



Course Specifications (Postgraduate Degree)

Course Title:	Biochemical Methodology
Course Code:	BCH 530
Program:	Master (MSc)
Department:	Biochemistry Department
College:	College of Science
Institution:	King Saud University

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A. Course Identification

1. Credit hours: 3 (0+3)
2. Course type <input checked="" type="checkbox"/> Required <input type="checkbox"/> Elective
3. Level/year at which this course is offered: Postgraduate (MSc)
4. Pre-requisites for this course (if any): None
5. Co-requisites for this course (if any): None

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	6	100 %
2	Blended		
3	E-learning		
4	Correspondence		
5	Other		

7. Actual Learning Hours (based on academic semester)

No	Activity	Learning Hours
Contact Hours		
1	Lecture	
2	Laboratory/Studio	6 h / 14 weeks = 84
3	Seminars	
4	Others (specify)	
	Total	84

* The length of time that a learner takes to complete learning activities that lead to achievement of course learning outcomes, such as study time, homework assignments, projects, preparing presentations, library times

B. Course Objectives and Learning Outcomes

1. Course Description

This course is designed to provide an introductory experience to conducting experiments in a biochemistry laboratory. The course covers a broad spectrum of modern techniques and their principles. Biochemical tools and concepts are at the core of recent advances in protein biochemistry.

Extraction, homogenization and Centrifugation: sub-cellular fractionation,

- Spectrometry: spectrophotometry

- Chromatography: purification of proteins, affinity and/or ion exchange, hydrophobic chromatography.

- Electrophoresis: polyacrylamide gel electrophoresis (e.g. LDH isozymes), SDS-polyacrylamide gel electrophoresis (molecular weight determination) Immunoelectrophoresis.

2. Course Main Objective

1. To give students hands-on experience with the various basic Biochemical techniques.

2. Apply scientific principles and methodologies in scientific investigations.

3. To teach students necessary skills for conducting their own research projects, and interpret and present their scientific.

4. To teach students to purify, characterize and identify selected enzymes via utilization of the various protein purification strategies.
5. To teach students with necessary skills to express data in the form of tables, figures, schematic graph, and/or text.
6. To acquaint students with the latest computing skills and/or relevant software for text processing, data analysis, graphing, and documentation.
7. To promote critical thinking and derive conclusions from their assigned project or experiment.

3. Course Learning Outcomes

Course Learning Outcomes (CLOs)		Aligned PLOs*
1	Knowledge	
1.1	Student would become familiar with conventional and/or advanced protein isolation, purification and characterization techniques.	K1
1.2	Students will have hands on experience on the use of : Spectroscopy, fluorescence, chromatographic techniques, electrophoretic techniques (Native, SDS-PAGE, and iso-electric focusing) and Understand enzyme kinetics and/or mechanisms	K3-K4
2	Skills	
2.1	Students will be able discuss, explain, emphasize, and illustrate strategies of protein separation.	S1
2.2	Students will develop the ability to understand the various biochemical properties of protein	S1
2.3	Students will be able to discuss, explain, and illustrate the principles of the various techniques used.	S3
2.4	Analyze papers collected through literature search	S3
2.5	Conduct critical analysis of basic research protocols	S2
2.6	Develop scientific writing and presentation skills	S5
2.7	Develop skills to integrate theoretical knowledge in conducting their own research.	S4
3	Values	
3.1	Ability to study independently	V1
3.2	Ability to work as member of a team	V1
3.3	Ability to use internet to search for information	V4

* Program Learning Outcomes

C. Course Content

No	List of Topics	Contact Hours
1	Introduction How to search/cite literature Identify various purification procedures for protein of interest PubMed search for the given key words; retrieve full text publications; read, check the materials required and save in pdf format	6
2	Protein Extraction Homogenization	6
3	Introduction to Spectrophotometry Protein assay methods	6

	Determination of protein by UV absorption, extinction coefficient and colorimetric methods and their comparison	
4	Protein purification methods Use of various techniques such as gel filtration (Mol. Wt. and desalting), ion-exchange and affinity chromatography Purification lactate dehydrogenase/acid phosphatase Separation of protein by ion exchange; gel filtration and affinity chromatography. Enzyme assay	6
5	Introduction electrophoresis and separation of proteins by native polyacrylamide gel electrophoresis (PAGE), SDS-PAGE, iso-electric focusing (IEF). Separation of proteins on PAGE, SDS-PAGE (sub unit mol. Wt. determination) and IEF for isoelectric point determination	6
6	Characterization of partially purified LDH	3
7	Study enzyme characterization – Study the effect of pH, temperature, substrate concentration, enzyme concentration on enzyme activity	3
8	Enzyme kinetics Determination of K_m and V_{max} of an enzyme	6
9	Determination of an enzyme inhibition constant K_i of two inhibitors and type of inhibition	6
Total		48

D. Teaching and Assessment

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

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	Knowledge		
1.1	Student should become familiar with conventional and/or advanced protein isolation, purification and characterization.	<ul style="list-style-type: none"> Students will be assigned individually to carry out compete purification scheme of a protein, where the student will be responsible for the efficacy of the sequential purification steps, and will be evaluated by analyzing purification table. Email questions are encouraged and could be answered them in class if the answer is lengthy. 	<ul style="list-style-type: none"> Assessing the capability of student to carry out experiment Evaluation of results versus expected ones. Written reports about the results Oral exams and quizzes.
1.2	Students will also use several techniques for protein characterization including: Spectroscopy, fluorescence, chromatographic techniques, electrophoretic techniques (Native, SDS-PAGE, and iso-electric focusing) and enzyme kinetics and/or mechanisms		

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
		<ul style="list-style-type: none"> Student will be responsible to characterize their proteins of choice for: Molecular weight determination, enzyme activity & kinetics as well as the strategies for determining spectroscopic parameters via well-designed experiments 	
2.0	Skills		
2.1	Students will be able to discuss, explain, emphasize, and illustrate strategies of protein purification.	<ul style="list-style-type: none"> Power-point presentation Reading literature Quizzes and examples Evaluation of Literature for appropriate methods 	<ul style="list-style-type: none"> Assessing the capability of student to design an experiment Evaluation of student's ability to appreciate a technique Oral exams and quizzes
2.2	Students will be able to choose techniques for protein purification and characterization.		
2.3	Students will be able to discuss, explain, and illustrate the principles of the various used techniques.		
2.4	Analyze papers collected through literature search		
2.5	Conduct critical analysis of basic research protocols		
2.6	Develop scientific writing and presentation skills		
2.7	Develop skills on how to apply the information gained theoretically in conducting their own research.		
3.0	Values		
3.1	Ability to study independently	<p>Hands on training with all items of the course</p>	<ul style="list-style-type: none"> Students are given assignments which they have to hand in on specific dates Students make presentations and are asked to critically evaluate each other. Reports Quizzes Exams
3.2	Ability to work as member of a team		
3.3	To use internet to search for information		

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Reports	Every week	30%
2	Oral exams	Every week	40%
3	Quizzes	Every week	10%
4	Attendance	Every week	10%
5	Poster	Last week	10%

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

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice:

Office hours 8 hrs./ week

F. Learning Resources and Facilities

1. Learning Resources

Required Textbooks	Protein Purification Methods: a practical approach (Harris & Angal, IRL Press), 1989.
Essential Reference Materials	<ul style="list-style-type: none"> • Hatti-Kaul, R., and Mattiasson, B. (2004). <i>Isolation and Purification of Proteins</i>. Marcel Dekker Inc., New York, NY. • Walker, John M. (2002). <i>The Protein Protocols Handbook</i>, 2nd edition. Humana Press, Inc., Totowa, NJ. • Doonan, Shawn, ed. (1996) <i>Protein Purification and Protocols. Methods in Molecular Biology</i>, 59, Humana Press, Inc., Totowa, NJ. • Janson, J-C., and Rydén, L. (1989). <i>Protein Purification. Principles, High Resolution Methods, and Application</i>. VCH Publishers, Inc. • Jacoby, William B. (ed.) (1984). <i>Enzyme Purification and Related Techniques. Methods Enzymol.</i>, Vol. 104, Academic Press, San Diego, California. • Scopes, Robert K. (1994). <i>Protein Purification, Principles and Practice</i>, third Ed. Springer-Verlag, New York. • Ahmad, Hafiz (2005). <i>Principles and Reactions of Protein Extraction, Purification, and Characterization</i>. CRC Press (Taylor & Francis).
Electronic Materials	
Other Learning Materials	

2. Educational and research Facilities and Equipment Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	<ul style="list-style-type: none"> • Lecture room • laboratory
Technology Resources (AV, data show, Smart Board, software, etc.)	<ul style="list-style-type: none"> • A minimum of one computer
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	<ul style="list-style-type: none"> • Spectrophotometer • Spectrofluorometer • Electrophoresis apparatus • Various chromatography columns • Basic equipment such as blenders, centrifuges, etc. • Enzyme substrates, cofactors, other sigma chemicals etc

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Feedback on Effectiveness of Teaching	Students	Questionnaires and surveys
Evaluation of teaching and assessment Instructor or by the Department	- Instructor - The Department	- Peer consultation on teaching. - Departmental council discussion

Evaluation Areas/Issues (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)

Evaluators (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify))

Assessment Methods (Direct, Indirect)

H. Specification Approval Data

Council / Committee	Dr. Nikhat Siddiqi
Reference No.	
Date	2020-2021