovery and Development • Plant and Brain Cannabinoids: • The Chemistry of phytocannabinoids • Bioactive marine metabolite from red sea water • Toxins of Marine Invertebrates and Microorganisms • Chemistry of the irregular 	Scientific papers, text books and Internet	x	x	x	x	

				monoterpenes <ul style="list-style-type: none"> • Chemistry of diterpenes • Natural Products for Pest Management • Recent Advances in the Chemistry of Insect Pheromones and their applications. • Recent Trends of Some Natural Sweet Substances from Plants • Natural Antioxidant (NAO) of plants acting as scavengers of free radicals • Potential Anticancer Natural Products from Plant-Associated Fungi • Plant Fungal Endophytes: Interactions, Metabolites and Biosyntheses • Nature Derived Antibiotics 						
and Transfer	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
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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: 2017/2018

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, Hsqc, 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 Activity
5	Characteristic group absorb. Applications on IR
6	MS, GC and GC-MS: theory, sample handling, instrumentation. Parent ion characteristic

7	NMR: theory, sample handling, instrumentation.
8	¹ HNMR and ¹³ CNMR and other types of NMR.
9	Two dimensional NMR Application of some simple spectra.
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: Terpenes Activity
13	Structure elucidation of different natural product classes: Coumarins
14	Structure elucidation of different natural product classes: Sugar and glycosides
15	Group discussion

5- Teaching and Learning Methods:

- Lectures
- Self learning
- Open discussion

6- Student Assessment methods:

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

Oral exam assess: a1, a2, b1 and b2

Activity assess: d1

Assessment schedule:

Assessment (1): Activity	Week 4-12
Assessment (2): Written exam	Week 16
Assessment (3): oral exam	Week 16

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).

Facilities required for teaching and learning:

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

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- **Course Coordinators:** Prof Dr/ Assem El-Shazly
 - **Head of Department:** Prof. Dr. Azza El-Shafae
 - **Date of approval:** 9/2017

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 Activity	x				x
5	Characteristic group absorb. Applications on IR	x	x	x		
6	MS: theory, sample handling, instrumentation. Parent ion characteristic	x				
7	NMR: theory, sample handling, instrumentation.					
8	¹ HNMR and ¹³ CNMR and other types of NMR.	x				
9	Two dimensional NMR Application of some simple spectra.	x	x	x		
10	Structure elucidation of different natural product classes: Flavonoids		x	x	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	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	
15	Group discussion	x	x	x	x	

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. Parent ion characteristic NMR: theory, sample handling, instrumentation. 1HNMR and 13CNMR and other types of NMR. Two dimensional NMR	Scientific papers, text books and Internet	x	x	x	x	

	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	<p>Application of UV on different Natural Products</p> <p>Applications on IR</p> <p>Application of some simple spectra.</p> <p>Structure elucidation of different natural product classes using IR, UV, MS, HNMR, , C13, H-HCOSY, Hsqc, Hmpc, ATP, Dept, GC and GC-MS,.....etc:</p> <p>Flavonoids</p> <p>Structure elucidation of different natural product classes:</p> <p>Alkaloids</p> <p>Structure elucidation of different natural product classes:</p> <p>Terpenes</p> <p>Structure elucidation of different natural product classes:</p> <p>Coumarins</p>	Scientific papers, text books and Internet	x	x	x	x	
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				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 Structure elucidation of different natural product classes: Terpenes Structure elucidation of different natural product classes: Coumarins Structure elucidation of different natural	Scientific papers, text books and Internet	x	x	x	x	

				product classes: Sugar and glycosides						
	2.2.3- Correlate and integrate different pharmaceutical knowledge to solve professional problems.	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 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	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
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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: 2017/2018

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

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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

	Activity
6	Preparation of a plant sample for herbarium
7	Extraction: methods and solvents
8	Isolation: blind phytochemical versus biological guiding
9	Isolation: fractionation and purification Activity
10	Chromatography: classical methods
11	Chromatography: new techniques for analysis and isolation
12	Crystallization: methodology
13	Derivatization: reasons and different types
14	Derivatization: reactions and different mechanisms
15	Applications: Case studies

5- Teaching and Learning Methods:

- Lectures
- Self learning
- Open discussion

6- Student Assessment methods:

Written exams to assess: a1, a2, a3, a4, b1 and b2

Oral exam assess: a1, a2, a3, a4, b1 and b2

Activity assess: d1, d2

Assessment schedule:

Assessment (1): Activity	Week 5,9
Assessment (2): Written exam	Week 16

Assessment (3): oral exam	Week 16
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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).

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. Azza El-Shafae
- **Date:** /9/2017

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 Activity		x			x		x	x
6	Preparation of a plant sample for herbarium		x			x			
7	Extraction: methods and solvents			x			x		
8	Isolation: blind phytochemical versus biological guiding			x			x		
9	Isolation: fractionation and purification Activity			x			x	x	x
10	Chromatography: classical methods				x		x		
11	Chromatography: new techniques for analysis and isolation				x		x		
12	Crystallization: methodology			x			x		
13	Derivatization: reasons and different types			x			x		
14	Derivatization: reactions and different mechanisms			x			x		
15	Applications: Case studies	x	x	x	x		x		

Matrix II of Methods in natural products research

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	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 learning as well as in related areas.	A.4- Classify different medicinal plants families according to their taxonomical categories.	a2	Authorization of identified plants: plant authors and binomial system Activity Preparation of a plant sample for herbarium	Scientific papers, text books and Internet	x	x	x	x	

		<p>A.6- Mention different classes of natural products, their chemical conversions and biological activities.</p> <p>A.8- Acquire full awareness about different sources of information regarding medicinal plants including websites, flora, herbarium setting, extraction methods, chromatography and spectroscopy.</p>	a3	<p>Extraction: methods and solvents</p> <p>Isolation: blind phytochemical versus biological guiding</p> <p>Isolation: fractionation and purification</p> <p>Activity</p>	<p>Scientific papers, text books and Internet</p>	x	x	x	x	
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	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 problems.	B.1- Appraise critically the quality of data and information obtained from different sources in different forms.	b1	Information sources: Chemical abstract, text book Information sources: internet resources Information sources: flora books Herbarium setting and structure Authorization of identified plants: plant authors and binomial system Activity Preparation of a plant sample for herbarium	Scientific papers, text books and Internet	x	x	x	x	

	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: classical methods Chromatography: new techniques for analysis and isolation	Scientific papers, text books 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	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

Master Thesis Specification

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:** 2017/2018

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
1 st	<ul style="list-style-type: none">• 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

	<p>protocol.</p> <ul style="list-style-type: none">• Integrate different knowledge required to solve suggested problem.• Continuous evaluation to the thesis outcome according to the schedule.
2 nd	<ul style="list-style-type: none">• 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.....
3 rd	<ul style="list-style-type: none">• Select some of the compounds for their pharmacological or microbiological activities.• Interpret the biological results.• Perform statistical analysis and biological correlation for the results.

	<ul style="list-style-type: none">• Present and describe the results graphically.• Understand any legal aspects related to the thesis work.
4 th	<ul style="list-style-type: none">• 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 semiARS.• 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
- Annual Seminars

6- References:

- **Websites:** Pubmed, Sciencedirect, Wileyinterscience

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, laminar flow hood, incubators, HPLC and GC apparatus.

Head of Department: Prof. Dr. Azza El-Shafae

PhD Degree 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:** Dr. Rasha Adel
- 6- Date of program specification approval:** 2017

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. Provide the community with highly qualified and professionals with skills and ethical values based on National Academic Reference Standards (ARS).
2. Have the advanced and in-depth knowledge and skills in areas related to Pharmacognosy topics, biotechnology and gene expression
3. Provide information regarding the safe, economic and effective use of natural medications.

4. Apply various recent and modern techniques in isolation , structure determination& of natural products , plant biotechnology & gene therapy strategies
- 5-Plan study, develop innovate methods and tools in the field of pharmacognosy for the conduct of scientific research
- 6- Effectively use information technology for the preparation and submission of a detailed literature review
- 7-Actively participate in the awareness and development of the community.

2-Graduate attributes:

1. Have recent scientific and in-depth knowledge related to Plant
 - a. secondary metabolites, their biosynthesis and the mechanism of their production .
2. They will be knowledgeable with ways of identifying the 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. They will be knowledgeable with the practical means that leads to modified structures that full fill market need of natural products.
6. They will be knowledgeable with specifying gene and enzymes involved in biosynthesis and regulations.
7. Communicate information, arguments and analyses effectively.

8. Analyses issues logically, consider different options and viewpoints and make informed decisions.
9. Social responsibilities and professionalism, acknowledge of ethics and ethical standards.
10. A commitment to lifelong learning, with the ability to acquire and apply knowledge, develop existing skills, adapt to change and acquire new skills.
11. The ability to recognize the need to work within personal limitations and the scope of pharmaceutical practice.
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- Show knowledge of the 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- Aware the basic methods and tools of natural products biosynthesis.

A.6- Recognize 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- Verify the relevant knowledge concerning 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- Expect 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- Conduct research studies that add to the current knowledge.

B6- Formulate scientific papers.

- B7- Assess hazards and risks in Pharmacognosy field.
- B8- Plan to improve performance in the Pharmacognosy field.
- B9- Take professional decisions and bears responsibility.
- B10- Be creative and innovative.
- B11- 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 and to improve the 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- Direct scientific meetings and manage time effectively.

4- Academic Standards:

- ARS (National Academic Reference Standards)

Matrix: Comparison between PhD degree program ILOs and the National Academic Reference Standards

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-Show knowledge of 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-Aware the basic methods and tools of natural products biosynthesis.
	2.1.3- The ethical and legal principles in pharmacy and academic practices.	A.6- Recognize 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-Verify the relevant knowledge concerning 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-Expect a new natural products with few available spectral data.
		B.3-Predict bioproducts, mechanism of biosynthetic ways and how to enhance

on and Practica		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-Modify and develop methods arise from instrumental techniques on field of biotechnology..
	2.2.3- Conduct research studies that add to the current knowledge.	B.5- Construct research studies that add to the current knowledge.
	2.2.4- Formulate scientific papers.	B.6-Write professional scientific paper in the field of natural products.
	2.2.5- Asses hazards and risks in professional practice in his \ her areas of specialization.	B.7- Assess practical difficulties and risks in the field of natural product research.
	2.2.6- Plan to improve performance in the pharmaceutical area of interest.	B.8- Develop current methods and techniques to improve performance in the field of natural products.
	2.2.7- Take Professional decisions and bears responsibility in wide array of pharmaceutical fields.	B.9- Take professional and scientific decisions regarding natural products spectroscopy, biosynthesis and biotechnology.
	2.2.8- Be creative and innovative.	B.10- Demonstrate creativity and innovation in natural product research study and practice.
	2.2.9- Manage discussions and arguments based on evidence and logic.	B.11- Manage semiARS and open discussion settings in the field of natural products.
	2.3.1- Master basic and modern professional skills in the area of	C.1- Identify and make taxonomical citation of crude drugs.

	specialization.	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- Develop, innovate and apply methods and tools in the field of natural products research.
	2.3.4- Properly use technological means in a better professional practice.	C.8- Use properly the available technological means in the field of natural products in a better professional practice.
	2.3.5- Plan to improve professional practice and to improve the performance of other scholars.	C.9- Make plans to improve professional practices and performances of other scholars.
	Transferable Skills	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-Retrieve information from different sources.
2.4.6- Work as a member and lead a team of workers.	D.6-Work effectively as a member and leader of a team.
2.4.7- Direct scientific meetings and to manage time effectively.	D.7- Direct scientific meeting with in a specified time.

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:

- a- TOEFL (500 units)
- b- Computer course
- c- Number of semesters: 2 semester

c-Study plan:

Course Code	Course Title	Credit hours	Program ILOs Covered
	Special Courses:		
Gsp4	Advanced Spectroscopy	4	A2, B1, B4, D1 and 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 and D7

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
Semiars	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: Professor Dr. Ahmed Fouad Haleem	Program evaluation Courses evaluation	Program report Courses report
Others methods	Matrix with ARS Questionnaires	The Matrix Results of the questionnaires

Program coordinator: Dr. Rasha Adel

Head of Department: Prof. Dr. Azza El-Shafae

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: 2017/2018

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 H1 and C13 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 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 H1 and C13 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	Perform presentations with confidence
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 H^1 , C^{13} NMR and advanced techniques related to NMR as H-H cosy, Hmpc, APT and Dept.
2	Instrumentation and sampling
3	Chemical shift
4	Simple spin coupling
5	Proton in hetero atom, coupling of proton on hetero atoms Activity
6	AMX, ABX and ABC systems with three coupling constant.
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 aliphatic and monocyclic compounds.
12	Fragmentation of alcohols, amides and amines
13	Fragmentation cyclic amines
14	Aromatic hydrocarbons
15	Mass spectra of some important chemical classes

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 5-9
Assessment (2): Written exam	Week 16
Assessment (3): oral exam	Week 16

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).

- Structural Elucidation of Natural Products; MS; Djerassi, C. and Budzikiewicz, H. and Williams, D.H.; Holden-Day USA(1964).
- Application of Absorption Spectroscopy of Organic Compounds; Dyer, J.R.; Prentice-Hall(1965).
- 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: Ass. Prof. Dr. : Wafaa Hasan Badr

Head of Department: Prof.Dr. : Azza El-Shafae

Date: 9/2017

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 ^1H , ^{13}C NMR and advanced techniques related to NMR as H-H cosy, Hmpc, APT and 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 aliphatic and monocyclic compounds.						x		x	x	x		
12	Fragmentation of alcohols, amides and amines						x		x	x	x		
13	Fragmentation cyclic amines						x		x	x	x		
14	Aromatic hydrocarbons						x		x	x	x		
15	Mass spectra of some important chemical classes						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 and advanced spectral methods.	a1	Introduction of ^1H , ^{13}C NMR and advanced techniques related to NMR as H-H cosy, Hmpc, APT and Dept.	Scientific papers, text books and Internet	x	x	x	x	
			a2	Instrumentation and sampling	Internet					
			a3	Chemical shift	Scientific papers, text books and Internet	x	x	x	x	
			a4	Simple spin coupling	Scientific papers, text books and Internet					
				Proton in hetero atom, coupling of proton on hetero atoms	Scientific papers, text books and Internet	x	x	x	x	
				AMX, ABX and ABC systems with three coupling constant.	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	Internet					

				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 aliphatic and monocyclic compounds.	Scientific papers, text books and Internet	x	x	x	x	
				Fragmentation of alcohols, amides and amines						
				Fragmentation cyclic amines	Scientific papers, text books and Internet	x	x	x	x	
				Aromatic hydrocarbons						
				Mass spectra of some important chemical classes	Scientific papers, text books and Internet	x	x	x	x	
Intellectual Skills	2.2.1- Analyze and evaluate information in the field of specialization	B.1- Appraise critically the quality of data and information offered from	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	Scientific	x	x	x	x	

	and analogies to solve problems	different sources to solve problems.		palynology.	papers, text books and Internet					
				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	
			b3	All topics	Scientific papers, text books and Internet	x	x	x	x	
	2.2.2- Propose solutions to specified problems in	B.4- Advance , develop and modify the methods arise	b4	All topics	Scientific papers, text books and Internet	x	x	x	x	

	the light of the available data (information).	from instrumental techniques in the field of biotechnology.								
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	Scientific papers, text books and Internet		x			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: 2017/2018

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, terpenoids, 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 2 nd 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 activity
5	Acetate Pathway: Oxidative phenol coupling, Applications
6	Shikimate Pathway: Aromatic Amino Acids and Phenylpropanoids, Simple Phenols, Coumarins.
7	Shikimate Pathway : Flavonoids and anthocyanins
8	Shikimate Pathway : Anthraquinones
9	Shikimate Pathway : Other aromatics, Mixed Origin Compounds :
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	Open discussion about the course

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 4-12
Assessment (2): Written exam	Week 16
Assessment (3): oral exam	Week 16

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; Torssell, 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

Facilities required for teaching and learning:

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

Library, Labs.

Course Coordinators: Prof Dr/ Wafaa Hassan Badr

Head of Department: Prof Dr/ Azza El-Shafae

Date: 9/2017

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 Activity					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	Open discussion about the course	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-Illustrate in-depth knowledge and 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- 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
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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: 2017-2018

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	Understand 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	Recognize plant disease resistance.
b3	Recognize molecular pharming.
b4	Recognize metabolic engineering, metabolomics and proteomics
b5	Experience practical applications and problem solving.
General and transferable skills	
d1	Transfer the very high capacity of the data streams that are producing data for molecular biology
d2	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 Activity
6	Techniques for plant transformation A) <i>Agrobacterium</i> - based techniques
7	Techniques for plant transformation B) Non- <i>Agrobacterium</i> - 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	Practical applications and problem solving

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 5-9
Assessment (2): Written exam	Week 16
Assessment (3): oral exam	Week 16

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 : Azza El-Shafae

Date : 9 / 2017

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	b5	d1	d2	
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 Activity		x									x	X	
6	Techniques for plant transformation A) Agrobacterium- based techniques			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	Practical applications and problem solving						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-Illustrate 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 vector-related technologies	Scientific papers, text books and Internet	x	X	x	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 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	Herbicide tolerance and pest resistance- Practical applications and problem solving	Scientific papers, text books and Internet	x	X	x	x	
			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- 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 as a member and lead a team of workers.	D.6- Work effectively as a member and a leader of a team.	d2	activity	Scientific papers, text books and Internet	x				x

PhD Thesis Specification

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: 2017/2018

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
1 st	Suggest the possible points/ problems of research that the candidate can work on in the frame of the aim of work and

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

	<p>protocol.</p> <p>Apply ethical recommendations in all aspects of scientific research e.g. citation, publication.....</p>
3 rd	<p>Select some of the compounds for their pharmacological or microbiological activities.</p> <p>Interpret the biological results.</p> <p>Perform statistical analysis and biological correlation for the results.</p> <p>Present and describe the results graphically.</p> <p>Understand any legal aspects related to the thesis work.</p>
4 th	<p>Communicate with supervisors to discuss results.</p> <p>Work effectively as a member of a team (e.g. Supervisors and various professionals).</p> <p>Present the results periodically in semiARS.</p> <p>Write scientific reports on the obtained results with conclusive significance.</p> <p>Discuss obtained results in comparison with pervious literatures.</p> <p>Suggest possible recommendations based on the outcome of the thesis and decide future plans.</p> <p>Present the thesis in a written form.</p> <p>Summarize the thesis in an understandable Arabic language for non professionals.</p> <p>Write references in the required form (Thesis, Paper.....).</p> <p>Demonstrate the thesis in a final power point presentation.</p> <p>Continue self-learning throughout the experimental work and writing scientific papers.</p>

5- Teaching and Learning Methods:

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

6- References:

- Websites: Pubmed, Sciencedirect, Wileyinterscience

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

Head of Department: Prof. Dr. Azza El-Shaf

Program Matrix of PhD degree of Pharmacognosy

Program courses	Program ILOs																																		
	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
Advanced Spectroscopy		X							X			X																	X	X					
Biosynthesis of natural products	X										X																				X				
Advanced Natural Products Biotechnology			X								X																	X						X	
Thesis	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X