

Speech of the Dean



The Faculty of Science aims to develop, enrich, and prepare highly qualified graduates by:

- Building a research educational institution capable of keeping abreast of the continuous and continuous development of the basic sciences and their various applications.
- Graduation of distinguished generations capable of competing in the labor market and assimilating advanced modern technology through academic standards and local and international reference marks.
- Continuing development and modernization of educational and research programs and the provision of high-level scientific programs in various fields, creating a climate conducive to research and creativity, encouraging research in general and applied research in particular.
- To play an effective role in the development of society through training programs, awareness, counseling and interaction between the faculty and the community.
- Working to create and develop international relations, especially Arab and African, through scientific and cultural exchanges.
- Deepening national loyalty and preserving the principles of society and noble human values

The mission of the Faculty of Science is to activate its potential to help the institutions of society overcome their challenges and to provide curricula with a deep academic dimension with a background that focuses on the scientific aspects needed by the institutions of the community. Academic studies are linked to the problems facing the society in order to advance the academic level.

The faculty provides the necessary resources for researchers and graduate students through libraries, museums and research laboratories in specialized departments and centers.

The Graduate Certificate Regulations were prepared for the first time in line with the system in developed countries, to continuously improve performance to achieve the desired benefit from postgraduate studies and to relate them to the research needs of the society.

Finally, I would like to thank Dr. Nagwa Abo El-Maali, Vice Dean for Graduate Studies for the outstanding effort in preparing this Bylaw and the outstanding attention in the preparation of research centers in the faculty. I would also like to thank all the faculty members for their continued support for the development of graduate programs. I also call on all students and interested in postgraduate studies to take advantage of this comprehensive guide which explains all matters related to postgraduate studies. I hope that this Bylaw will provide all useful information to serve our country, The Great Egypt.

Dean of the Faculty of Science

Prof. Hassan Mohamed Hassan El- Hawary

Speech of the Vice Dean for Graduate Studies and Research



The postgraduate studies aim at continuous work to increase and develop science and knowledge at the highest levels and to prepare specialized national competencies in various scientific fields to keep sustainable development plans, the vision of Egypt 2030 and to meet the needs of teaching and teaching staff.

In view of the importance of postgraduate studies for advanced societies, the faculty has sought to develop the Bylaw. The number of these programs is currently 83 programs. These programs include doctoral, master and diploma programs. The aim of the development is to push the educational process in line with the system of credit hours practiced in most countries of the world.

Ministerial Resolution No. (4833) on 27/9/2016 regarding the issuance of this Bylaw of the credit hours system and resolution no. (1766) dated 15/5/2018 regarding its amendment have been issued after the approval of the Assiut University Council and the Basic Sciences Sector Committee.

The aim of this Bylaw is to raise the scientific and practical efficiency of postgraduate diplomas in the applied fields of fine disciplines in the branches of multiple sciences, and new professional diplomas have been established according to the need to conform with the development of fields of work and application in different sciences.

It also aims to develop the research capabilities, scientific thinking and development of the master students in the branch, field and subject chosen by the student from the research plan of the faculty using modern techniques and methods through studying a number of advanced academic courses and carrying out academic and applied research through an integrated scientific message.

Students who receive theses acquire the skills related to the problems of society in Egypt and other modern technological subjects.

The doctoral study aims to develop independent thinking and the ability to innovate and develop and then add new science by following the scientific and technical research and deepening the research capacity developed at the master stage by conducting specialized research with precise specialization.

The scientific departments follow the students of the master's and doctorate in terms of progress in the search through supervisors and the Department of Graduate Studies so periodically report every six months. In order to encourage researchers in the faculty to publish the good science, we created an Award for research with the highest Impact Factor for the extracted research from their scientific theses.

Finally, I would like to thank all the faculty members for their continuous efforts to promote the teaching, doing basic and applied researches.

I ask Allah to achieve the benefit for this work to serve our beloved country Egypt,

Vice Dean for Graduate Studies and Research

Prof. Nagwa Thabet Abo El- Maali

The Faculty Vision

The Faculty of Science of Assiut University is looking forward to achieving a distinguished scientific position among the faculties of Egyptian science and to retaining and sustaining the society with distinguished graduates, who are able to create, enrich and compete locally and internationally.

The Faculty Mission

Faculty of Science - Assiut University is a foundation for higher education and scientific research in the field of basic sciences to achieve the mission of the university in accordance with the traditions and moral values by:

- Preparing generations of scientists and workers in scientific, research, educational and industrial centers.
- Provide the best educational services for students in the study of basic science for the bachelor stage to acquire the skills required in the specialization through educational programs according to local, global and national standards.
- Contribute to the advancement of mathematics, computer science, physical, chemical, biological and geological sciences through graduate programs and research.
- Utilizing its human resources, research potentials and consultancy expertise to contribute to solving the problems of the environment, serving the production and service sectors, and working on the development of society.
- Maintaining the distinctive feature of the college in its uniqueness in studies of the development of the South Valley and the implementation of projects in support of the exit policy from the narrow valley in southern Egypt.

Preface

The first Bylaw for graduate studies was issued in 1957 at the Faculty of Science, Assiut University and then the Postgraduate Research Studies began in 1958 and since that date, the faculty has been involved in the preparation of scientific cadres of faculty members and researchers in Egypt and the Arab world and some foreign universities and research centers.

The current Issue is aimed at the development of the Previous Internal Bylaw which was issued on 26/4/1994, and its amended on 24/9/1997, 16/8/1999, 10/10/2006, 20/7/2008, 11/7/2011 with the introduction of modern systems in postgraduate studies and research throughout Credit Hours system.

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Mathematics Programs

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	2- Bioinformatics		
	1- Pure Mathematics	M600	M.Sc.
	2- Applied Mathematics		
	3- Mathematical Statistics		
	4- Computer Science		
	5- Scientific Computing		
	1- Pure Mathematics	M700	Ph.D.
	2- Applied Mathematics		
	3- Mathematical Statistics		
	4- Computer Science		
	5- Scientific Computing		



Postgraduate Mathematics Diploma

1- Professional Diploma in Applied Statistics

Course Code	Number of Courses	Course Type	Credit Hours
M500	6 Courses (3 Courses/Semester)	Compulsory	18
	2 Courses (1 Course/Semester)	Elective	6
	Project	Compulsory	6
Total credit hours			30

	Course Code	Course Title	Hours/Week			Course Type
			L	T/P	C	
First Semester	M 501	Calculus and Numerical Computations	3	-	3	Compulsory
	MS501	Descriptive Statistics with Statistical Software	2	2	3	
	MS503	Statistical Methods I	3	-	3	
	MS505	Statistical Computing	2	2	3	Elective (select one)
	MS507	Regression and Linear Models	2	2	3	
	MS509	Medical Statistics	3	-	3	
	MS511	Operations Research	3	-	3	
	MS513	Statistical Quality Control	3	-	3	
Second Semester	M 502	Linear Algebra with Applications	3	-	3	Compulsory
	MS502	Statistical Methods II	3	-	3	
	MS504	Biostatistics with Statistical Software	2	2	3	
	MS506	Decision Making and Forecasting	3	-	3	Elective (select one)
	MS508	Analysis of Variance and Design of Experiments	2	2	3	
	MS510	Time Series Analysis	3	-	3	
	MS512	Demography	3	-	3	
MS514	Special Course in Statistics	3	-	3		

Postgraduate Computer Science Diploma

2- Professional Diploma in Bioinformatics

Course Code	Number of Courses	Course Type	Credit Hours
MC500	6 Courses (3 Courses/Semester)	Compulsory	18
	2 Courses (1 Course/Semester)	Elective	6
	Project	Compulsory	6
Total credit hours			30

	Course Code	Course Title	Hours/Week			Course Type
			L	T/P	C	
First Semester	MC521	Mathematical Biology	2	-	2	Compulsory
	MC523	Computation Biology Techniques	2	2	2	
	MC525	Bioinformatics (1)	2	2	3	
	MC527	Web Programming	2	2	3	Elective (select one)
	MC529	Biological Database	2	2	3	
	MC531	Python and Linux for Bioinformatics	2	2	3	
Second Semester	MC522	Introduction to Systems Biology	2	2	3	Compulsory
	MC524	Analyzing Next Generation Sequencing Data	2	2	3	
	MC526	Applied Statistics for Bioinformatics using R	2	2	3	
	MC528	Metabolic Engineering	2	2	3	Elective (select one)
	MC530	Computational Intelligence	2	2	3	
	MC532	Biological Data Mining	2	2	3	

M.Sc. Mathematics Programs

1- M.Sc. Degree in Pure Mathematics

Course Code	Number of Courses	Course Type	Credit Hours
M600	6 Courses (3 Courses/Semester)	Compulsory	18
	2 Courses (1 Course/Semester)	Elective	6
	Seminars	Compulsory	2
	Thesis	Compulsory	22
Total credit hours			48

	Course Code	Course Title	Hours/Week			Course Type
			L	T/P	C	
First Semester	M601	Linear Algebra I	3	-	3	Compulsory
	M603	Numerical Analysis I	3	-	3	
	M605	Functional Analysis	3	-	3	
	M607	Calculus of Variations	3	-	3	Elective (select one)
	M609	Differential Geometry I	3	-	3	
	M611	Fuzzy Mathematics	3	-	3	
	M613	Special Functions	3	-	3	
M615	Special Course	3	-	3		
Second Semester	M602	Topology I	3	-	3	Compulsory
	M604	Partial Differential Equations I	3	-	3	
	M606	Discrete Mathematics	3	-	3	
	M608	Topics in Analysis I	3	-	3	Elective (select one)
	M610	Dynamical Systems I	3	-	3	
	M612	Operations Research I	3	-	3	
	M614	Selected Topics Related to Pure Mathematics	3	-	3	
	MC600	Practical (Computer)	3	-	3	

2- M.Sc. Degree in Applied Mathematics

Course Code	Number of Courses	Course Type	Credit Hours
M600	6 Courses (3 Courses/Semester)	Compulsory	18
	2 Courses (1 Course/Semester)	Elective	6
	Seminars	Compulsory	2
	Thesis	Compulsory	22
Total credit hours			48

	Course Code	Course Title	Hours/Week			Course Type
			L	T/P	C	
First Semester	M603	Numerical Analysis I	3	-	3	Compulsory
	M617	Fluid Mechanics I	3	-	3	
	M619	Mathematical methods I	3	-	3	
	M621	Mechanics of Continuous media I	3	-	3	Elective (select one)
	M623	Elasticity theory I	3	-	3	
	M625	Electrodynamics I	3	-	3	
	M627	Statistical Mechanics I	3	-	3	
M629	Special course	3	-	3		
Second Semester	M616	Advanced Quantum mechanics I	3	-	3	Compulsory
	MC618	Computational method in applied mathematics I	3	-	3	
	M620	Electromagnetic theory I	3	-	3	
	M622	Quantum electrodynamics I	3	-	3	Elective (select one)
	M624	Quantum Optics I	3	-	3	
	M626	Mathematical Modeling	3	-	3	
	M628	Selected Topics Related to Applied Mathematics	3	-	3	
MC600	Practical (Computer)	3	-	3		

3- M.Sc. Degree in Mathematical Statistics

Course Code	Number of Courses	Course Type	Credit Hours
M600	6 Courses (3 Courses/Semester)	Compulsory	18
	2 Courses (1 Course/Semester)	Elective	6
	Seminars	Compulsory	2
	Thesis	Compulsory	22
Total credit hours			48

	Course Code	Course Title	Hours/Week			Course Type
			L	T/P	C	
First Semester	MS601	Mathematical Statistics I	3	-	3	Compulsory
	MS603	Order Statistics	3	-	3	
	M601	Linear Algebra I	3	-	3	
	MS605	Sampling Theory	3	-	3	Elective (select one)
	MS607	Nonparametric Statistics	3	-	3	
	MS609	Regression Analysis	3	-	3	
	M603	Numerical Analysis I	3	-	3	
	MS611	Special Coerce	3	-	3	
Second Semester	MS602	Mathematical Statistics II	3	-	3	Compulsory
	MS604	Bayesian Statistics	3	-	3	
	MS606	Computational Statistics	3	-	3	
	MS608	Stochastic Processes	3	-	3	Elective (select one)
	M612	Operations Research I	3	-	3	
	MS610	Queuing Theory	3	-	3	
	MS612	Selected Topics related to Mathematical Statistics	3	-	3	
	MC600	Practical (Computer)	3	-	3	

4- M.Sc. Degree in Computer Science

Course Code	Number of Courses	Course Type	Credit Hours
M600	6 Courses (3 Courses/Semester)	Compulsory	18
	2 Courses (1 Course/Semester)	Elective	6
	Seminars	Compulsory	2
	Thesis	Compulsory	22
Total credit hours			48

	Course Code	Course Title	Hours/Week			Course Type
			L	T/P	C	
First Semester	MC601	Computational Intelligence	3	-	3	Compulsory
	M601	Linear Algebra I	3	-	3	
	M603	Numerical Analysis I	3	-	3	
	MC603	Advanced Algorithms	3	-	3	Elective (select one)
	MC605	Network Security	3	-	3	
	MC607	Advanced Theory of Computation	3	-	3	
	MC609	Scientific Information Visualization	3	-	3	
MC611	Special Course	3	-	3		
Second Semester	MC602	High – Performance Computing	3	-	3	Compulsory
	MS606	Computational Statistics	3	-	3	
	M606	Discrete Mathematics	3	-	3	
	M612	Operations Research I	3	-	3	Elective (select one)
	M626	Mathematical Modeling	3	-	3	
	MC604	Advanced Image Processing	3	-	3	
	MC606	Selected Topics related to Computer Science	3	-	3	
MC600	Practical (Computer)	3	-	3		

5- M.Sc. Degree in Scientific Computing

Course Code	Number of Courses	Course Type	Credit Hours
M600	6 Courses (3 Courses/Semester)	Compulsory	18
	2 Courses (1 Course/Semester)	Elective	6
	Seminars	Compulsory	2
	Thesis	Compulsory	22
Total credit hours			48

	Course Code	Course Title	Hours/Week			Course Type
			L	T/P	C	
First Semester	MC601	Computational Intelligence	3	-	3	Compulsory
	M601	Linear Algebra I	3	-	3	
	M603	Numerical Analysis I	3	-	3	
	MC603	Advanced Algorithms	3	-	3	Elective (select one)
	MC607	Advanced Theory of Computation	3	-	3	
	MC609	Scientific Information Visualization	3	-	3	
	MC613	Introduction to Finite Element Methods	3	-	3	
MC615	Special Course	3	-	3		
Second Semester	MC602	High – Performance Computing	3	-	3	Compulsory
	MS606	Computational Statistics	3	-	3	
	M606	Discrete Mathematics	3	-	3	
	M612	Operations Research I	3	-	3	Elective (select one)
	M626	Mathematical Modeling	3	-	3	
	MC608	Computational Fluid Dynamics	3	-	3	
	MC610	Selected Topics related to Scientific Computing	3	-	3	
MC600	Practical (Computer)	3	-	3		

Ph.D. Mathematics Program

1- Ph.D. Degree in Pure Mathematics

Course Code	Number of Courses	Course Type	Credit Hours
M700	4 Courses (2 Course/Semester)	Elective	12
	Seminars	Compulsory	4
	Thesis	Compulsory	44
Total credit hours			60

Course Code	Course Title	Hours/Week			Course Type
		L	T/P	C	
M701	Complex analysis	3	-	3	Elective (select two courses each semester)
M702	General Relativity	3	-	3	
M703	Number theory	3	-	3	
M704	Algebraic geometry	3	-	3	
M705	Operation Research II	3	-	3	
M706	Numerical analysis II	3	-	3	
M707	Dynamical systems II	3	-	3	
M708	Partial Differential Equations II	3	-	3	
M709	Lie algebra	3	-	3	
M710	Harmonic analysis	3	-	3	
M711	Optimization theory	3	-	3	
M712	Riemannian geometry	3	-	3	
M713	Topology II	3	-	3	
M714	Differential Equations	3	-	3	
M715	Numerical Linear Algebra	3	-	3	
M716	Information geometry	3	-	3	
M717	Topics in Analysis II	3	-	3	
M718	Integral Equations	3	-	3	
M719	Selected Topics related to Mathematical Logic	3	-	3	
M720	Differential Geometry II	3	-	3	
M721	Special Course I	3	-	3	

2- Ph.D. Degree in Applied Mathematics

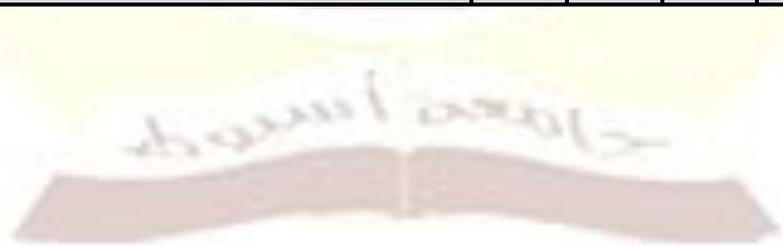
Course Code	Number of Courses	Course Type	Credit Hours
M700	4 Courses (2 Course/Semester)	Elective	12
	Seminars	Compulsory	4
	Thesis	Compulsory	44
Total credit hours			60

Course Code	Course Title	Hours/Week			Course Type
		L	T/P	C	
M706	Numerical analysis II	3	-	3	Elective (select two courses each semester)
M718	Integral Equations	3	-	3	
M722	Fluid Mechanics II	3	-	3	
M723	Advanced Quantum mechanics II	3	-	3	
M724	Mathematical methods II	3	-	3	
M725	Elasticity theory II	3	-	3	
M726	Computational method in applied Mathematics II	3	-	3	
M727	Electrodynamics II	3	-	3	
M728	Statistical Mechanics II	3	-	3	
M729	Nonlinear Dynamical Systems	3	-	3	
M730	Electromagnetic theory II	3	-	3	
M731	Quantum electrodynamics II	3	-	3	
M732	Theory of Relativistic Quantum Mechanics	3	-	3	
M733	Special Course II	3	-	3	
M734	Selected Topics related to Applied Mathematical	3	-	3	

3- Ph.D. Degree in Mathematical Statistics

Course Code	Number of Courses	Course Type	Credit Hours
M700	4 Courses (2 Course/Semester)	Elective	12
	Seminars	Compulsory	4
	Thesis	Compulsory	44
Total credit hours			60

Course Code	Course Title	Hours/Week			Course Type
		L	T/P	C	
MS701	Advanced Probability	3	-	3	Elective (select two courses each semester)
MS702	Multivariate Statistical Analysis	3	-	3	
MS703	Time Series Analysis	3	-	3	
MS704	Stochastic Differential equation	3	-	3	
MS705	Fuzzy probability and Statistics	3	-	3	
MS706	Nonlinear Regression Analysis	3	-	3	
MS707	Advanced Biostatistics	3	-	3	
MS708	Experimental Design	3	-	3	
MS709	Reliability and Life testing	3	-	3	
MS710	Special Course	3	-	3	
M705	Operation Research II	3	-	3	
M711	Optimization theory	3	-	3	
M718	Integral Equations	3	-	3	
MS711	Selected Topics related to Mathematical Statics	3	-	3	



4- Ph.D. Degree in Computer Science

Course Code	Number of Courses	Course Type	Credit Hours
M700	4 Courses (2 Course/Semester)	Elective	12
	Seminars	Compulsory	4
	Thesis	Compulsory	44
Total credit hours			60

Course Code	Course Title	Hours/Week			Course Type
		L	T/P	C	
M706	Numerical Analysis II	3	-	3	Elective (select two courses each semester)
MC701	Advanced Computational Geometry	3	-	3	
M716	Information Geometry	3	-	3	
MS701	Advanced Probability	3	-	3	
MS702	Multivariate Statistical Analysis	3	-	3	
MS705	Fuzzy probability and Statistics	3	-	3	
MS706	Nonlinear Regression Analysis	3	-	3	
MC702	Nonlinear Optimization	3	-	3	
MC703	Computational Complexity Theory	3	-	3	
MC704	Distributed and Parallel Computing	3	-	3	
MC705	Data Mining and Knowledge Discovery	3	-	3	
MC706	Advanced Artificial Intelligence	3	-	3	
MC707	Advanced Cryptoghy	3	-	3	
MC708	Software Reliability Engineering	3	-	3	
MC709	Information Theory	3	-	3	
MS707	Advanced Biostatistics	3	-	3	
MC710	Special Course I	3	-	3	
MC718	Selected Topics related to Computer Science	3	-	3	

5- Ph. D. Degree in Scientific Computing

Course Code	Number of Courses	Course Type	Credit Hours
M700	4 Courses (2 Course/Semester)	Elective	12
	Seminars	Compulsory	4
	Thesis	Compulsory	44
Total credit hours			60

Course Code	Course Title	Hours/Week			Course Type
		L	T/P	C	
M 706	Numerical Analysis II	3	-	3	Elective (select two courses each semester)
M 718	Integral Equations	3	-	3	
MC 701	Advanced Computational Geometry	3	-	3	
MC 705	Data Mining and Knowledge Discovery	3	-	3	
MC 711	Parallel Computations for large-scale problems	3	-	3	
MC 712	Computational Biology	3	-	3	
MC 713	Numerical Methods for Time-Dependent Partial Differential Equations	3	-	3	
MC 702	Nonlinear Optimization	3	-	3	
MC 714	Quantum Computing	3	-	3	
MC 704	Distributed and Parallel Computing	3	-	3	
MC 715	Bioinformatics and Genomics	3	-	3	
MC 716	Computational Methods for Finance	3	-	3	
MC 717	Special Course II	3	-	3	
MC719	Selected Topics related to Scientific Computing	3	-	3	

Physics Programs

Notice	Programs	Code	Degree
	1- Medical Physics	P500	Diploma
	1- Solid State Physics	P600	M.Sc.
	2- Nanomaterials		
	3- Nuclear Physics		
	4- Radiation Physics		
	5- Plasma Physics		
	6- Laser Physics		
	7- Theoretical Physics		
	8- Medical Physics		
	1- Solid State Physics	P700	Ph.D.
	2- Nanomaterials		
	3- Nuclear Physics		
	4- Radiation Physics		
	5- Plasma Physics		
	6- Laser Physics		
	7- Theoretical Physics		

Postgraduate Physics Diploma

1- Diploma in Medical Physics

Course Code	Number of Courses	Course Type	Credit Hours
P500	6 Courses (3 Courses/Semester)	Compulsory	18
	2 Courses (1 Course/Semester)	Elective	6
	Project	Project	6
Total credit hours			30

	Course Code	Course Title	Hours/Week			Course Type
			L	T/P	C	
First Semester	MD501	Basic Human Anatomy and Physiology	3	-	3	Compulsory
	P503	Principles of Medical Imaging	3	-	3	
	P505	Introduction to Nuclear Medicine	3	-	3	
	P507	Radiation Therapy	3	-	3	Elective (select one)
	P509	Medical Accelerators	3	-	3	
	P511	Radiation Physics and Protection	3	-	3	
Second Semester	MD502	Medical Training	3	-	3	Compulsory
	P504	Fundamentals of Radiological Sciences	3	-	3	
	P506	Computation and Image Processing	3	-	3	
	P508	Selected Topics Related to Medical Physics	3	-	3	Elective (select one)
	P510	Clinical Dosimetry Measurements	3	-	3	

M.Sc. Physics Programs

1- M.Sc. Degree in Solid State Physics

Course Code	Number of Courses	Course Type	Credit Hours
P600	6 Courses (3 Courses/Semester)	Compulsory	18
	2 Courses (1 Course/Semester)	Elective	6
	Seminars	Compulsory	2
	Thesis	Compulsory	22
Total credit hours			48

	Course Code	Course Title	Hours/Week			Course Type
			L	T/P	C	
First Semester	P601	Electromagnetic Theory I	3	-	3	Compulsory
	P603	Quantum Mechanics I	3	-	3	
	M603	Numerical Analysis I	3	-	3	
	P605	Advanced Electronics	3	-	3	Elective (select one)
	P607	Magnetic Resonance	3	-	3	
	P609	Methods of Experimental Solid State Physics	3	-	3	
	P611	Physics of Metals and Alloys	3	-	3	
	P613	Semiconductor Properties and Applications	3	-	3	
Second Semester	P602	Condensed Matter Physics	3	-	3	Compulsory
	P604	Crystal Structure	3	-	3	
	P606	Statistical Physics	3	-	3	
	P608	Selected Topics Related to Solid State Physics	3	-	3	Elective (select one)
	P610	Thermal Analysis	3	-	3	
	P612	Thin Films and Technological Applications	3	-	3	
	P614	Introduction of Nanomaterials	3	-	3	

2- M.Sc. Degree in Nanomaterials

Course Code	Number of Courses	Course Type	Credit Hours
P600	6 Courses (3 Courses/Semester)	Compulsory	18
	2 Courses (1 Course/Semester)	Elective	6
	Seminars	Compulsory	2
	Thesis	Compulsory	22
Total credit hours			48

	Course Code	Course Title	Hours/Week			Course Type
			L	T/P	C	
First Semester	P601	Electromagnetic Theory I	3	-	3	Compulsory
	P603	Quantum Mechanics I	3	-	3	
	M603	Numerical Analysis I	3	-	3	
	P607	Magnetic Resonance	3	-	3	Elective (select one)
	P609	Methods of Experimental Solid State Physics	3	-	3	
	P615	Semiconductor Devices	3	-	3	
	P617	Quantum Dots	3	-	3	
	CP601	Organic Chemistry for Physicist	3	-	3	
Second Semester	P606	Statistical Physics	3	-	3	Compulsory
	P614	Introduction of Nanomaterials	3	-	3	
	P616	Synthesis and Characterizations of Nanomaterials	3	-	3	
	P602	Condensed Matter Physics	3	-	3	Elective (select one)
	P664	Selected Topics Related to Nanomaterials	3	-	3	
	P612	Thin Films and Technological Applications	3	-	3	
	P618	Nanocomposites	3	-	3	
	CP602	Inorganic Chemistry for Physicist	3	-	3	

3- M.Sc. Degree in Nuclear Physics

Course Code	Number of Courses	Course Type	Credit Hours
P600	6 Courses (3 Courses/Semester)	Compulsory	18
	2 Courses (1 Course/Semester)	Elective	6
	Seminars	Compulsory	2
	Thesis	Compulsory	22
Total credit hours			48

	Course Code	Course Title	Hours/Week			Course Type
			L	T/P	C	
First Semester	P601	Electromagnetic Theory I	3	-	3	Compulsory
	P603	Quantum Mechanics I	3	-	3	
	M603	Numerical Analysis I	3	-	3	
	P619	Accelerators and Reactors Physics	3	-	3	Elective (select one)
	P621	Methods of Experimental Nuclear Physics	3	-	3	
	P623	Elementary Particles	3	-	3	
	P625	Methods of Mathematical Physics	3	-	3	
Second Semester	P606	Statistical Physics	3	-	3	Compulsory
	P620	Nuclear Structure I	3	-	3	
	P622	Nuclear Reactions I	3	-	3	
	P666	Selected Topics Related to Nuclear Physics	3	-	3	Elective (select one)
	P624	Physics of Nuclear Medicine & Instrumentations	3	-	3	
	P626	Quantum Field Theory	3	-	3	
	P628	Radiation Physics	3	-	3	
	M626	Mathematical Modeling	3	-	3	

4- M.Sc. Degree in Radiation Physics

Course Code	Number of Courses	Course Type	Credit Hours
P600	6 Courses (3 Courses/Semester)	Compulsory	18
	2 Courses (1 Course/Semester)	Elective	6
	Seminars	Compulsory	2
	Thesis	Compulsory	22
Total credit hours			48

	Course Code	Course Title	Hours/Week			Course Type
			L	T/P	C	
First Semester	P601	Electromagnetic Theory I	3	-	3	Compulsory
	P603	Quantum Mechanics I	3	-	3	
	M603	Numerical Analysis I	3	-	3	
	P607	Magnetic Resonance	3	-	3	Elective (select one)
	P619	Accelerators and Reactors Physics	3	-	3	
	P621	Methods of Experimental Nuclear Physics	3	-	3	
	P625	Methods of Mathematical Physics	3	-	3	
Second Semester	P606	Statistical Physics	3	-	3	Compulsory
	P628	Radiation Physics	3	-	3	
	P630	Neutron Physics I	3	-	3	
	P668	Selected Topics Related to Radiation Physics	3	-	3	Elective (select one)
	P620	Nuclear Structure I	3	-	3	
	P622	Nuclear Reactions I	3	-	3	
	P624	Physics of Nuclear Medicine & Instrumentations	3	-	3	
	M626	Mathematical Modeling	3	-	3	

5- M.Sc. Degree in Plasma Physics

Course Code	Number of Courses	Course Type	Credit Hours
P600	6 Courses (3 Courses/Semester)	Compulsory	18
	2 Courses (1 Course/Semester)	Elective	6
	Seminars	Compulsory	2
	Thesis	Compulsory	22
Total credit hours			48

	Course Code	Course Title	Hours/Week			Course Type
			L	T/P	C	
First Semester	P601	Electromagnetic Theory I	3	-	3	Compulsory
	P603	Quantum Mechanics I	3	-	3	
	M603	Numerical Analysis I	3	-	3	
	P607	Magnetic Resonance	3	-	3	Elective (select one)
	P613	Semiconductor Properties and Applications	3	-	3	
	P625	Methods of Mathematical Physics	3	-	3	
	P627	Physical Electronics	3	-	3	
Second Semester	P606	Statistical Physics	3	-	3	Compulsory
	P632	Plasma Physics	3	-	3	
	P634	Physics of Corona Discharge	3	-	3	
	P670	Selected Topics Related to Plasma Physics	3	-	3	Elective (select one)
	P636	Methods of Experimental Plasma Physics	3	-	3	
	P638	Gas Discharge	3	-	3	
	P640	Plasma Physics Applications	3	-	3	
	M626	Mathematical Modeling	3	-	3	

6- M.Sc. Degree in Laser Physics

Course Code	Number of Courses	Course Type	Credit Hours
P600	6 Courses (3 Courses/Semester)	Compulsory	18
	2 Courses (1 Course/Semester)	Elective	6
	Seminars	Compulsory	2
	Thesis	Compulsory	22
Total credit hours			48

	Course Code	Course Title	Hours/Week			Course Type
			L	T/P	C	
First Semester	P601	Electromagnetic Theory I	3	-	3	Compulsory
	P603	Quantum Mechanics I	3	-	3	
	M603	Numerical Analysis I	3	-	3	
	P607	Magnetic Resonance	3	-	3	Elective (select one)
	P613	Semiconductor Properties and Applications	3	-	3	
	P625	Methods of Mathematical Physics	3	-	3	
Second Semester	P606	Statistical Physics	3	-	3	Compulsory
	P642	Laser Physics and Quantum Electronics	3	-	3	
	P644	Laser Applications	3	-	3	
	P672	Selected Topics Related to Laser Physics	3	-	3	Elective (select one)
	P646	Methods of Experimental Laser Physics	3	-	3	
	P648	Laser Physics and Technology	3	-	3	
	M626	Mathematical Modeling	3	-	3	

7- M.Sc. Degree in Theoretical Physics

Course Code	Number of Courses	Course Type	Credit Hours
P600	6 Courses (3 Courses/Semester)	Compulsory	18
	2 Courses (1 Course/Semester)	Elective	6
	Seminars	Compulsory	2
	Thesis	Compulsory	22
Total credit hours			48

	Course Code	Course Title	Hours/Week			Course Type
			L	T/P	C	
First Semester	P601	Electromagnetic Theory I	3	-	3	Compulsory
	P603	Quantum Mechanics I	3	-	3	
	M603	Numerical Analysis I	3	-	3	
	P625	Methods of Mathematical Physics	3	-	3	Elective (select one)
	P629	High temperature – High pressure Physics	3	-	3	
	P631	Shock Waves and Detonation	3	-	3	
	P633	Equation of State	3	-	3	
Second Semester	P606	Statistical Physics	3	-	3	Compulsory
	P674	Selected Topics Related to Theoretical Physics	3	-	3	
	P650	Computational Physics	3	-	3	
	P604	Crystal Structure	3	-	3	Elective (select one)
	P620	Nuclear Structure I	3	-	3	
	P622	Nuclear Reactions I	3	-	3	
	P652	Dense Fluids Physics	3	-	3	
	M604	Partial Differential Equations I	3	-	3	

8- M.Sc. Degree in Medical Physics

Course Code	Number of Courses	Course Type	Credit Hours
P600	6 Courses (3 Courses/Semester)	Compulsory	18
	2 Courses (1 Course/Semester)	Elective	6
	Seminars	Compulsory	2
	Thesis	Compulsory	22
Total credit hours			48

	Course Code	Course Title	Hours/Week			Course Type
			L	T/P	C	
First Semester	MD601	Human Anatomy and Physiology	3	-	3	Compulsory
	P635	Nuclear Medicine	3	-	3	
	P637	Radiation Detection and Measurements	3	-	3	
	P619	Accelerators and Reactors Physics	3	-	3	Elective (select one)
	P639	Experimental Methods in Radiation Detection	3	-	3	
	P641	Applications of Laser in Medicine	3	-	3	
Second Semester	P654	Medical Imaging	3	-	3	Compulsory
	P656	Radiobiology and Radiotherapy	3	-	3	
	P658	Biostatistics and Computer Simulation	3	-	3	
	P676	Selected Topics Related to Medical Physics	3	-	3	Elective (select one)
	P660	Radiation Dosimetry	3	-	3	
	P662	Radiation Protection	3	-	3	

Ph.D. Physics Programs

1- Ph.D. Degree in Solid State Physics

Course Code	Number of Courses	Course Type	Credit Hours
P700	4 Courses (2 Course/Semester)	Elective	12
	Seminars	Compulsory	4
	Thesis	Compulsory	44
Total credit hours			60

Course Code	Course Title	Hours/Week			Course Type
		L	T/P	C	
P701	Selected Topics Related to Solid State Physics	3	-	3	Elective (select two courses each semester)
P702	Advanced Condensed Matter Physics	3	-	3	
P703	Electromagnetic Theory II	3	-	3	
P704	Quantum Mechanics II	3	-	3	
P705	Molecular Spectroscopy	3	-	3	
P706	Applied Magnetic Materials	3	-	3	
P707	Ceramic Materials	3	-	3	
P708	Advanced Functional Materials	3	-	3	
M706	Numerical Analysis II	3	-	3	

2- Ph.D. Degree in Nanomaterials

Course Code	Number of Courses	Course Type	Credit Hours
P700	4 Courses (2 Course/Semester)	Elective	12
	Seminars	Compulsory	4
	Thesis	Compulsory	44
Total credit hours			60

Course Code	Course Title	Hours/Week			Course Type
		L	T/P	C	
P702	Advanced Condensed Mater Physics	3	-	3	Elective (select two courses each semester)
P706	Applied Magnetic Materials	3	-	3	
P707	Ceramic materials	3	-	3	
P708	Advanced Functional Materials	3	-	3	
P709	Advanced Fine Particle Engineering	3	-	3	
P710	Advanced Semiconductor Devices	3	-	3	
P724	Selected Topics Related to Nanomaterials	3	-	3	
BP701	Biological Science	3	-	3	

3- Ph.D. Degree in Nuclear Physics

Course Code	Number of Courses	Course Type	Credit Hours
P700	4 Courses (2 Course/Semester)	Elective	12
	Seminars	Compulsory	4
	Thesis	Compulsory	44
Total credit hours			60

Course Code	Course Title	Hours/Week			Course Type
		L	T/P	C	
P704	Quantum Mechanics II	3	-	3	Elective (select two courses each semester)
P711	Nuclear Structure II	3	-	3	
P712	Nuclear Reactions II	3	-	3	
P713	Accelerators and Reactors Physics II	3	-	3	
P714	Elementary Particle Physics II	3	-	3	
P726	Selected Topics Related to Nuclear Physics	3	-	3	
M706	Numerical Analysis II	3	-	3	

4- Ph.D. Degree in Radiation Physics

Course Code	Number of Courses	Course Type	Credit Hours
P700	4 Courses (2 Course/Semester)	Elective	12
	Seminars	Compulsory	4
	Thesis	Compulsory	44
Total credit hours			60

Course Code	Course Title	Hours/Week			Course Type
		L	T/P	C	
P704	Quantum Mechanics II	3	-	3	Elective (select two courses each semester)
P713	Accelerators and Reactors Physics II	3	-	3	
P715	Radiation Physics II	3	-	3	
P716	Neutron Physics II	3	-	3	
P728	Selected Topics Related to Radiation Physics	3	-	3	
M706	Numerical Analysis II	3	-	3	

5- Ph.D. Degree in Plasma Physics

Course Code	Number of Courses	Course Type	Credit Hours
P700	4 Courses (2 Course/Semester)	Elective	12
	Seminars	Compulsory	4
	Thesis	Compulsory	44
Total credit hours			60

Course Code	Course Title	Hours/Week			Course Type
		L	T/P	C	
P703	Electromagnetic Theory II	3	-	3	Elective (select two courses each semester)
P704	Quantum Mechanics II	3	-	3	
P705	Molecular Spectroscopy	3	-	3	
P717	Methods of Experimental Plasma Physics II	3	-	3	
P718	Plasma Physics II	3	-	3	
P719	Fusion Energy Technology	3	-	3	
P730	Selected Topics Related to Plasma Physics	3	-	3	
M706	Numerical Analysis II	3	-	3	

6- Ph.D. Degree in Laser Physics

Course Code	Number of Courses	Course Type	Credit Hours
P700	4 Courses (2 Course/Semester)	Elective	12
	Seminars	Compulsory	4
	Thesis	Compulsory	44
Total credit hours			60

Course Code	Course Title	Hours/Week			Course Type
		L	T/P	C	
P702	Advanced Condensed Matter Physics	3	-	3	Elective (select two courses each semester)
P703	Electromagnetic Theory II	3	-	3	
P704	Quantum Mechanics II	3	-	3	
P705	Molecular Spectroscopy	3	-	3	
P720	Methods of Experimental Laser Physics II	3	-	3	
P721	Magnetic Resonance II	3	-	3	
P722	Laser Applications II	3	-	3	
P732	Selected Topics Related to Laser Physics	3	-	3	
M706	Numerical Analysis II	3	-	3	



7- Ph.D. Degree in Theoretical Physics

Course Code	Number of Courses	Course Type	Credit Hours
P700	4 Courses (2 Course/Semester)	Elective	12
	Seminars	Compulsory	4
	Thesis	Compulsory	44
Total credit hours			60

Course Code	Course Title	Hours/Week			Course Type
		L	T/P	C	
P702	Advanced Condensed Matter Physics	3	-	3	Elective (select two courses each semester)
P703	Electromagnetic Theory II	3	-	3	
P704	Quantum Mechanics II	3	-	3	
P711	Nuclear Structure II	3	-	3	
P712	Nuclear Reactions II	3	-	3	
P721	Magnetic Resonance II	3	-	3	
P734	Selected Topics Related to Theoretical Physics	3	-	3	
M706	Numerical Analysis II	3	-	3	
M708	Partial Differential Equations II	3	-	3	

Chemistry Programs

Notice	Programs	Code	Degree
	1- Professional Diploma in Biochemistry	C500	Diploma
	2- Professional Diploma in Quality Control		
	3- Professional Diploma in Applied Forensic Chemistry		
	4- Professional Diploma in Applied Organic Chemistry		
	5- Professional Diploma in Environmental Analytical Chemistry		
	1- Analytical Chemistry	C600	M.Sc.
	2- Inorganic Chemistry		
	3- Organic Chemistry		
	4- Physical Chemistry		
	5- Biochemistry		
	1- Analytical Chemistry	C700	Ph.D.
	2- Inorganic Chemistry		
	3- Physical Chemistry		
	4- Organic Chemistry		
	5- Biochemistry		

Diploma Chemistry Programs

1- Professional Diploma in Biochemistry

Course Code	Number of Courses	Course Type	Credit Hours
C500	10 Courses (5 Courses/Semester)	Compulsory	18
	3 Courses	Elective	6
	Project	Compulsory	6
	Total credit hours		30

	Course Code	Course Title	Hours/Week			Course Type
			L	T/P	C	
First Semester	C501	Food chemistry analysis	2	-	2	Compulsory
	C503	Endocrinology	2	-	2	
	MD503	Biological fluids	2	-	2	
	MS504	Biostatistics with Statistical Software	2	-	2	
	C505	Practical Biochemistry I	-	3	1	
	MD505	Physiological Biochemistry	2	-	2	Elective (select one)
	MD507	Microbiology and immunochemistry	2	-	2	
	MD509	Human Nutrition	2	-	2	
Second Semester	C502	Analytical Biochemistry	2	-	2	Compulsory
	Z502	Enzymology	2	-	2	
	B518	Biotechnology	2	-	2	
	MD504	Medical biomarkers	2	-	2	
	C506	Practical biochemistry II	-	3	1	
	B520	Advanced Molecular Biology	2	-	2	Elective (select two)
	MC525	Bioinformatics	2	-	2	
	MD506	Intoxification of biological systems	2	-	2	
	MD508	Environmental health community	2	-	2	

2- Professional Diploma in Quality Control

Course Code	Number of Courses	Course Type	Credit Hours
C500	6 Courses (3 Courses/Semester)	Compulsory	18
	2 Courses (1 Course/Semester)	Elective	6
	Project	Compulsory	6
Total credit hours			30

	Course Code	Course Title	Hours/Week			Course Type
			L	T/P	C	
First Semester	C511	Measurement and Testing Techniques	3	-	3	Compulsory
	C513	Customer Satisfaction and Quality Assurance	3	-	3	
	C515	Statistical Quality Control and Sampling	2	2	3	
	C517	Advanced Probability and Statistics	3	-	3	Elective (select one)
	C519	Human Factors in Quality Assurance	3	-	3	
	C521	Reliability	3	-	3	
	C523	Good Manufacturing Practices	3	-	3	
C525	Quality Assurance for the Service Delivery Process	3	-	3		
Second Semester	C512	Quality Function Management and TQM	3	-	3	Compulsory
	C514	Advanced Experimental Design	3	-	3	
	C516	ISO 9000 and the Audit Function	2	2	3	
	C518	Software Reliability	3	-	3	Elective (select one)
	C520	Biomedical Quality Control Methods	3	-	3	
	C522	Statistical Quality Control for Service Professionals	3	-	3	
	C524	Six Sigma Principles and Applications	3	-	3	

3- Professional Diploma in Applied Forensic Chemistry

Course Code	Number of Courses	Course Type	Credit Hours
C500	6 Courses (3 Courses/Semester)	Compulsory	18
	2 Courses (1 Course/Semester)	Elective	6
	Project	Compulsory	6
Total credit hours			30

	Course Code	Course Title	Hours/Week			Course Type
			L	T/P	C	
First Semester	MD501	Principles of Forensic Science	3	-	3	Compulsory
	C531	Modern Analytical Techniques	2	2	3	
	C533	Environmental Forensics 1	3	-	3	
	C535	Applied Statistics for Data Analysis	3	-	3	Elective (select one)
	C537	Forensic Analysis of DNA	3	-	3	
	C539	Spectral Analysis and Applied Spectroscopy	2	2	3	
	MD511	Forensic Medicine	3	-	3	
	C541	Medicinal Chemistry of Drugs of Abuse	2	2	3	
Second Semester	MD502	General Toxicology	3	-	3	Compulsory
	C532	Forensic Chemistry	3	-	3	
	C534	Biochemical Analysis	3	-	3	
	C536	Laboratory QA/QC	--	3	3	Elective (select one)
	C538	Organic and Food Analyses	3	-	3	
	MD504	Histochemistry	2	2	3	
	C540	Environmental Forensics 2	3	-	3	
	C542	Special Topics in Forensic Science	3	-	3	

4- Professional Diploma in Applied Organic Chemistry

Course Code	Number of Courses	Course Type	Credit Hours
C500	9 Courses	Compulsory	18
	3 Courses	Elective	6
	Project	Compulsory	6
Total credit hours			30

	Course Code	Course Title	Hours/Week			Course Type
			L	T/P	C	
First Semester	C551	Spectroscopic analysis	2	-	2	Compulsory
	C553	Textile and fibers	2	-	2	
	C555	Polymers	2	-	2	
	C557	Statistics	2	-	2	
	C559	Drug synthesis	2	-	2	
	C561	Industrial inorganic chemistry	2	-	2	Elective (select one)
	C563	Environmental organic chemistry	2	-	2	
Second Semester	C552	Chromatographic Techniques	2	-	2	Compulsory
	C554	Dyes and pigments	2	-	2	
	C556	Petroleum and petrochemicals	2	-	2	
	C558	Practical applied chemistry	-	6	2	
	C560	Review article	2	-	2	Elective (select two)
	C562	Food analysis	2	-	2	
	C564	Synthetic organic chemistry	2	-	2	
	C566	Nanomaterials and applications	2	-	2	

5- Professional Diploma in Environmental Analytical Chemistry

Course Code	Number of Courses	Course Type	Credit Hours
C500	6 Courses (3 Courses/Semester)	Compulsory	18
	2 Courses (1 Course/Semester)	Elective	6
	Project	Compulsory	6
Total credit hours			30

	Course Code	Course Title	Hours/Week			Course Type
			L	T/P	C	
First Semester	C571	Fundamentals of Environmental Chemistry	3	-	3	Compulsory
	C573	Pollution and its Control	3	-	3	
	C575	Environmental Chemistry of Selected Xenobiotics and Heavy Metals.	3	-	3	
	Mang501	Executive Development Skills	3	-	3	Elective (select one)
	M533	Chemometrics	2	2	3	
	C577	Quality Assurance/ Quality Control Principles	2	3	3	
	C579	Water Analysis	2	2	3	
	C581	Fuel Analysis	2	2	3	
Second Semester	C572	Instrumental Methods of Analysis	2	3	3	Compulsory
	C574	Problem and Activity-Orientated Environmental Analysis	3	-	3	
	C576	Laboratory Work, Environmental Analysis 1 & 2	-	6	3	
	Mang502	Oral and Written Communication	3	-	3	Elective (select one)
	C578	Cement Analysis	3	-	3	
	C580	Fertilizer Analysis	3	-	3	

M.Sc. Chemistry Programs

1- M.Sc. Degree in Analytical Chemistry

Course Code	Number of Courses	Course Type	Credit Hours
C600	6 Courses (3 Courses/Semester)	Compulsory	18
	2 Courses (1 Course/Semester)	Elective	6
	Seminars	Compulsory	2
	Thesis	Compulsory	22
Total credit hours			48

	Course Code	Course Title	Hours/Week			Course Type
			L	T/P	C	
First Semester	C601	Analytical Separation Science	2	2	3	Compulsory
	C603	Bioanalysis	3	-	3	
	M605	Chemometrics (I)	2	2	3	
	C607	Thermal Analysis	2	2	3	Elective (select one)
	C609	Quantum Chemistry	3	-	3	
	C611	Femtochemistry	3	-	3	
Second Semester	C602	Advanced Instrumental Analysis	2	2	3	Compulsory
	C604	Environmental Analysis (I)	2	2	3	
	C606	Nanochemistry- an Introduction and Potential Applications	2	2	3	
	C608	Selected Topics related to Analytical Chemistry	3	-	3	Elective (select one)
	C610	Bioinorganic Chemistry	3	-	3	
	C612	Biophysical Chemistry	3	-	3	
	C614	Laboratory Quality Control/ Assurance System	-	3	3	

2- M.Sc. Degree in Inorganic Chemistry

Course Code	Number of Courses	Course Type	Credit Hours
C600	6 Courses (3 Courses/Semester)	Compulsory	18
	2 Courses (1 Course/Semester)	Elective	6
	Seminars	Compulsory	2
	Thesis	Compulsory	22
Total credit hours			48

	Course Code	Course Title	Hours/Week			Course Type
			L	T/P	C	
First Semester	C621	Recent Applications of Organometallic Chemistry	3	-	3	Compulsory
	C623	Structural Inorganic Chemistry and Crystal Structure	3	-	3	
	C625	Application of Spectroscopy in Inorganic Chemistry	2	2	3	
	C627	Application of Group Theory in Chemistry and Spectroscopy	3	-	3	Elective (select one)
	C629	Thermal Analysis	2	2	3	
	C631	Femtochemistry and Laser Spectra	3	-	3	
Second Semester	C622	Organic Stereochemistry	3	-	3	Compulsory
	C624	Kinetics and Mechanisms of Inorganic Reactions	3	-	3	
	C626	Magnetochemistry of Inorganic Compounds	3	-	3	
	C628	Recent Methods and Advances in Calculating Stability Constants of Complexes	3	-	3	Elective (select one)
	C630	Luminescence Spectra of Inorganic Compounds	3	-	3	
	C632	Selected Topics related to Inorganic Chemistry (1)	3	-	3	

3- M.Sc. Degree in Organic Chemistry

Course Code	Number of Courses	Course Type	Credit Hours
C600	6 Courses (3 Courses/Semester)	Compulsory	18
	2 Courses (1 Course/Semester)	Elective	6
	Seminars	Compulsory	2
	Thesis	Compulsory	22
Total credit hours			48

	Course Code	Course Title	Hours/Week			Course Type
			L	T/P	C	
First Semester	C633	Advanced organic synthesis	2	-	2	Compulsory
	C635	Advanced physical organic chemistry	2	-	2	
	C637	Dyes and textiles	2	-	2	
	C639	Advanced NMR spectroscopy	2	-	2	
	C641	Polymers synthesis and characterization	2	-	2	Elective (select two)
	C643	Advanced heterocyclic chemistry	2	-	2	
	C645	Green organic chemistry	2	-	2	
	C647	Computational organic chemistry	2	-	2	
	C649	Selected topics in analytical chemistry	2	-	2	
	C651	Organic electrochemistry	2	-	2	
Second Semester	C634	Spectroscopic analysis	2	-	2	Compulsory
	C636	Advanced stereochemistry	2	-	2	
	C638	Selected topics in organic chemistry	2	-	2	
	C640	Organometallics in organic synthesis	2	-	2	
	C642	Statistics	2	-	2	
	C644	Chromatographic analysis	2	-	2	Elective (select one)
	C646	Biocatalysis and enzymes in organic synthesis	2	-	2	
	C648	Molecular Photochemistry	2	-	2	
	C650	Selected topics in inorganic chemistry	2	-	2	

4- M.Sc. Degree in Physical Chemistry

Course Code	Number of Courses	Course Type	Credit Hours
C600	6 Courses (3 Courses/Semester)	Compulsory	18
	2 Courses (1 Course/Semester)	Elective	6
	Seminars	Compulsory	2
	Thesis	Compulsory	22
Total credit hours			48

	Course Code	Course Title	Hours/Week			Course Type
			L	T/P	C	
First Semester	C653	Advanced Electrochemistry I	2	2	3	Compulsory
	C655	Surface Chemistry	3	-	3	
	MS 606	Computational Statistics	3	-	3	
	C657	Theories and mechanisms of catalytic reactions	3	-	3	Elective (select one)
	C659	The modern Aspect of Polarography and Voltammetry	2	2	3	
	C661	Nuclear and Radiochemistry	3	-	3	
	C663	Application of Group Theory in Chemistry and Spectroscopy	3	-	3	
	C665	Quantum Chemistry	3	-	3	
Second Semester	C654	Theoretical Chemistry	3	-	3	Compulsory
	C656	Solid State Chemistry	3	-	3	
	C658	Crystal structure analysis	2	2	3	
	C660	The modern Aspect of Colloidal Chemistry	3	-	3	Elective (select one)
	C662	Advanced Chemical Kinetics	3	-	3	
	C664	The Phase Diagrams for Solutions of Materials and Alloys	3	-	3	
	C666	Thermal and surface analysis	3	-	3	
	C668	Selected Topics related to Physical chemistry I	3	-	3	

5- M.Sc. Degree in Biochemistry

Course Code	Number of Courses	Course Type	Credit Hours
C600	6 Courses (3 Courses/Semester)	Compulsory	18
	2 Courses (1 Course/Semester)	Elective	6
	Seminars	Compulsory	2
	Thesis	Compulsory	22
Total credit hours			48

	Course Code	Course Title	Hours/Week			Course Type
			L	T/P	C	
First Semester	C671	Bioenergetics & the metabolism of carbohydrate and lipids	2	-	2	Compulsory
	C673	Biochemistry of extracellular & intracellular communication	2	-	2	
	C675	Structures & function of proteins and enzymes	2	-	2	
	C677	Biocatalysts and enzymes in organic synthesis	2	-	2	
	C679	Macromolecular Recognition	2	-	2	
	C681	Xenobiotics metabolism	2	-	2	Elective (select one)
	MD683	Physiology	2	-	2	
Second Semester	C672	Instrumental chemical analysis	2	-	2	Compulsory
	C674	Metabolism of proteins & amino acids	2	-	2	
	MD676	Molecular biology & cancer biology	2	-	2	
	C678	Chemistry of natural products	2	-	2	
	C680	Green organic chemistry	2	-	2	Elective (select two)
	MD682	Histology	2	-	2	
	C684	Selected topics in biochemistry	2	-	2	

Ph.D. Chemistry Programs

1- Ph.D. Degree in Analytical Chemistry

Course Code	Number of Courses	Course Type	Credit Hours
C700	4 Courses (2 Course/Semester)	Elective	12
	Seminars	Compulsory	4
	Thesis	Compulsory	44
Total credit hours			60

Course Code	Course Title	Hours/Week			Course Type
		L	T/P	C	
C701	Quality Management in Analytical Chemistry	3	-	3	Elective (select two courses each semester)
M702	Chemometrics (II)	3	-	3	
C703	Environmental Analytical Chemistry (II)	3	-	3	
C704	Selected Topics in Analytical Chemistry (2)	3	-	3	
C705	Laboratory Safety	3	-	3	
C706	Analytical Chemistry lab	3	-	3	
C707	Bioanalytical Chemistry and Chemical Sensors	3	-	3	
C708	Advanced Analytical Chemistry	3	-	3	
C709	Pharmaceutical & Toxicological Analysis	3	-	3	
C710	Selected Topics related to Analytical Chemistry	3	-	3	

2- Ph.D. Degree in Inorganic Chemistry

Course Code	Number of Courses	Course Type	Credit Hours
C700	4 Courses (2 Course/Semester)	Elective	12
	Seminars	Compulsory	4
	Thesis	Compulsory	44
Total credit hours			60

Course Code	Course Title	Hours/Week			Course Type
		L	T/P	C	
C720	Supramolecular Coordination Compounds	3	-	3	Elective (select two courses each semester)
C721	Photochemical Reactions of Inorganic Compounds	3	-	3	
C722	Stereochemistry of Coordination Compounds	3	-	3	
C723	Bioinorganic Chemistry	3	-	3	
C724	Application of Polarography and Cyclic Voltammetry to Inorganic Compounds	3	-	3	
C725	Selected Topics related to Inorganic Chemistry (2)	3	-	3	

3- Ph.D. Degree in Physical Chemistry

Course Code	Number of Courses	Course Type	Credit Hours
C700	4 Courses (2 Course/Semester)	Elective	12
	Seminars	Compulsory	4
	Thesis	Compulsory	44
Total credit hours			60

Course Code	Course Title	Hours/Week			Course Type
		L	T/P	C	
C730	Advanced Electrochemistry II	3	-	3	Elective (select two courses each semester)
C731	Concepts of Modern Catalysis	3	-	3	
C732	Advanced Kinetics for Modern Chemical Reactions and their Theories	3	-	3	
C733	Thermodynamics for Multi- Compound Reactions in Solution	3	-	3	
C734	Advanced Nuclear Chemistry	3	-	3	
C735	Nanostructured Materials; Preparation, Characterization and Application	3	-	3	
C736	Statistical Thermodynamics	3	-	3	
C737	Mass Transfer in Electrochemistry	3	-	3	
C738	Femtochemistry and Laser Spectroscopy	3	-	3	
C739	Selected Topics in Physical Chemistry II	3	-	3	

4- Ph.D. Degree in Organic Chemistry

Course Code	Number of Courses	Course Type	Credit Hours
C700	6 Courses (3 Course/Semester)	Elective	12
	Seminars	Compulsory	4
	Thesis	Compulsory	44
Total credit hours			60

Course Code	Course Title	Hours/Week			Course Type
		L	T/P	C	
C750	Asymmetric synthesis	2	-	2	Elective (select Three courses each semester)
C751	Toxins and medicinal chemistry	2	-	2	
C752	Supramolecular chemistry	2	-	2	
C753	Homogeneous and heterogeneous catalysis	2	-	2	
C754	Selected topics in organic reaction mechanisms	2	-	2	
C755	Modern physical organic chemistry	2	-	2	
C756	Advanced natural products chemistry	2	-	2	
C757	Environmental organic chemistry	2	-	2	
C758	Advanced biochemistry	2	-	2	
C759	Photochemistry and Chemistry of Organic Laser	2	-	2	

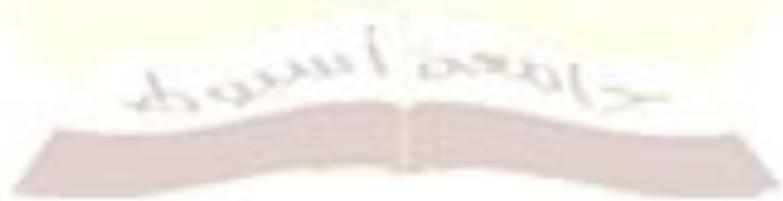
5- Ph.D. Degree in Biochemistry

Course Code	Number of Courses	Course Type	Credit Hours
C700	6 Courses (3 Course/Semester)	Elective	12
	Seminars	Compulsory	4
	Thesis	Compulsory	44
Total credit hours			60

Course Code	Course Title	Hours/Week			Course Type
		L	T/P	C	
C761	Drug-drug interaction	2	-	2	Elective (select Three courses each semester)
C762	Drug delivery	2	-	2	
C763	Nano biotechnology	2	-	2	
C764	Genetic engineering	2	-	2	
ZC765	Immunology	2	-	2	
C766	Selected topics in biochemistry	2	-	2	
ZC767	Microbial ecology	2	-	2	
C768	Drug Synthesis and Design	2	-	2	
C769	3D reconstruction of macromolecules using single particle electron microscopy.	2	-	2	

Geology Programs

Notice	Program	Code	Degree
	1- Applied Geophysics 2- Petroleum Geology & Hydrogeology 3- Economic Ores& Minerals 4- Medical Geology 5- Applied Environmental Geosciences	G500	Diploma Professional Diploma
	1- Applied Geophysics 2- Petroleum Geology 3- Stratigraphy & Paleontology 4- Sedimentary Geology 5- Structural Geology 6- Hydrogeology 7- Igneous & Metamorphic Rocks 8- Ores & Economic Geology	G600	M.Sc.
	1- Applied Geophysics 2- Petroleum Geology 3- Stratigraphy & Paleontology 4- Sedimentary Geology 5- Structural Geology 6- Hydrogeology 7- Igneous & Metamorphic Rocks 8- Ores & Economic Geology	G700	Ph.D.



Postgraduate Geology Diploma

1- Diploma in Applied Geophysics

Course Code	Number of Courses	Course Type	Credit Hours
G500	6 Courses (3 Courses/Semester)	Compulsory	18
	2 Courses (1 Course/Semester)	Elective	6
	Project	Compulsory	6
Total credit hours			30

	Course Code	Course Title	Hours/Week			Course Type
			L	T/P	C	
First Semester	G501	Geodynamics	3	-	3	Compulsory
	G503	Seismic Prospecting	2	2	3	
	G505	Digital Data Processing	2	2	3	
	G507	Earthquake Seismology	2	2	3	Elective (select one)
	G509	Special Topics in Geophysics	2	2	3	
Second Semester	G502	Electric and Electromagnetic Prospecting	2	2	3	Compulsory
	G504	Gravity and Magnetic Prospecting	2	2	3	
	G506	Well logging and Petrophysics	2	2	3	
	G508	Telluric and Magnetotelluric Methods	2	2	3	Elective (select one)
	G510	Radioactive and Geothermal Methods	2	2	3	

2- Diploma in Petroleum Geology & Hydrogeology

Course Code	Number of Courses	Course Type	Credit Hours
G500	6 Courses (3 Courses/Semester)	Compulsory	18
	2 Courses (1 Course/Semester)	Elective	6
	Project	Compulsory	6
Total credit hours			30

	Course Code	Course Title	Hours/Week			Course Type
			L	T/P	C	
First Semester	G511	Petroleum Geology-2	3	-	3	Compulsory
	G513	Groundwater Hydrology	2	2	3	
	G515	Well Hydraulics	2	2	3	
	G517	Sequence Stratigraphy-2	2	2	3	Elective (select one)
	G519	Advanced Structure Geology	2	2	3	
Second Semester	G506	Well logging and Petrophysics	2	2	3	Compulsory
	G512	Petroleum Reservoirs (Siliciclastic, Carbonate and Fracture)	2	2	3	
	G514	Advanced Hydrochemistry	2	2	3	
	G516	Groundwater Aquifer Systems in Egypt	3	-	3	Elective (select one)
	G518	Sedimentary Rocks and Sedimentary Environments	2	2	3	

3- Diploma in Economic Ores & Minerals

Course Code	Number of Courses	Course Type	Credit Hours
G500	6 Courses (3 Courses/Semester)	Compulsory	18
	2 Courses (1 Course/Semester)	Elective	6
	Project	Compulsory	6
Total credit hours			30

	Course Code	Course Title	Hours/Week			Course Type
			L	T/P	C	
First Semester	G521	Ore Genesis	3	-	3	Compulsory
	G523	Mineral Processing	2	2	3	
	G525	Advanced Mineral Deposits of Egypt	3	-	3	
	G527	Mineral Economics	3	-	3	Elective (select one)
	G505	Digital Data Processing	2	2	3	
Second Semester	G520	Advanced Ore Mineralogy and Ore Microscopy	2	2	3	Compulsory
	G522	Exploration of Mineral Deposits	2	2	3	
	G524	Selected topics related to Economic Ores and Minerals	2	2	3	
	G526	Advanced Geostatistics	2	2	3	Elective (select one)
	G528	Structural Geology for Economic Geologists	2	2	3	

Professional Diploma

4- Professional Diploma in Medical Geology

Course Code	Number of Courses	Course Type	Credit Hours
G500	6 Courses (3 Courses/Semester)	Compulsory	18
	2 Courses (1 Course/Semester)	Elective	6
	Project	Compulsory	6
Total credit hours			30

	Course Code	Course Title	Hours/Week			Course Type
			L	T/P	C	
First Semester	G529	Air Pollution and Health	2	2	3	Compulsory
	Md531	Environmental Metallotoxicology	2	2	3	
	Md533	Water and Health	2	2	3	
	G535	Inorganic geochemistry Techniques	2	2	3	Elective (select one)
	G537	Geological Impact on Nutrition	2	2	3	
Second Semester	G530	Environmental Geochemistry	2	2	3	Compulsory
	Md530	Soil and Health	2	2	3	
	Md532	Minerals and Health of Human and Animal	2	2	3	
	G534	Waste Disposal and Pollution	2	2	3	Elective (select one)
	G540	GIS	2	2	3	

5- Professional Diploma in Applied Environmental Geosciences

Course Code	Number of Courses	Course Type	Credit Hours
G500	6 Courses (3 Courses/Semester)	Compulsory	18
	2 Courses (1 Course/Semester)	Elective	6
	Project	Compulsory	6
Total credit hours			30

	Course Code	Course Title	Hours/Week			Course Type
			L	T/P	C	
First Semester	G539	Applied Geochemistry	2	2	3	Compulsory
	G541	Remote Sensing & Image Processing.	2	2	3	
	G543	Soil Mechanics and Stabilization Techniques.	2	2	3	
	G545	Information Technology	2	2	3	Elective (select one)
	G547	Hydrogeology	2	2	3	
Second Semester	G540	GIS	2	2	3	Compulsory
	G542	Applied Sedimentology & Quaternary Geology.	2	2	3	
	G544	Environmental Geosciences	2	2	3	
	G546	Applications of GIS & Remote Sensing in Environmental Geosciences	2	2	3	Elective (select one)
	G548	Environmental Impact and Risk Assessment	2	2	3	



M.Sc. Geology Programs

1- M.Sc. Degree in Applied Geophysics

Course Code	Number of Courses	Course Type	Credit Hours
G600	6 Courses (3 Courses/Semester)	Compulsory	18
	2 Courses (1 Course/Semester)	Elective	6
	Seminars	Compulsory	2
	Thesis	Compulsory	22
Total credit hours			48

	Course Code	Course Title	Hours/Week			Course Type
			L	T/P	C	
First Semester	G601	Earthquake Seismology	3	2	3	Compulsory
	G603	Electric and Electromagnetic Prospecting	3	2	3	
	G605	Geodynamics2	3	-	3	
	G607	Marine Geophysics	3	-	3	Elective (select one)
	G609	Seismic Stratigraphy	3	2	3	
Second Semester	G602	Gravity and Magnetic Prospecting	3	2	3	Compulsory
	G604	Seismic Prospecting	3	2	3	
	G606	Inverse Theory and Inversion Concepts	3	-	3	
	G608	Data Analysis Techniques in Geophysics	3	2	3	Elective (select one)
	G610	Well logging and Petrophysics2	3	2	3	
	G611	Selected Topics related to Applied Geophysics	3	2	3	

2- M.Sc. Degree in Petroleum Geology

Course Code	Number of Courses	Course Type	Credit Hours
G600	6 Courses (3 Courses/Semester)	Compulsory	18
	2 Courses (1 Course/Semester)	Elective	6
	Seminars	Compulsory	2
	Thesis	Compulsory	22
Total credit hours			48

	Course Code	Course Title	Hours/Week			Course Type
			L	T/P	C	
First Semester	G613	Petroleum System2	2	2	3	Compulsory
	G615	Advanced Sequence Stratigraphy and Sedimentary Basin Development	2	2	3	
	G617	Formation Evaluation	2	2	3	
	G619	Siliciclastic Reservoir Rocks	3	-	3	Elective (select one)
	G621	Environmental Sedimentology	3	-	3	
Second Semester	G610	Well logging and Petrophysics2	2	2	3	Compulsory
	G612	Petroleum Geochemistry	2	2	3	
	G614	Geophysical Exploration	2	2	3	
	G616	Carbonate Reservoir Rocks	3	-	3	Elective (select one)
	G618	The Phanerozoic Eon of Egypt	3	-	3	
	G620	Advanced Sedimentology	3	-	3	
	G622	Selected Topics related to Petroleum Geology	3	-	3	

3- M.Sc. Degree in Stratigraphy & Paleontology

Course Code	Number of Courses	Course Type	Credit Hours
G600	6 Courses (3 Courses/Semester)	Compulsory	18
	2 Courses (1 Course/Semester)	Elective	6
	Seminars	Compulsory	2
	Thesis	Compulsory	22
Total credit hours			48

	Course Code	Course Title	Hours/Week			Course Type
			L	T/P	C	
First Semester	G623	Applied Stratigraphy	3	-	3	Compulsory
	G625	Advanced Vertebrate Paleontology	3	-	3	
	G629	Advanced Invertebrate Paleontology	3	-	3	
	G615	Advanced Sequence Stratigraphy and Sedimentary Basin Development	3	-	3	Elective (select one)
	G627	Remote Sensing and Image Processing	3	-	3	
Second Semester	G618	The Phanerozoic Eon of Egypt	3	-	3	Compulsory
	G624	Applied Micropaleontology	3	-	3	
	G626	Origin and Evolution of Earth	3	-	3	
	G628	Advanced Plant Fossils	3	-	3	Elective (select one)
	G630	Paleogeography & Paleoclimatology	3	-	3	
	G632	Selected Topics related to Stratigraphy & Paleontology	3	-	3	

4- M.Sc. Degree in Sedimentary Geology

Course Code	Number of Courses	Course Type	Credit Hours
G600	6 Courses (3 Courses/Semester)	Compulsory	18
	2 Courses (1 Course/Semester)	Elective	6
	Seminars	Compulsory	2
	Thesis	Compulsory	22
Total credit hours			48

	Course Code	Course Title	Hours/Week			Course Type
			L	T/P	C	
First Semester	G631	Advanced Sedimentology	3	-	3	Compulsory
	G623	Applied Stratigraphy	3	-	3	
	G 615	Advanced Sequence Stratigraphy and Sedimentary Basin Development	3	-	3	
	G635	Quaternary Sedimentology	3	-	3	Elective (select one)
	G637	Clay Mineralogy	3	-	3	
Second Semester	G642	Advanced Depositional Systems	3	-	3	Compulsory
	G636	Sedimentary Basin Analysis	3	-	3	
	G638	Advanced Geotectonics	3	-	3	
	G640	Environmental Sedimentology	3	-	3	Elective (select one)
	G644	Advanced Geochemistry of Sedimentary Rocks	3	-	3	
	G646	Selected Topics related to Sedimentary Geology	3	-	3	

5- M.Sc. Degree in Structural Geology

Course Code	Number of Courses	Course Type	Credit Hours
G600	6 Courses (3 Courses/Semester)	Compulsory	18
	2 Courses (1 Course/Semester)	Elective	6
	Seminars	Compulsory	2
	Thesis	Compulsory	22
Total credit hours			48

	Course Code	Course Title	Hours/Week			Course Type
			L	T/P	C	
First Semester	G627	Remote Sensing and Image Processing	2	2	3	Compulsory
	G639	Advanced Structural Analysis	3	-	3	
	G641	Applied Structural Geology (Case Study)	2	2	3	
	G643	Petrofabric Analysis	2	2	3	Elective (select one)
	G645	Global Tectonics	3	-	3	
	G647	Tectonic Evolution of the Arabian-Nubian Shield	3	-	3	
Second Semester	G634	Advanced Structural Geology and Tectonics	3	-	3	Compulsory
	G648	Tectonic Provinces of Egypt	3	-	3	
	G650	GIS and Production of Geologic Maps and Cross Sections	2	2	3	
	G652	Morphotectonics and Analytical Geomorphology	3	-	3	Elective (select one)
	G654	Engineering Geology	2	2	3	
	G656	Selected Topics related to Structural Geology	2	2	3	

6- M.Sc. Degree in Hydrogeology

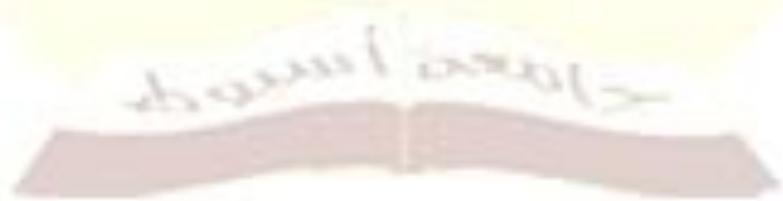
Course Code	Number of Courses	Course Type	Credit Hours
G600	6 Courses (3 Courses/Semester)	Compulsory	18
	2 Courses (1 Course/Semester)	Elective	6
	Seminars	Compulsory	2
	Thesis	Compulsory	22
Total credit hours			48

	Course Code	Course Title	Hours/Week			Course Type
			L	T/P	C	
First Semester	G649	Groundwater Modeling	2	2	3	Compulsory
	G651	Water Quality Modeling	2	2	3	
	G653	Hydrogeophysics	2	2	3	
	G655	Field Hydrogeology	2	2	3	Elective (select one)
	G657	Coastal Aquifers and Saltwater Intrusion	3		3	
	G659	Water Resources in Arid Environments	3	-	3	
Second Semester	G658	Surface Water/Groundwater Interaction	2	2	3	Compulsory
	G660	Applications of GIS in Water Resources	2	2	3	
	G662	Evaluation of Groundwater Resources	2	2	3	
	G664	Karst and Fractured Aquifers	3	-	3	Elective (select one)
	G666	Aqueous Geochemistry and Groundwater Contamination	2	2	3	
	G668	Selected Topics related to Hydrogeology	3	-	3	

7- M.Sc. Degree in Igneous & Metamorphic Rocks

Course Code	Number of Courses	Course Type	Credit Hours
G600	6 Courses (3 Courses/Semester)	Compulsory	18
	2 Courses (1 Course/Semester)	Elective	6
	Seminars	Compulsory	2
	Thesis	Compulsory	22
Total credit hours			48

	Course Code	Course Title	Hours/Week			Course Type
			L	T/P	C	
First Semester	G661	Petrology of Metamorphic Rocks	2	2	3	Compulsory
	G663	General Characteristics of Metamorphic Terrains	3	-	3	
	G665	Basement Tectonics of Egypt	2	2	3	
	G 667	High-Grade Metamorphism and Anatexis	2	2	3	Elective (select one)
	G669	Alkaline Rocks	2	2	3	
Second Semester	G670	Petrology of Igneous Rocks2	2	2	3	Compulsory
	G672	Advanced Geochemistry	3	-	3	
	G674	Advanced Mineralogy	2	2	3	
	G676	Igneous Petrogenesis and Plate Tectonics	3	-	3	Elective (select one)
	G678	Petrology of Mantel	3	-	3	
	G680	Selected Topics related to Igneous& Metamorphic Rocks	3	-	3	



8- M.Sc. Degree in Ores & Economic Geology

Course Code	Number of Courses	Course Type	Credit Hours
G600	6 Courses (3 Courses/Semester)	Compulsory	18
	2 Courses (1 Course/Semester)	Elective	6
	Seminars	Compulsory	2
	Thesis	Compulsory	22
Total credit hours			48

	Course Code	Course Title	Hours/Week			Course Type
			L	T/P	C	
First Semester	G671	Mineral Deposits & Plate Tectonics	2	2	3	Compulsory
	G673	Mineral Deposits in African Belt	3	-	3	
	G675	Geochemistry of Mineral Deposits	2	2	3	
	G677	Mining Geology and Resource Estimation	2	2	3	Elective (select one)
	G679	Applications of Industrial Minerals and Rocks 1	2	2	3	
Second Semester	G682	Advanced Ore Petrology	3	-	3	Compulsory
	G684	Fluid Inclusions: Techniques and Applications	2	2	3	
	G686	Exploration Geochemistry	2	2	3	
	G688	Prospecting of Mineral Deposits	3	-	3	Elective (select one)
	G690	Advanced Ore Deposits	3	-	3	
	G692	Selected Topics related to Ores & Economic Geology	3	-	3	

Ph.D. Geology Programs

1- Ph.D. Degree in Applied Geophysics

Course Code	Number of Courses	Course Type	Credit Hours
G700	4 Courses (2 Course/Semester)	Elective	12
	Seminars	Compulsory	4
	Thesis	Compulsory	44
Total credit hours			60

Course Code	Course Title	Hours/Week			Course Type
		L	T/P	C	
G701	Electric and Electromagnetic Prospecting -3	2	2	3	Elective
G702	Well Logging and Petrophysics -3	2	2	3	
G703	Gravity and Magnetic Prospecting -3	2	2	3	
G704	Seismic Exploration -3	2	2	3	
G705	Shallow Geophysical Exploration and Applications	2	2	3	
G706	Seismic Hazard and Geophysical Site Investigations	2	2	3	
G707	Advanced Sequence Stratigraphy	2	2	3	
G708	East African Rift and Geology of Nile Basin	3	-	3	
G709	Selected Topics related to Applied Geophysics	2	2	3	

2- Ph.D. Degree in Petroleum Geology

Course Code	Number of Courses	Course Type	Credit Hours
G700	4 Courses (2 Course/Semester)	Elective	12
	Seminars	Compulsory	4
	Thesis	Compulsory	44
Total credit hours			60

Course Code	Course Title	Hours/Week			Course Type
		L	T/P	C	
G704	Seismic Exploration -3	2	2	3	Elective
G708	East African Rift and Geology of Nile Basin	3	-	3	
G707	Advanced Sequence Stratigraphy	2	2	3	
G710	Petroleum System -3	2	2	3	
G711	Advanced Geophysical Hydrocarbon Exploration	2	2	3	
G712	Petroleum Geochemistry -2	2	2	3	
G713	Advanced Sedimentary Basin Analysis	2	2	3	
G714	Modern Applications of Remote Sensing Techniques to Geologic Problems	2	2	3	
G715	Selected Topics related to Petroleum Geology	3	-	3	

3- Ph.D. Degree in Stratigraphy & Paleontology

Course Code	Number of Courses	Course Type	Credit Hours
G700	4 Courses (2 Course/Semester)	Elective	12
	Seminars	Compulsory	4
	Thesis	Compulsory	44
Total credit hours			60

Course Code	Course Title	Hours/Week			Course Type
		L	T/P	C	
G707	Advanced Sequence Stratigraphy	3	-	3	Elective
G708	East African Rift and Geology of Nile Basin	3	-	3	
G716	Global Stratigraphic Correlation	3	-	3	
G717	Micropalaeontology in the Petroleum Exploration	3	-	3	
G718	Geological Time Scale & the World Type Geologic	3	-	3	
G719	Phanerozoic Mass Extinctions	3	-	3	
G720	Advanced Quaternary and Environmental Geology	3	-	3	
G721	Stratigraphy of Africa	3	-	3	
G722	Selected Topics related to Stratigraphy & Paleontology	3	-	3	

4- Ph.D. Degree in Sedimentary Geology

Course Code	Number of Courses	Course Type	Credit Hours
G700	4 Courses (2 Course/Semester)	Elective	12
	Seminars	Compulsory	4
	Thesis	Compulsory	44
Total credit hours			60

Course Code	Course Title	Hours/Week			Course Type
		L	T/P	C	
G707	Advanced Sequence Stratigraphy	3	-	3	Elective
G708	East African Rift and Geology of Nile Basin	3	-	3	
G713	Advanced Sedimentary Basin Analysis	3	-	3	
G714	Modern Applications of Remote Sensing Techniques to Geologic Problems	2	2	3	
G720	Advanced Quaternary and Environmental Geology	3	-	3	
G721	Stratigraphy of Africa	3	-	3	
G723	Advanced Geochemistry of Sediments and Sedimentary Rocks	3	-	3	
G724	Selected Topics related to Sedimentary Geology	3	-	3	

5- Ph.D. Degree in Structural Geology

Course Code	Number of Courses	Course Type	Credit Hours
G700	4 Courses (2 Course/Semester)	Elective	12
	Seminars	Compulsory	4
	Thesis	Compulsory	44
Total credit hours			60

Course Code	Course Title	Hours/Week			Course Type
		L	T/P	C	
G708	East African Rift and Geology of Nile Basin	3	-	3	Elective
G714	Modern Applications of Remote Sensing Techniques to Geologic Problems	2	2	3	
G725	Modern Concepts in Structural Geology and Tectonics	3	-	3	
G726	Geodynamics and Neo-tectonics	3	-	3	
G727	Quantitative Geomorphology	2	2	3	
G728	Tectonic Framework of the Middle East	3	-	3	
G729	Tectonics of Sedimentary Basins	3	-	3	
G730	Tectonic Setting of the Mediterranean Basins	3	-	3	
G731	Selected Topics related to Structural Geology	2	2	3	

6- Ph.D. Degree in Hydrogeology

Course Code	Number of Courses	Course Type	Credit Hours
G700	4 Courses (2 Course/Semester)	Elective	12
	Seminars	Compulsory	4
	Thesis	Compulsory	44
Total credit hours			60

Course Code	Course Title	Hours/Week			Course Type
		L	T/P	C	
G713	Advanced Sedimentary Basin Analysis	3	-	3	Elective
G714	Modern Applications of Remote Sensing Techniques to Geologic Problems	2	2	3	
G720	Advanced Quaternary and Environmental Geology	3	-	3	
G732	Integrated Water Resources Management	3	-	3	
G733	Socio- Hydrogeology	3	-	3	
G734	Integrated Watershed Management	3	-	3	
G735	Isotope Hydrogeology	3	-	3	
G736	Environmental Impact Assessment	3	-	3	
G737	Selected Topics related to Hydrogeology	3	-	3	



7- Ph.D. Degree in Igneous & Metamorphic Rocks

Course Code	Number of Courses	Course Type	Credit Hours
G700	4 Courses (2 Course/Semester)	Elective	12
	Seminars	Compulsory	4
	Thesis	Compulsory	44
Total credit hours			60

Course Code	Course Title	Hours/Week			Course Type
		L	T/P	C	
G714	Modern Applications of Remote Sensing Techniques to Geologic Problems	2	2	3	Elective
G721	Stratigraphy of Africa	3	-	3	
G738	Micro Tectonics	3	-	3	
G739	Modern and Ancient Volcanic Successions	3	-	3	
G740	Metamorphic Mineral Reaction & Equilibria	3	-	3	
G741	Metamorphism and Tectonics	3	-	3	
G742	The Evolving Continents	3	-	3	
G743	Isotope Geology	3	-	3	
G744	Selected Topics related to Igneous & Metamorphic Rocks	3	-	3	

8- Ph.D. Degree in Ores & Economic Geology

Course Code	Number of Courses	Course Type	Credit Hours
G700	4 Courses (2 Course/Semester)	Elective	12
	Seminars	Compulsory	4
	Thesis	Compulsory	44
Total credit hours			60

Course Code	Course Title	Hours/Week			Course Type
		L	T/P	C	
G714	Modern Applications of Remote Sensing Techniques to Geologic Problems	2	2	3	Elective
G721	Stratigraphy of Africa	3	-	3	
G745	Hydrothermal Alteration	2	2	3	
G746	Isotope Geochemistry for Economic Geologists	3	-	3	
G747	Applications of Industrial Minerals and Rocks -2	3	-	3	
G748	Fluids in Earth Crust	3	-	3	
G749	Mineral Hazards to Human Health	3	-	3	
G750	Advanced Mineral Exploration	3	-	3	
G751	Selected Topics related to Ores & Economic Geology	3	-	3	

Botany and Microbiology Programs

Programs	Code	Degree
1- Professional Diploma in Applied Microbiology	B500	Diploma
1- Plant Physiology	B600	M.Sc.
2- Plant Ecology		
3- Taxonomy of Flowering Plants and Flora of Egypt		
4- Microbiology		
1- Plant Physiology	B700	Ph.D.
2- Plant Ecology		
3- Taxonomy of Flowering Plants and Flora of Egypt		
4- Microbiology		



Postgraduate Botany and Microbiology Diploma

1- Professional Diploma in Applied Microbiology

Course Code	Number of Courses	Course Type	Credit Hours
B500	6 Courses (3 Courses/Semester)	Compulsory	18
	2 Courses (1 Course/Semester)	Elective	6
	Thesis	Project	6
Total credit hours			30

	Course Code	Course Title	Hours/Week			Course Type
			L	T/P	C	
First Semester	B501	Virology and Immunology	3	-	3	Compulsory
	B503	Yeasts systematics	2	2	3	
	B505	Medical microbiology	2	2	3	
	B507	Biofuels and Renewable Energy	3	-	3	Elective (select one)
	B509	Aquatic Hyphomycetes	3	-	3	
	B511	Environmental Microbiology	3	-	3	
	B513	Microbial Toxins	3	-	3	
MD515	Medical Biochemistry					
Second Semester	B502	Applied Phycology	2	2	3	Compulsory
	B504	Microbiological Analyses	2	2	3	
	B506	Selected Topic in Microbiology	3	-	3	
	B508	Microbial Bioremediation	2	2	3	Elective (select one)
	B510	Food Microbiology	3	-	3	
	B512	Applied Bacteriology	2	2	3	
	B514	Biosafety and Biocontrol	2	2	3	
Z650	Selected Topics in Parasitology	2	2	3		

M.Sc. Botany Programs

1- Master Degree of Science in Plant Physiology

Course Code	Number of Courses	Course Type	Credit Hours
B600	6 Courses (3 Courses/Semester)	Compulsory	18
	2 Courses (1 Course/Semester)	Elective	6
	Seminars	Compulsory	2
	Thesis	Compulsory	22
Total credit hours			48

	Course Code	Course Title	Hours/Week			Course Type
			L	T/P	C	
First Semester	B601	Molecular Physiology	2	2	3	Compulsory
	B603	Mineral Nutrition	2	2	3	
	B605	Plant Water Relations	3	-	3	
	B607	Environmental Pollution	2	2	3	Elective (select one)
	B609	Plant Biotechnology	2	2	3	
	B627	Soil Microbiology	2	2	3	
Second Semester	B602	Physiology and Plant Biochemistry	2	2	3	Compulsory
	B604	Plant Hormones	2	2	3	
	B606	Selected Topics related to Plant Physiology	2	2	3	
	B608	Physiology of Salt Tolerance	2	2	3	Elective (select one)
	B610	Enzymology	2	2	3	
	M640	Biostatistics	2	2	3	

2- M.Sc. Degree in Plant Ecology

Course Code	Number of Courses	Course Type	Credit Hours
B600	6 Courses (3 Courses/Semester)	Compulsory	18
	2 Courses (1 Course/Semester)	Elective	6
	Seminars	Compulsory	2
	Thesis	Compulsory	22
Total credit hours			48

	Course Code	Course Title	Hours/Week			Course Type
			L	T/P	C	
First Semester	B603	Mineral Nutrition	2	2	3	Compulsory
	B605	Plant Water Relations	3	-	3	
	B607	Environmental Pollution	2	2	3	
	B611	Ecology of Halophytes	3	-	3	Elective (select one)
	B613	Ecology of Mediterranean Region	3	-	3	
B615	Biology of Seeds Dispersal and Germination	3	-	3		
Second Semester	B612	Environmental Soil Chemistry	2	2	3	Compulsory
	B614	Phytogeography and Natural Ecosystems	3	-	3	
	B616	Selected Topics related to Plant Ecology	2	2	3	
	B618	Microenvironment of Plants	2	2	3	Elective (select one)
	B620	Phytosociology and Functional groups	2	2	3	
	M640	Biostatistics	2	2	3	



3- M.Sc. Degree in Taxonomy of Flowering Plants and Flora of Egypt

Course Code	Number of Courses	Course Type	Credit Hours
B600	6 Courses (3 Courses/Semester)	Compulsory	18
	2 Courses (1 Course/Semester)	Elective	6
	Seminars	Compulsory	2
	Thesis	Compulsory	22
Total credit hours			48

	Course Code	Course Title	Hours/Week			Course Type
			L	T/P	C	
First Semester	B617	Principles of Plant Taxonomy	2	2	3	Compulsory
	B619	Cytotaxonomy	2	2	3	
	B621	Comparative Plant Morphology	2	2	3	
	B613	Ecology of Mediterranean Region	2	2	3	Elective (select one)
	B623	Taxonomy of Aquatic Plants	2	2	3	
	B625	Botanical Gardens and Herbaria	3	-	3	
Second Semester	B622	Advanced Palynology	2	2	3	Compulsory
	B624	Chemotaxonomy	2	2	3	
	B626	Selected Topics related to Plant Taxonomy	2	2	3	
	B614	Phytogeography and Natural Ecosystems	3	-	3	Elective (select one)
	B628	Medicinal Plants	2	2	3	
	B630	Fossil Plants	2	2	3	



4- M.Sc. Degree in Microbiology

Course Code	Number of Courses	Course Type	Credit Hours
B600	6 Courses (3 Courses/Semester)	Compulsory	18
	2 Courses (1 Course/Semester)	Elective	6
	Seminars	Compulsory	2
	Thesis	Compulsory	22
Total credit hours			48

	Course Code	Course Title	Hours/Week			Course Type
			L	T/P	C	
First Semester	B627	Soil Microbiology	2	2	3	Compulsory
	B629	Microbial Secondary Metabolites	2	2	3	
	B631	Microbial Enzymes	2	2	3	
	B633	Advanced Virology	2	2	3	Elective (select one)
	B635	Advanced Bacteriology	2	2	3	
	B637	Advanced Mycology	2	2	3	
	B639	Advanced Algae	2	2	3	
Second Semester	B632	Aquatic Microbiology	2	2	3	Compulsory
	B634	Microbial Biotechnology	2	2	3	
	B636	Selected Topics related to Microbiology	2	2	3	
	B638	Host Parasite Relationship	2	2	3	Elective (select one)
	B640	Industrial Microbiology	2	2	3	
	B642	Physiology of Bacteria	2	2	3	
	B644	Microbial Pollution	2	2	3	

Ph.D. Botany Programs

1- Ph.D. Degree in Plant Physiology

Course Code	Number of Courses	Course Type	Credit Hours
B700	4 Courses (2 Course/Semester)	Elective	12
	Seminars	Compulsory	4
	Thesis	Compulsory	44
Total credit hours			60

Course Code	Course Title	Hours/Week			Course Type
		L	T/P	C	
B701	Growth Regulators	3	-	3	Elective
B702	Plant Metabolism Regulation	3	-	3	
B703	Bioinformatics	2	2	3	
B704	Plant Signals	3	-	3	
B705	Secondary Metabolites	2	2	3	
B706	Environmental Stresses	3	-	3	
B707	Mechanisms Associated with Environmental Stress Tolerance in Plants	3	-	3	
B708	Plant Tissue Culture	2	2	3	
B709	Genetic and Molecular Biology	2	2	3	
B710	Selected Topics related to Plant Physiology	2	2	3	

2- Ph.D. Degree in Plant Ecology

Course Code	Number of Courses	Course Type	Credit Hours
B700	4 Courses (2 Course/Semester)	Elective	12
	Seminars	Compulsory	4
	Thesis	Compulsory	44
Total credit hours			60

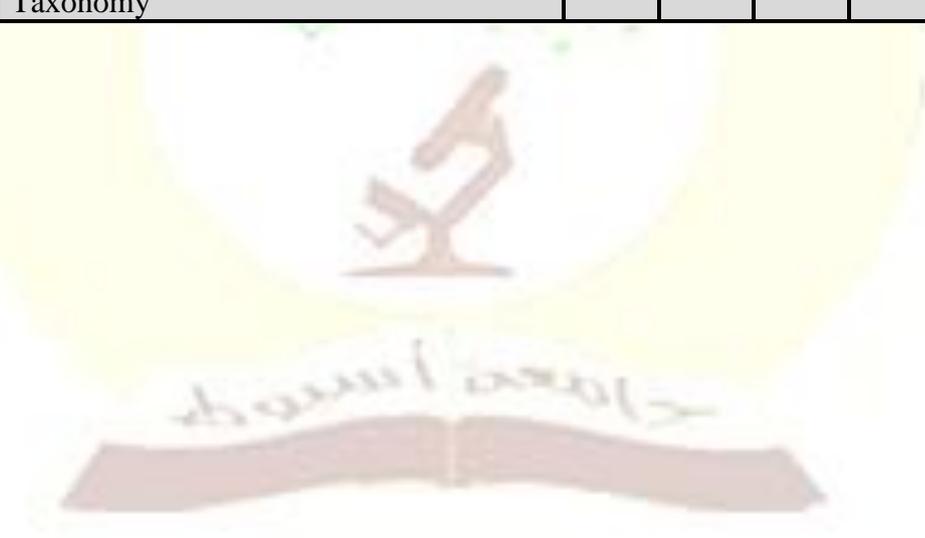
Course Code	Course Title	Hours/Week			Course Type
		L	T/P	C	
B711	Phytotechnology	3	-	3	Elective
B712	Ecology of Xerophytes	3	-	3	
B713	Vegetation Analysis	2	2	3	
B714	Ecology of Aquatic Plants	2	2	3	
B715	Botanical Maps	2	2	3	
B716	Physiological Plant Ecology	3	-	3	
B717	Evolutionary Ecology	3	-	3	
B718	Selected Topics related to Plant Ecology	2	2	3	



3- Ph.D. Degree in Taxonomy of Flowering Plants and Flora of Egypt

Course Code	Number of Courses	Course Type	Credit Hours
B700	4 Courses (2 Course/Semester)	Elective	12
	Seminars	Compulsory	4
	Thesis	Compulsory	44
Total credit hours			60

Course Code	Course Title	Hours/Week			Course Type
		L	T/P	C	
B715	Botanical Maps	2	2	3	Elective
B719	Molecular Systematic	2	2	3	
B720	Flora of Egypt in Relation to Neighboring regions	2	2	3	
B721	Paleobotany	2	2	3	
B722	Numerical Taxonomy	2	2	3	
B723	Plant Nomenclature	2	2	3	
B724	Modern trends in Plant Identification	2	2	3	
B725	Selected Topics related to Plant Taxonomy	2	2	3	



4- Ph.D. Degree in Microbiology

Course Code	Number of Courses	Course Type	Credit Hours
B700	4 Courses (2 Course/Semester)	Elective	12
	Seminars	Compulsory	4
	Thesis	Compulsory	44
Total credit hours			60

Course Code	Course Title	Hours/Week			Course Type
		L	T/P	C	
B726	Actinomycetes	2	2	3	Elective
B727	Algal Toxins	2	2	3	
B728	Ecophysiology of Aquatic Fungi	2	2	3	
B729	Bacterial Biotechnology	2	2	3	
B730	Biochemistry and Physiology of the Plant Pathogenic Viruses	2	2	3	
B731	Bioremediation of Environmental Pollutants	3	-	3	
B732	Biosensors and Their Biological Functions	2	2	3	
B733	Cyanobacteria	2	2	3	
B734	Freshwater Algae	2	2	3	
B735	Fungal Biotechnology	2	2	3	
B736	Fungal Enzymes	2	2	3	
B737	Medical Mycology	2	2	3	
B738	Industrial Mycology	2	2	3	
B739	Lichens	2	2	3	
B740	Marine and Fresh Water Bacteria	2	2	3	
B741	Marine Phytoplankton	2	2	3	
B742	Microbial Biotransformations	2	2	3	
B743	Microbial Genetics	3	-	3	
B744	Mycorrhizae	2	2	3	
B745	Mycotoxins	2	2	3	
B746	Nitrogen Fixing Prokaryotes	2	2	3	
B747	Seaweeds	2	2	3	
B748	Seed-Borne Fungi	2	2	3	
B749	Serological Techniques and Plant Viruses	2	2	3	
B750	Viroids	3	-	3	
B751	Plant Viruses and the Environment	3	-	3	
B752	Selected Topics related to Microbiology	2	2	3	

Zoology and Entomology Programs
1- Zoology Programs

Notice	Programs	Code	Degree
	1- Cell Biology	Z600	M.Sc.
	2- Histology and Histochemistry		
	3- Invertebrates		
	4- Parasitology		
	5- Physiology		
	6- Fish Biology		
	7- Comparative Anatomy and Embryology		
	8- Immunology		
	1- Cell Biology	Z700	Ph.D.
	2- Histology and Histochemistry		
	3- Invertebrates		
	4- Parasitology		
	5- Physiology		
	6- Fish Biology		
	7- Comparative Anatomy and Embryology		
	8- Immunology		

2- Entomology Programs

Notice	Programs	Code	Degree
	1- Entomology	E600	M.Sc.
	1- Entomology	E700	Ph.D.
	2- Insect Molecular Biology		
	3- Economic and Applied Entomology		

1- M.Sc. Degree in Zoology

1- M.Sc. Degree in Zoology (Cell Biology)

Course Code	Number of Courses	Course Type	Credit Hours
Z600	6 Courses (3 Courses/Semester)	Compulsory	18
	2 Courses (1 Course/Semester)	Elective	6
	Seminars	Compulsory	2
	Thesis	Compulsory	22
Total credit hours			48

	Course Code	Course Title	Hours/Week			Course Type
			L	T/P	C	
First Semester	Z601	Cell Biology	3	-	3	Compulsory
	Z603	Molecular Biology	3	-	3	
	Z605	Practical Cell Biology	2	2	3	
	Z607	Cellular Traffic and Endocytosis	3	-	3	Elective (select one)
	Z609	Tumor Biology	3	-	3	
	Z611	Signal Transduction	3	-	3	
Second Semester	Z602	Histology	3	-	3	Compulsory
	Z604	Histochemistry	3	-	3	
	ZM606	Biostatistics	3	-	3	
	Z608	Stem Cells	3	-	3	Elective (select one)
	Z610	Special Course	3	-	3	
	Z612	Selected Topics related to Cell Biology	3	-	3	

2. M.Sc. Degree in Zoology (Histology and Histochemistry)

Course Code	Number of Courses	Course Type	Credit Hours
Z600	6 Courses (3 Courses/Semester)	Compulsory	18
	2 Courses (1 Course/Semester)	Elective	6
	Seminars	Compulsory	2
	Thesis	Compulsory	22
Total credit hours			48

	Course Code	Course Title	Hours/Week			Course Type
			L	T/P	C	
First Semester	Z601	Cell biology	3	-	3	Compulsory
	Z613	Histochemistry and micro techniques	2	2	3	
	Z615	Special course	3	-	3	
	Z617	Immunology (1)	3	-	3	Elective (select one)
	ZM606	Biostatistics	3	-	3	
	Z619	Pathology (1)	3	-	3	
	Z621	Genetic and Molecular Biology	3	-	3	
Second Semester	Z602	Histology	3	-	3	Compulsory
	Z614	Physiology	3	-	3	
	Z616	Basic Toxicology	3	-	3	
	Z618	Aquatic Pollution (1)	3	-	3	Elective (select one)
	Z620	Biochemistry	3	-	3	
	Z622	Endocrinology	3	-	3	
	Z624	Special Course	3	-	3	
	Z626	Selected Topics related to Histology and Histochemistry	3	-	3	

3. M.Sc. Degree in Zoology (Invertebrates)

Course Code	Number of Courses	Course Type	Credit Hours
Z600	6 Courses (3 Courses/Semester)	Compulsory	18
	2 Courses (1 Course/Semester)	Elective	6
	Seminars	Compulsory	2
	Thesis	Compulsory	22
Total credit hours			48

	Course Code	Course Title	Hours/Week			Course Type
			L	T/P	C	
First Semester	Z623	Invertebrate Structure and Function	3	-	3	Compulsory
	Z625	Animal Ecology	3	-	3	
	Z627	Principles of Systematic Zoology	3	-	3	
	Z639	Fresh Water Ecology	3	-	3	Elective (select one)
	Z629	Ecophysiology (1)	3	-	3	
	Z631	Special course	3	-	3	
	Z603	Molecular Biology	3	-	3	
Second Semester	Z602	Histology	3	-	3	Compulsory
	ZM606	Biostatistics	3	-	3	
	Z630	Practical Invertebrates	2	2	3	
	Z632	Biology of Mollusca	3	-	3	Elective (select one)
	Z634	Immunology of Invertebrates	3	-	3	
	Z636	Soil Ecology	3	-	3	
	Z638	Invertebrate Relationships	3	-	3	
	Z640	Selected Topics related to Invertebrates	3	-	3	

4. M.Sc. Degree in Zoology (Parasitology)

Course Code	Number of Courses	Course Type	Credit Hours
Z600	6 Courses (3 Courses/Semester)	Compulsory	18
	2 Courses (1 Course/Semester)	Elective	6
	Seminars	Compulsory	2
	Thesis	Compulsory	22
Total credit hours			48

	Course Code	Course Title	Hours/Week			Course Type
			L	T/P	C	
First Semester	Z633	Parasitic Protozoa	3	-	3	Compulsory
	Z635	Histo-Pathology	3	-	3	
	ZM606	Biostatistics	3	-	3	
	Z613	Histochemistry and Microtechniques	3	-	3	Elective (select one)
	Z637	Parasites of Fishes	3	-	3	
	Z620	Biochemistry	3	-	3	
	Z641	Special Course	3	-	3	
Second Semester	Z642	Parasitic Helminthes	3	-	3	Compulsory
	Z602	Histology	3	-	3	
	Z644	Intermediate Hosts and Biological Vectors	2	2	3	
	Z646	Immunology	3	-	3	Elective (select one)
	Z648	Practical and Research Project in Parasitology	2	2	3	
	Z650	Selected Topics related to Parasitology	3	-	3	

5. M.Sc. Degree in Zoology (Physiology)

Course Code	Number of Courses	Course Type	Credit Hours
Z600	6 Courses (3 Courses/Semester)	Compulsory	18
	2 Courses (1 Course/Semester)	Elective	6
	Seminars	Compulsory	2
	Thesis	Compulsory	22
Total credit hours			48

	Course Code	Course Title	Hours/Week			Course Type
			L	T/P	C	
First Semester	Z643	Comparative Physiology	3	-	3	Compulsory
	Z645	Physiological Biochemistry	3	-	3	
	ZM606	Biostatistics	3	-	3	
	Z647	Nutrition and Metabolism	3	-	3	Elective (select one)
	Z649	Immunohistochemistry	3	-	3	
	Z651	Pharmacology	3	-	3	
	Z653	Comparative Reproduction	3	-	3	
Second Semester	Z652	Selected Topics in Physiology	3	-	3	Compulsory
	Z654	Lab and Research Project in Physiology	2	2	3	
	Z656	Cell Physiology	3	-	3	Elective (select one)
	Z658	Pathology (2)	3	-	3	
	Z660	Biotechnology	3	-	3	
	Z662	Environmental Physiology	3	-	3	

6. M.Sc. Degree in Zoology (Fish Biology)

Course Code	Number of Courses	Course Type	Credit Hours
Z600	6 Courses (3 Courses/Semester)	Compulsory	18
	2 Courses (1 Course/Semester)	Elective	6
	Seminars	Compulsory	2
	Thesis	Compulsory	22
Total credit hours			48

	Course Code	Course Title	Hours/Week			Course Type
			L	T/P	C	
First Semester	Z655	Limnology	3	-	3	Compulsory
	Z657	Fish Ecology	3	-	3	
	Z659	Fish Physiology	3	-	3	
	Z661	Special Course	3	-	3	Elective (select one)
	Z663	Electron Microscopic Technique	3	-	3	
	Z603	Molecular Biology	3	-	3	
Second Semester	Z666	Aquaculture	2	2	3	Compulsory
	Z668	Fish Population Dynamics	3	-	3	
	ZM606	Biostatistics	3	-	3	
	Z670	Cryo preservation	3	-	3	Elective (select one)
	Z672	Fish Biodiversity	3	-	3	
	Z674	Fisheries Managements	3	-	3	
	Z676	Fish Taxonomy	3	-	3	
	Z678	Selected Topics related to Fish Biology	3	-	3	

7. M.Sc. Degree in Zoology (Comparative Anatomy and Embryology)

Course Code	Number of Courses	Course Type	Credit Hours
Z600	6 Courses (3 Courses/Semester)	Compulsory	18
	2 Courses (1 Course/Semester)	Elective	6
	Seminars	Compulsory	2
	Thesis	Compulsory	22
Total credit hours			48

	Course Code	Course Title	Hours/Week			Course Type
			L	T/P	C	
First Semester	Z665	Comparative Anatomy of Nervous system (Cranial nerves and sensory organs)	3	-	3	Compulsory
	Z667	Molecular Taxonomy and Vertebrate Fauna	3	-	3	
	Z669	Experimentation and Data Analysis	2	2	3	
	Z671	Development of Vertebrate Body	3	-	3	Elective (select one)
	Z673	Advanced Histology and Histochemistry	3	-	3	
	Z603	Molecular Biology	3	-	3	
	Z677	Special Course				
Second Semester	Z680	Biology of Regeneration	3	-	3	Compulsory
	Z682	Isolating Mechanism and Speciation	3	-	3	
	Z684	Developmental Biology and Electron Microscopy	3	-	3	
	Z643	Comparative Physiology	3	-	3	Elective (select one)
	Z686	Special Course	3	-	3	
	Z688	Selected Topics Related to Comparative Anatomy and Embryology	3	-	3	

8. M.Sc. Degree in Zoology (Immunology)

Course Code	Number of Courses	Course Type	Credit Hours
Z600	8 Courses (4 Courses/Semester)	Compulsory	18
	2 Courses (1 Course/Semester)	Elective	6
	Seminars	Compulsory	2
	Thesis	Compulsory	22
Total credit hours			48

	Course Code	Course Title	Hours/Week			Course Type
			L	T/P	C	
First Semester	Z689	Comparative and Developmental Immunology	2	-	2	Compulsory
	Z691	Advanced Immunohistochemistry	1	2	2	
	Z693	Molecular Hematology	2	-	2	
	Z695	Lab and Research Project in Immunology	1	4	3	
	Z697	Host-Pathogen Interactions	3	-	3	Elective (select one)
	Z645	Physiological Biochemistry	3	-	3	
	Z647	Nutrition and Metabolism	3	-	3	
Second Semester	Z690	Molecular Immunology	2	-	2	Compulsory
	Z692	Tumor Immunology	2	-	2	
	Z694	Pathophysiology	2	-	2	
	ZM606	Biostatistics	3	-	3	
	Z696	Principals of Animal Cell and Tissue Culture	2	2	3	Elective (select one)
	Z656	Cell Physiology	3	-	3	

2- Ph.D. Degree in Zoology

1- Ph.D. Degree in Zoology (Cell Biology)

Course Code	Number of Courses	Course Type	Credit Hours
Z700	4 Courses (2 Courses/Semester)	Elective	12
	Seminars	Compulsory	4
	Thesis	Compulsory	44
Total credit hours			60

Course Code	Course Title	Hours/Week			Course Type
		L	T/P	C	
Z701	Advanced Cell Biology	3	-	3	Elective
Z702	Advanced Histology	3	-	3	
Z703	Advanced Molecular Biology	3	-	3	
Z704	Advanced Signal Transduction	3	-	3	
Z705	Advanced Cellular Traffic and Endocytosis	3	-	3	
Z706	Advanced Stem Cells	3	-	3	
Z707	Advanced Tumor Biology	3	-	3	
Z708	Molecular and Cellular Immunology	3	-	3	
MZ708	Mathematical and Statistical Packages	3	-	3	
Z709	Selected Topics Related to Cell Biology	3	-	3	

2- Ph.D. Degree in Zoology (Histology and Histochemistry)

Course Code	Number of Courses	Course Type	Credit Hours
Z700	4 Courses (2 Courses/Semester)	Elective	12
	Seminars	Compulsory	4
	Thesis	Compulsory	44
Total credit hours			60

Course Code	Course Title	Hours/Week			Course Type
		L	T/P	C	
Z701	Advanced Cell Biology	3	-	3	Elective
Z702	Advanced Histology	3	-	3	
Z710	Histochemistry	3	-	3	
Z711	Biochemical Toxicology	3	-	3	
Z712	Immunology (2)	3	-	3	
Z713	Aquatic pollution (2)	3	-	3	
Z714	Genetic Engineering	3	-	3	
Z715	Microbiology	3	-	3	
MZ708	Mathematical and Statistical Packages	3	-	3	
Z716	Selected Topics related to Histology and Histochemistry	3	-	3	

3- Ph.D. Degree in Zoology (Invertebrates)

Course Code	Number of Courses	Course Type	Credit Hours
Z700	4 Courses (2 Courses/Semester)	Elective	12
	Seminars	Compulsory	4
	Thesis	Compulsory	44
Total credit hours			60

Course Code	Course Title	Hours/Week			Course Type
		L	T/P	C	
Z717	Invertebrate Hematology	3	-	3	Elective
Z718	Nanobiology	3	-	3	
Z713	Aquatic Pollution (2)	3	-	3	
Z720	Soil Biology	3	-	3	
Z721	Invertebrate Biodiversity and Conservation	3	-	3	
Z722	Aquatic Ecotoxicology and Terrestrial Ecotoxicology	3	-	3	
Z723	Biology of Hirudinea	3	-	3	
Z724	Biology of Crustacea	3	-	3	
Z725	Invertebrate Taxonomy	3	-	3	
MZ708	Mathematical and Statistical Packages	3	-	3	
Z726	Ecophysiology (2)	3	-	3	
Z727	Special Course	3	-	3	
Z728	Selected Topics related to Invertebrates	3	-	3	

4- Ph.D. Degree in Zoology (Parasitology)

Course Code	Number of Courses	Course Type	Credit Hours
Z700	4 Courses (2 Courses/Semester)	Elective	12
	Seminars	Compulsory	4
	Thesis	Compulsory	44
Total credit hours			60

Course Code	Course Title	Hours/Week			Course Type
		L	T/P	C	
Z729	Advanced Parasitology	3	-	3	Elective
Z730	Ultrastructure of Histopathology	3	-	3	
Z703	Advanced Molecular Biology	3	-	3	
Z731	Special Course	3	-	3	
Z732	Special Topics related to Parasitology	3	-	3	
Z733	Hematology	3	-	3	
Z734	Ecotoxicology	3	-	3	
Z735	Seminars and Research Project related to Parasitology	3	-	3	
MZ708	Mathematical and Statistical Packages	3	-	3	

5- Ph.D. Degree in Zoology (Physiology)

Course Code	Number of Courses	Course Type	Credit Hours
Z700	4 Courses (2 Courses/Semester)	Elective	12
	Seminars	Compulsory	4
	Thesis	Compulsory	44
Total credit hours			60

Course Code	Course Title	Hours/Week			Course Type
		L	T/P	C	
Z736	Neurophysiology	3	-	3	Elective
Z737	Immuno-regulation and Cell Signaling	3	-	3	
Z738	Molecular Genetics	3	-	3	
Z739	Special Course	3	-	3	
Z740	Cell Cycle Control and Cancer	3	-	3	
Z706	Advanced Stem Cells	3	-	3	
Z742	Applied Immunology	3	-	3	
Z743	Dysfunction of Some Organs	3	-	3	
Z744	Molecular Endocrinology	3	-	3	
Z745	Reproduction and Infertility Problems	3	-	3	
Z746	Advanced Molecular Hematology	3	-	3	
Z747	Seminar and Research Project related to Physiology	3	-	3	
Z748	Selected Topics Related to Physiology	3	-	3	
Z708	Molecular and Cellular Immunology	3	-	3	
MZ708	Mathematical and Statistical Packages	3	-	3	

6- Ph.D. Degree in Zoology (Fish Biology)

Course Code	Number of Courses	Course Type	Credit Hours
Z700	4 Courses (2 Courses/Semester)	Elective	12
	Seminars	Compulsory	4
	Thesis	Compulsory	44
Total credit hours		60	

Course Code	Course Title	Hours/Week			Course Type
		L	T/P	C	
Z749	Fish Biogeography	3	-	3	Elective
Z750	Aquatic Ecosystem	3	-	3	
Z751	Fish Hatchery Managements	3	-	3	
Z752	Aquatic Toxicology	3	-	3	
Z753	Fish Embryology	3	-	3	
Z754	Bioinformatics	3	-	3	
Z755	Nanotechnology	3	-	3	
Z756	Fish Reproduction	3	-	3	
Z757	Fish Food and Feeding Biology	3	-	3	
Z710	Histochemistry	3	-	3	
Z758	Selected Topics related to Fish Biology	3	-	3	
MZ708	Mathematical and Statistical Packages	3	-	3	

7- Ph.D. Degree in Zoology (Comparative Anatomy and Embryology)

Course Code	Number of Courses	Course Type	Credit Hours
Z700	4 Courses (2 Courses/Semester)	Elective	12
	Seminars	Compulsory	4
	Thesis	Compulsory	44
Total credit hours		60	

Course Code	Course Title	Hours/Week			Course Type
		L	T/P	C	
Z759	Experimental Embryology	3	-	3	Elective
Z760	Functional Anatomy of Vertebrates	3	-	3	
Z703	Advanced Molecular Biology	3	-	3	
Z761	Vertebrate Physiology	3	-	3	
Z714	Genetic Engineering	3	-	3	
Z763	Advanced Developmental Biology	3	-	3	
Z764	Practical and Research Project	3	-	3	
ZP708	Biomechanics	3	-	3	
Z765	Selected Topics related to Comparative Anatomy and Embryology	3	-	3	
Z766	Special Course	3	-	3	

8- Ph.D. Degree in Zoology (Immunology)

Course Code	Number of Courses	Course Type	Credit Hours
Z700	4 Courses (2 Courses/Semester)	Elective	12
	Seminars	Compulsory	4
	Thesis	Compulsory	44
Total credit hours			60

Course Code	Course Title	Hours/Week			Course Type
		L	T/P	C	
MD767	Immunotherapy	3	-	3	Elective
Z767	Immunopathology	3	-	3	
Z768	Seminar and Research Project in Immunology	3	-	3	
Z737	Immuno-regulation and Cell Signaling	3	-	3	
Z738	Molecular Genetics	3	-	3	
Z740	Cell Cycle Control and Cancer	3	-	3	
Z743	Dysfunction of Some Organs	3	-	3	
MZ769	Bioinformatics	3	-	3	

2. Entomology Programs

1. M.Sc. in Entomology

Course Code	Number of Courses	Course Type	Credit Hours
E600	6 Courses (3 Courses/Semester)	Compulsory	18
	2 Courses (1 Course/Semester)	Elective	6
	Seminars	Compulsory	2
	Thesis	Compulsory	22
Total credit hours			48

	Course Code	Course Title	Hours/Week			Course Type
			L	T/P	C	
First Semester	E601	Insect Comparative Anatomy	3	-	3	Compulsory
	E603	Insect Taxonomy and Ecology	3	-	3	
	E605	Selected Topics	3	-	3	
	E607	Medical Entomology	3	-	3	Elective (select one)
	E609	Insect Toxicology				
	E611	Microtechnique	3	-	3	
	E613	Social Insects	3	-	3	
E615	Insect Immunity	3	-	3		
Second Semester	E602	Insect Physiology and Behavior	3	-	3	Compulsory
	E604	Insect Control	3	-	3	
	EM606	Biostatistics	3	-	3	
	E610	Molecular Biology	3	-	3	Elective (select one)
	E608	Histology and Histochemistry	3	-	3	
	E612	Practical Entomology	3	-	3	
	E614	Chemical Ecology	3	-	3	
	E616	Selected Topics	3	-	3	

Ph.D. Entomology Program

1- Ph.D. Degree in Entomology (Insect Physiology)

Course Code	Number of Courses	Course Type	Credit Hours
E700	4 Courses (2 Courses/Semester)	Elective	12
	Seminars	Compulsory	4
	Thesis	Compulsory	44
Total credit hours			60

Course Code	Course Title	Hours/Week			Course Type
		L	T/P	C	
E701	Advanced Insect Physiology (1)	3	-	3	Elective
E702	Advanced Insect Behavior	3	-	3	
E703	Insect Endocrinology	3	-	3	
E704	Insect Sensory Physiology	3	-	3	
E705	Forensic Entomology	3	-	3	
E706	Histology and Histochemistry	3	-	3	
E707	Advanced Insect Control	3	-	3	
E708	Biochemistry	3	-	3	
E709	Selected Topics	3	-	3	

2- Ph.D. Degree in Insect Molecular Biology

Course Code	Number of Courses	Course Type	Credit Hours
E700	4 Courses (2 Courses/Semester)	Elective	12
	Seminars	Compulsory	4
	Thesis	Compulsory	44
Total credit hours		60	

Course Code	Course Title	Hours/Week			Course Type
		L	T/P	C	
E703	Insect Endocrinology	3	-	3	Elective
E704	Insect Sensory Physiology	3	-	3	
E705	Forensic Entomology	3	-	3	
E706	Histology and Histochemistry	3	-	3	
E707	Advanced Insect Control	3	-	3	
E711	Insect Behavior (2)	3	-	3	
E714	Genetic Engineering	3	-	3	
E716	Molecular Biology (2)	3	-	3	
E718	Insect Molecular Systematics	3	-	3	
E719	Cell Biology	3	-	3	
E720	Advanced Insect Physiology (2)	3	-	3	
E721	Selected Topics	3	-	3	

3- Ph.D. Degree in Economic and Applied Entomology

Course Code	Number of Courses	Course Type	Credit Hours
E700	4 Courses (2 Courses/Semester)	Elective	12
	Seminars	Compulsory	4
	Thesis	Compulsory	44
Total credit hours			60

Course Code	Course Title	Hours/Week			Course Type
		L	T/P	C	
E705	Forensic Entomology	3	-	3	Elective
E718	Insect Molecular Systematics	3	-	3	
E720	Advanced Insect Physiology (2)	3	-	3	
E724	Advanced Insect Behavior	3	-	3	
E725	Economic Entomology	3	-	3	
E707	Advanced Insect Control	3	-	3	
E706	Histology and Histochemistry	3	-	3	
E728	Aquatic Insects	3	-	3	
E729	Advanced Chemical Ecology	3	-	3	
E730	Apiculture and Bee Keeping	3	-	3	
E731	Acarology	3	-	3	
E733	Selected Topics	3	-	3	

Mathematics Programs

1- Professional Diploma in Applied Statistics

M501 Calculus and Numerical Computations

The concept of limits, the concept of continuity, the techniques of differentiation, various application of derivations, the integration as the reverse of differentiation. Approximate numbers; rounding off, significant figures, digits, errors of approximation. Finite differences, interpolation, Newton's Gregory formula for forward and backward interpolation. Divided difference formulae Inverse interpolation, numerical solution in one unknown – iterative methods. Numerical differentiation: Newton's backward, forward and Lagrange's interpolation. Numerical integration: Trapezoidal rule, Simpson's one third rule. Summation of series – Euler Meclaurin formula. Stirling's approximation of factorials (without proof)

M502 Linear Algebra with Applications

Matrices and their algebra, determinants, solutions of systems of linear equation using matrices and numerical methods, the basic concepts and manipulations of vectors and their application to engineering problems, Eigen values and Eigen vectors. Elementary number theory and Counting

MS501 Descriptive Statistics with Statistical Software

Meaning of Statistics. Primary and secondary data. Collection of data and scrutiny of data, Frequency and non– frequency data. Tabular and diagrammatic representation of non – frequency data (line diagram. Ratio chart, bar diagram, pictograph and pie diagram). Tabular representation of frequency data: Frequency, relative frequency, cumulative frequency and frequency density. Column diagram, frequency polygon, histogram and cumulative frequency diagram. Central tendency and dispersion. Measures of central tendency: mean, median and mode. Measures of dispersion: range, mean deviation and standard deviation, coefficient of variation and coefficient of concentration. Moments and quantiles, skewness and kurtosis of a frequency distribution. Bivariate data, scatter diagram, concept of correlation and correlation coefficient. Simple regression by least-squares method: its relationship with simple correlation. Correlation ratio. Rank correlation: Spearman's and Kendall's coefficients. Theory of attributes. Multivariate data, multiple regression by least squares method (up to two independent variables), multiple and partial correlation coefficients. Use of appropriate statistical software.

MS502 Statistical Methods II

Statistic and parameter. Random sampling from a distribution. Sampling distribution of a statistic and its standard error under random sampling. Sampling distributions of the sample sum in sampling from a binomial and Poisson distribution. Sampling distribution of sample mean and sample variance in sampling from a univariate normal distribution. Definitions of chi-square, t and F statistics and their probability density functions and basic properties (without derivations). Point and interval estimation. Intuitive considerations underlying the principles of unbiasedness, minimum variance and consistency. Basic principles of hypothesis testing: test, critical region, type I error and type II error, level of significance and power of a test. Tests for a single mean, for the equality of two means, for a single variance and for the equality of two variances, for the significance of correlation coefficient (under normal population models).

MS503 Statistical Methods I

The concepts of Probability, Concepts of Random Variable, Probability distribution, Distribution Function, Expected Value, Variance and Higher Moments. Probability generating function, moment generating function and cumulant. Basic discrete and continuous distributions. Concepts of independence, jointly distributed random variables and conditional distributions, use of generating functions. Central limit theorem and its application.

MS504 Biostatistics with Statistical Software

Explain the scope and uses of statistics in biology and medicine, State types and sources of biological and medical data, various types of variability associated with bio-medical data, e.g. response and reactions to drugs, vital statistical indices, the standardized rates, the meaning of genetics, the simple Mendelian ratio, the fundamental principles of bioassay, the relative potency, simple assays, direct and parallel lines. Use of appropriate statistical softwares.

MS505 Statistical Computing

Simulation techniques for various probability models - Different resampling plans. - Nonlinear regression and generalized linear models with applications - Cluster analysis and other multivariate applications - Smoothing and function estimation - EM algorithm, single and multiple imputation - Markov Chain Monte Carlo techniques. Use of appropriate statistical softwares.

MS506 Decision Making and Forecasting

Basic Concepts of Forecasting and Decision Making. Qualitative Methods of Forecasting (Delphi, Subjective Probabilities, Market Research). Quantitative Techniques of Forecasting and Regression Model. Quantitative Techniques of Forecasting and other Casual Models. (Econometric, Input-Output, Leading Indicator). Quantitative Techniques of Forecasting Time Series Model. (Trend Projection). Quantitative Techniques of Forecasting Time Series Model. (Smoothing and Decomposition). Quantitative Techniques of Forecasting and Box Jenkins Model. Selection of Right Forecasting Methods. Decision Making and Quantitative Tools. Decision Making and Qualitative Tools. Steps in Decision Making. Inventory management and introduction, inventory control, costs in inventory problems, Techniques of Inv. Control and with selective control (ABC analysis, Usage rate and criticality). Techniques of inv. Control and with known demand and E.O.Q with uniform demand, prod. Runs of unequal length, with finite rate of replenishment, Problem of E.O.Q with shortage. Techniques inv. Control and with uncertain demand and buffer stock computation, stochastic problems and uniform demand. Techniques inv. Control and with price discounts. Financial Applications and Computation of net present value, future value and internal rate of return, converting effective interest rate to nominal rate, computing compound interest, accumulated value, discount, annuities etc. Break even analysis, Standard / Marginal Costing.

MS507 Regression and Linear Models

Simple linear regression, Multiple linear regression, Regression diagnostics, Transformation of variable, Analysis of collinear data, Logistic regression, Stepwise regression, ONE WAY ANOVA, TWO WAY ANOVA, Multiway ANOVA and Nested Analysis, Comparison of individual means, Analysis of covariance, One Way Random effect model, Two way Mixed Model. Use of appropriate statistical software.

MS508 Analysis of Variance and Design of Experiments

Analysis of variance: Analysis of data for a one-way classification: fixed effects and random-effects models. Analysis of data for a two way classification with the same number of observations per cell: main effects and interaction effects for fixed-effects model only and estimation of error variance. Design of Experiment: Controlled experiments. Basic principles of designs: randomization, replication and local control. Description and method of analysis of experiments conducted according to a completely randomized, a randomized block and a latin square design. Factorial experiments: 22 and 23 experiments. Confounding: complete and partial. Use of appropriate statistical softwares.

MS509 Medical Statistics

Phase I, II and III Clinical Trials, Randomization, Blinding and Placebos, Sample size calculation, Comparing more than two treatments, Causality, Non-compliance and Intent-to-treat, Survival analysis in Phase III clinical trials, Early stopping of clinical trials, Multiplicity and interim analysis, Parallel and Crossover designs, Binary Response data, Categorical Data Analysis, Comparing Methods of measurements, Meta-analysis, Repeated measures analysis.

MS510 Time Series Analysis

Exploratory Analysis of Time Series: Graphical display, classical decomposition model – trend, seasonal and cyclical components, Stationary Stochastic Time Series: Weak and strong stationarity; AR, MA and ARMA models; Box-Jenkin's correlogram analysis – ACF and PACF; diagnostic tests. Non-Stationary Time Series: ARIMA model; deterministic and stochastic trends; unit root tests – DF and ADF tests. Forecasting based on ARIMA/ARMA model. Introductory VAR Analysis.

MS511 Operations Research

Nature of OR problems and applications in different areas. The LP problem, its formulation, graphic solution of two variable problems. Transportation and assignment problems. Deterministic inventory models – ABC analysis and inventory management. Queuing theory – single server waiting time model.

MS512 Demography

Scope and importance of demography. Data sources and their limitations. Population census, Vital registration, Population register, Demographic and Health surveys, other sources. Evaluation and adjustment of census and survey data on age-sex distribution - Growth of Human Population: Rate of natural increase; Arithmetic, Geometric and Exponential growths. International statistical classification of diseases, injuries and causes of death - Measures based on diseases (i.e., morbidity), death (i.e, mortality) and birth (i.e., fertility) statistics including measures such as Gross and Net reproduction rates, Mean length of generation, and Census measures of fertility - Life Tables: definition, simple construction and applications. Concept of Migration.

MS513 Statistical Quality Control

Concept, measurement and control of quality. Seven tools of Quality Control. Control charts – Concepts of control charts, R, p, np, and c charts. Interpretation of control charts. Acceptance sampling – inspection by attributes, OC curve, producer's and consumer's risks, AQL, LTPD, AOI, AOQL, IQL, single and double sampling plans.

2- Professional Diploma in Bioinformatics

MC521 Mathematical Biology

Part 1) Mathematics

(i) Computational methods in (i) optimization, (ii) Solving class of differential equations

Part 2) Biology

i) Molecular biology of prokaryotic and eukaryotic cells and their viruses. ii) Mechanisms of DNA replication, transcription, translation. Structure of genes and chromosomes. Regulation of gene expression, DNA methylation, and MicroRNA. iii) Biochemistry: metabolism of carbohydrates: lipids, proteins, nucleic acids, and amino acids, Glycolytic pathway, TCA cycle Electron transport and oxidative phosphorylation

MC522 Introduction to Systems Biology

Applications of omics technology: genomics, transcriptomics, proteomics, metabolomics to systems biology. Systems Biology cycle, Reconstruction of metabolic networks. Analyzing of large genome-scale metabolic models (GEM). Integration omics data with GEM. Application of systems biology: microbial systems biology and systems medicine.

MC523 Computation Biology Techniques

Introduction to programming with Matlab, algorithms, dynamic programming, graph theory, probability, Bayesian Network, and hidden Markov models.

MC524 Analyzing Next Generation Sequencing Data

Genome browser, genome mapping, An Analyzing of RNA-Seq, DNA-methylation, proteomics.

MC525 Bioinformatics

i) The NCBI public sequence database, searching in PubMed, sequence retrieval. ii) Comparing Genes, Proteins, and Genomes. iii) Genome Assembly. iii) Gene finding. iv) Protein-Protein Interaction.

MC526 Applied Statistics for Bioinformatics using R

Introduction to R package, Basics of statistical inference, p-values and confidence intervals, statistical modeling, multiple testing, factor analysis, empirical Bayes. Bioconductor package.

MC527 Web Programming

HTML 5.0, Javascript, client-server application and web-service

MC528 Metabolic Engineering

Principles of enzyme function and kinetics, stoichiometry and energetics of metabolism, regulation of metabolic pathway, metabolic control analysis, application of thermodynamics and systems biology in metabolic engineering,

MC529 Biological Database

Fundamentals of relational database design and its application to biological information. Introduction to SQL, XML schema, ontologies, SBML, database curation.

MC530 Computational Intelligence

Introduction to Neural Network, Genetic Algorithms, genetic programming,

MC531 Python and Linux for Bioinformatics

i) Linux command lines, how software works on Linux and how to use it, Linux tools for bioinformatics. ii) Introduction to Python, Organizing Data, files, error handles, classes, regular expression and Biopython.

MC532 Biological Data Mining

Introduction to data mining methods: association rules, classification and clustering. Application of these methods to omics data. Text mining for biological data. eQTL Analysis, Analyzing biological networks



1- M.Sc. Degree in Pure Mathematics

M601 Linear Algebra I

The course contains: Inner product spaces - Schawrz and triangular inequalities - Orthogonality - Gram-Schmidt - Matrix norms - Linear least squares - Sparse matrices - Positive definite - symmetric matrices and Cholesky's algorithm-Quadratic forms - Linear differential equations with constant coefficients -Schur normal form - QR factorization of matrices.

M602 Topology I

Topological spaces – Bases and sub-bases - Finite product spaces – Continuous maps – Homeomorphisms – Hausdorff spaces – compactness and connectedness – Separation axioms – Countability axioms.

M603 Numerical Analysis I

The course contains: Numerical treatment of initial value problems, boundary value problems and eigenvalue problems for ordinary and partial differential equations. Relevant linear algebra, discretizations, convergence, stability, error propagation, finite differences, finite elements, finite volumes, method of lines, conjugates gradient methods, multigrid methods.

M604 Partial Differential Equations I

The topics of this course are: Non-linear PDE of elliptic hyperbolic and parabolic types and their applications - Backlund transformation and soliton theory.

M605 Functional Analysis

Banach spaces - Hahn-Banach theorem - Banach-Steinhaus theorem - open mapping and closed graph theorems – Duality - weak topologies - reflexive and separable spaces -Bounded and unbounded operators - Closed operators – Adjoint – Spectrum - Compact self-adjoint operators and their spectral theory -Fredholm theory – Index -Spectral analysis of specific operators.

M606 Discrete Mathematics

Mathematical logic – sets – functions –relations – trees – Counting - Mathematical induction – Graphs and planar graphs – Trees and cut-sets – Finite state Machines – Analysis of Algorithms – Boolean Algebras and Logic Circuits – Possets and Lattices – Elements of coding theory.

M607 Calculus of Variations

The optimal path problem – The Euler-Lagrange equation – In n-dimensions –The parametric approach – Corner conditions – Strong external – Constraints – Sufficiency tests – The calculus of variations in practice.

M608 Topics in Analysis I

Metric spaces – The Riemann – Stielties Integral – Sequence and series of functions – Weierstrass approximations theorem – Stone-weierstrass theorem – Power series – Radius of convergence – Real power series – Order of summation.

M609 Differential Geometry I

The topics of this course are: Differentiable manifolds and embedding theorems, tangent bundle, vector fields and differential 1-forms, Riemannian metrics and connections, Geodesics, Exponential map, jacobi fields, and Comparison Theorems.

M610 Dynamical Systems I

Introduction - Equilibrium – Solutions - Periodic and Quasi-periodic Solutions - Stability Analysis - Introduction to perturbation Theory - Relaxation Oscillations - Bifurcation Theory - Chaos.

M611 Fuzzy Mathematics

Fuzzy set - Fuzzy numbers and their algebra – logic - Fuzzy logic calculations of linguistic variables. Minkovski distance between triangular fuzzy numbers.

M612 Operation Research I

Linear Programming (L.P): Basic concepts - Graphical method - simplex method. The two phases method, Duality of LP - Wolfe Decomposition - Transportation problem Integer programming (I.P): Graphical Representation - Gomory's Cutting plane method.numerative techniques - Bala's Algorithm Dynamic programming (D.P): Basic D.P structure - Multistage Decision Processes - Computational Procedure in D.P - LP as a case of D.P.

M613 Special Functions

This course study special functions and focus on: Gamma functions - Beta functions - Other functions defined by integrals - Bessel functions - Modified Bessel functions - Legendre polynomials - Hermite and Laguerre polynomials - Chebyshev and Jacobi polynomials - Hypergeometric functions - Generalized Hypergeometric functions.

M614 Selected Topics Related to Pure Mathematics

Topics of this course will be selected by Mathematics Department to meet new directions in pure mathematics.

M615 Special Course I

Topics of this course will be selected by Mathematics Department to meet new directions in pure mathematics.

MC600 Practical (Computer)

Topics of this course will be selected by Mathematics Department in Computer Science.

2- M.Sc. Degree in Applied Mathematics

M616 Advanced Quantum Mechanics I

The development of quantum mechanics - Wave packets and time-dependent Schrödinger equation – Simple solutions of Schrödinger equation – Vector spaces and linear operators: Dirac notations (Vector representation of states - Linear operators - Eigenvalues and eigenvectors, Relationship between kets and wave functions - Observables - Commutability and compatibility) – The linear harmonic oscillator – The Schrödinger and Heisenberg pictures – Angular momentum and spin – Motion in a magnetic field – Interaction matter – Relativistic theory.

M617 Fluid Mechanics I

Two and three dimensional motion – Rotational and irrotational motion – Viscous flow – Flow through porous medium – Theory of potential field – Water waves – Boundary Layer theory – Shallow water equations – Turbulent boundary layers.

MC618 Computational Method in Applied Mathematics I

Conservation Equations – Boundary – Layer Equations - Uncoupled laminar Boundary Layers – Uncoupled laminar Duct flow – Numerical Methods for parabolic and Elliptic Equations – Numerical Methods for Model Hyperbolic Equations.

M619 Mathematical Methods I

Topics of this course include: Orthogonal functions – Legendre functions – Legendre differential equation, Legendre polynomials – Hermite polynomials – Laguerre polynomials - Sturm-Liouville systems – Bessel Functions – Applications to physical problems Partial differential equations – Integral equations – Integro-differential equations – Differential-Difference equations.

M620 Electromagnetic Theory I

Basic laws of electromagnetic fields and wave operations - Diffraction method (Kirshof – Kotler) - Radiation of electromagnetic waves - Plane waves - Spread of electromagnetic waves in gyrotropic medium.

M621 Mechanics of Continuous Media I

Topics of this course include: Tensor analysis – Energy and entropy – Fundamental basic equations – Applications in elasticity – Elastic bodies – Viscous elastic bodies.

M622 Quantum Electrodynamics I

Free classical fields – Quantum free fields – Interacted fields – Scattering matrix.

M623 Elasticity Theory I

Elastic bodies - Analysis of strain – Analysis of stress – Stress-strain relation – Treatments of some problems in dynamics of elastic medium – Solutions of N-S equation in spherical and cylindrical coordinates – Oblate spheroidal elastic bodies.

M624 Quantum Optics I

Topics of this course include: Basic quantum Mechanics – Algebra of the Exponential Operator – Representations of some Lie-Algebra – The Electromagnetic field atom – Field interaction - Hamiltonian two-level atom and optical Bloch equation.

M625 Electrodynamics I

Topics of this course include: System of conductors – Continuous distribution – The basic equations of electromagnetic field in material media – Dielectrics of magnetism – Electrostatic stress & energy magnetism.

M626 Mathematical Modeling

The main goal of this course is to learn how to make a creative use of some mathematical tools, such as difference equations, ordinary and partial differential equations and numerical analysis, to build a mathematical description of some physical problems. The course topics includes: Introduction to Modeling -Qualitative Modeling with Functions - Modeling with Dimensional Analysis - Modeling with Difference Equations - Modeling with Ordinary Differential Equations - Empirical Modeling with Data Fitting - Modeling with Partial Differential Equations.

M627 Statistical Mechanics I

System of interacting Particles – Crystals - Kinetic theory of gases and other systems - Method of correlation functions – Kinetic properties of solids – Quantum statistics (B.E and F.D perfect gases) – Internal Partition Function.

M628 Selected Topics Related to Applied Mathematics

Topics of this course will be selected by Mathematics Department to meet new directions in applied mathematics.

M629 Special Course

Topics of this course will be selected by Mathematics Department to meet new directions in applied mathematics.

3- M.Sc. Degree in Mathematical Statistics

MS601 Mathematical Statistics I

Sampling distributions - Exponential families - completeness. Sufficiency – factorization - likelihood ratio - minimax principle. Point estimation. Lehmann-Scheffe and Cramer-Rao theorems. Interval estimation.

MS602 Mathematical Statistics II

Testing hypotheses: parametric methods. Neyman-Pearson lemma. Uniformly most powerful tests. Unbiased tests. Locally optimal tests. Large sample theory, asymptotically best procedures. Linear models, analysis of variance.

MS603 Order Statistics

Basic Distribution theory - expected values and moments - Discrete Order Statistics - Order Statistics for Some Specific Distributions - Moment Relations - Bounds and Applications - Characterizations using Order Statistics - Asymptotic theory.

MS604 Bayesian Statistics

Basic Concepts - Utility and Loss - Statistical Decision theory - Prior Information and Subjective Probability - Bayesian Statistical Inference and Decision Making - Approximate Bayes methods - Posterior approximation with the Gibbs sampler - Numerical Computations in Bayesian Analysis.

MS605 Sampling Theory

Simple random sampling - Sampling for proportions - Estimation of sample size - Sampling with varying probabilities - Sampling: stratified – systematic -cluster -double -sequential and incomplete.

MS606 Computational Statistics

Modern methods of computational statistics and their application to both practical problems and research -Methods of random variate generation -simulation of random vectors -Topics include Monte Carlo simulation –bootstrapping- numerical optimization in statistics -the MCMC techniques

MS607 Nonparametric Statistics

Order Statistics - Quartiles and Converges - Tests of Randomness - Tests of Goodness of Fit - One Sample and Paired Sample Procedure - The General two Sample Problems.

MS608 Stochastic Processes

Basic concepts of stochastic processes - Markov processes (discrete and continuous parameters) - Random walks - Poisson processes - Birth and death processes - Renewal processes and basic limit theorems - Discrete time martingales - stopping times - optional sampling theorem - Applications from theories of stochastic epidemics - survival analysis and others.

MS609 Regression Analysis

Least Square estimation: Gauss-Markoff Setup - Normal equations and least square Method of estimation - properties of estimator - variance of estimator - Estimation of variance - Linear Regression: Simple linear regression model - least square estimation of parameters - Hypothesis testing of slope and intercept - co-efficient of determination - Multiple Regression: Model - estimation of model parameters - test for significance of regression - regression co-efficient, co-efficient of determination - use of anova. Polynomial and logistic

regression: Models and method of estimation - logistic regression-binary-model and estimates.

MS610 Queueing Theory

Queueing Systems: General Concepts - Birth and Death Queueing systems - The Simple M/M/1 Queue - the M/M/1/k model - the M/M/∞ model - Non-Birth and Death Queueing Systems

MS611 Special Course

Topics of this course will be selected by Mathematics Department to meet new directions in mathematical statistics.

MS612 Selected Topics Related to Mathematical Statistics

Topics of this course will be selected by Mathematics Department to meet new directions in mathematical statistics.



4- M.Sc. Degree in Computer Science

MC601 Computational Intelligence

Computational Intelligence is used as an umbrella term for different approaches that deliver enhanced performance and applicability. It encompasses artificial neural nets, evolutionary algorithms, and fuzzy logic. This course gives a thorough introduction into all three aspects of computational intelligence from the perspective of computer science. It focuses on theoretical aspects as well as typical application scenarios.

MC602 High-Performance Computing

Introduction to high-performance computing: History and importance of computational science – Overview of application areas – Review of required skills

High-performance computing: Processor architectures – Memory systems for high performance – Input/output devices – Pipelining – Parallel languages and architectures – Parallel algorithm design and analysis – Applications studied and implemented on parallel machines.

MC603 Advanced Algorithms

Algorithm design and analysis is a fundamental and important part of computer science. This course introduces students to advanced techniques for the design and analysis of algorithms - and explores a variety of applications. The topics that the course covers include hashing - bloom filters – scheduling - network design - online load balancing - algorithms in machine learning - boosting (in the context of learning) - Markov chains and the MCMC method - byzantine agreement - internet algorithms, and nearest neighbor algorithms.

MC604 Advanced Image Processing

Recall of Linear Algebra - Multidimensional Signal Processing - Human Visual System - Image Representation: pyramids and wavelets - Random signals - Image Modeling - Image Sensor Models - Noise Models - Image Denoising - Image Restoration - Image Compression - Video Modeling and Compression - Digital Data Hiding.

MC605 Network Security

Basic concepts and techniques in information security and management such as risks and vulnerabilities - applied cryptography - authentication, access control - multilevel security - multilateral security - network attacks and defense - intrusion detection - physical security - copyright protection - privacy mechanisms, security management - system assurance and evaluation - and information warfare. Coverage of high-level concepts such as confidentiality – integrity - and availability applied to hardware – software - and data.

MC606 Selected Topics Related to Computed Science

Topics of this course will be selected by Mathematics Department to meet new directions in Computer Science.

MC607 Advanced Theory of Computation

This course includes: Algorithms, computability – decidability – enumerability - formal replacements and Church's thesis - Turing machines - primitive recursive functions - u-recursive functions - undecidable predicates.

MC609 Scientific Information Visualization

Study of computer visualization principles – techniques - and tools used for explaining and understanding information - includes visualization algorithms – techniques - and applications.

MC611 Special Course

Topics of this course will be selected by Mathematics Department to meet new directions in Computer Science.



5- M.Sc. Degree in Scientific Computing

MC608 Computational Fluid Dynamics

The course is an elementary introduction to computational fluid dynamics. The emphasis is on the basics of conservation laws, and on high-Reynolds number laminar flows. Both compressible and incompressible flows will be treated. Potential flow and the Kutta condition, quasi-1D flow of a perfect gas through a nozzle, and boundary layer flow over a flat plate are the examples treated in the computer labs. They illustrate such flow phenomena as shocks and boundary layers

MC610 Selected Topics Related to Scientific Computing

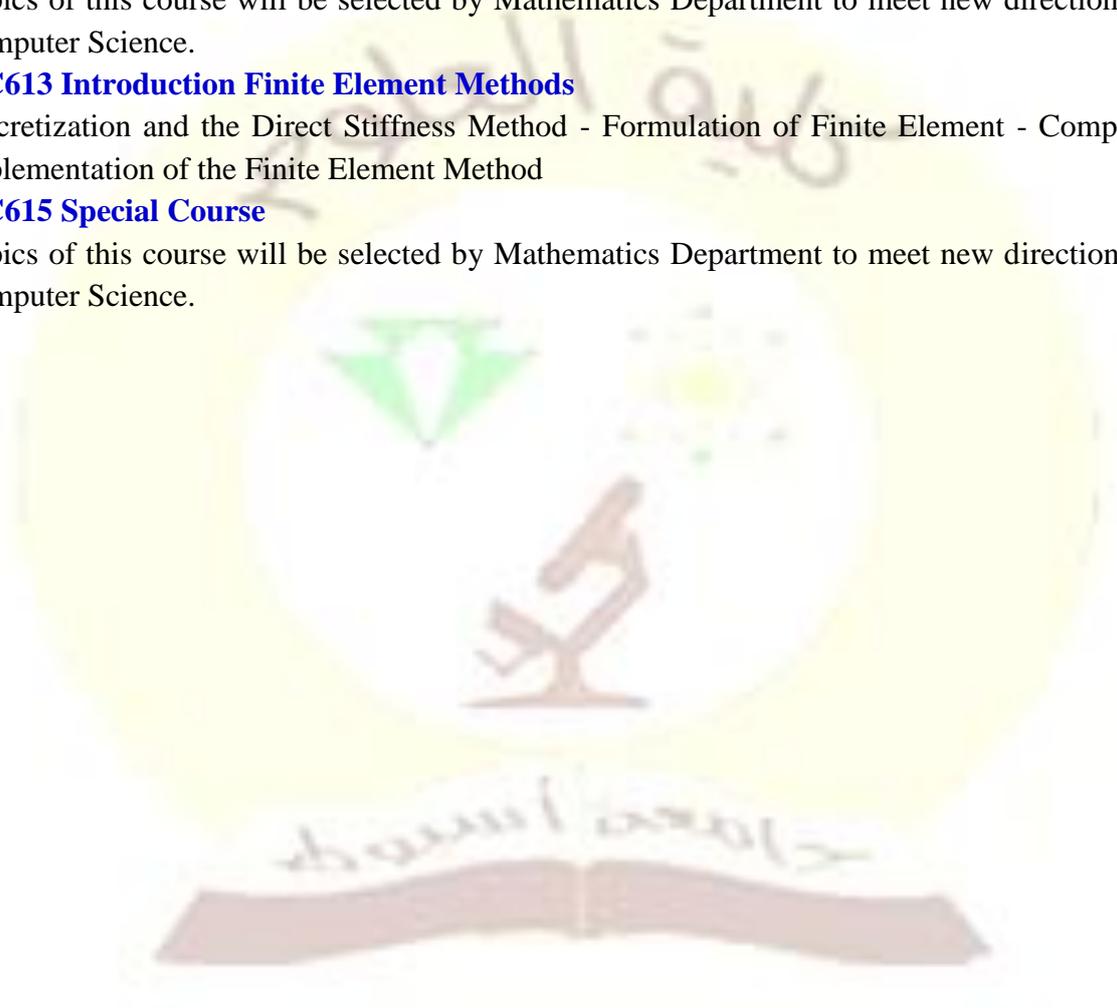
Topics of this course will be selected by Mathematics Department to meet new directions in Computer Science.

MC613 Introduction Finite Element Methods

Discretization and the Direct Stiffness Method - Formulation of Finite Element - Computer Implementation of the Finite Element Method

MC615 Special Course

Topics of this course will be selected by Mathematics Department to meet new directions in Computer Science.



1- Ph.D. Degree in Pure Mathematics

M701 Complex Analysis

The topics of this course are: Quaternionic and bicomplex algebra – Elementary bicomplex functions – Differentiation of bicomplex functions – Bicomplex integration – Bicomplex harmonic Analysis. Function of two complex variables – function of two complex matrices – functions of two linear operators - The fundamental theorem of algebra - the argument principle - calculus of residues - Fourier transform - the Gamma and Zeta functions - product expansions - Schwarz principle of reflection and Schwarz-Christoffel transformation - elliptic functions - conformal mapping and univalent functions - maximum principle and Schwarz's lemma - the Riemann mapping theorem.

M702 General Relativity

Riemannian and Pseudo Riemannian Spaces - Lorentz Space - Space time Space - Space like manifold time like manifold - light like manifold Einstein Field equations.

M703 Number Theory

Congruences – Primes – the Riemann zeta function. Quadratic reciprocity – the arithmetic of quadratic fields – class groups. Introduction to elliptic curves.

M704 Algebraic Geometry

Projective spaces – Bezout's theorem – plane conics – curves and their genus – affine varieties – Hilbert bases theorem – irreducible algebraic sets – zariski topology – coordinate ring and polynomial maps - Applications in quadratic surfaces – singularity dimension.

M705 Operation Research II

Classical optimization techniques (COT): Single variable optimization - Multivariable optimization with no constraints - Multivariable optimization with constraints (equality and inequality) - Single variable optimization technique(SVO):Unimodel functions - Elimination method - Fibonacci method Golden section method - Quadratic interpolation method, cubic interpolation method.Unconstrained optimization techniques: Random search method - Steepest descent method - Conjugate Gradient method - variable metric method. Constrained optimization techniques: Methods of feasible direction - Lagrange multiplier method - Penalty function methods - Kuhn- Tucker conditions.

M706 Numerical Analysis II

Different numerical methods for large problems with different time scales. Spectral methods – wavelets - multiple methods - preconditioned conjugate gradient methods - multigrid methods.

M707 Dynamical Systems II

Introduction - Hamiltonian Systems - Control of Chaos and Bifurcation - Tools to Analyze Motions - Chaotic Systems - Dynamics in State Space - The Theory of Complexity.

M708 Partial Differential Equations II

Basic constant-coefficient linear examples: Laplace's equation, the heat equation, and the wave equation, analyzed from many viewpoints including solution formulas - maximum principles - and energy inequalities. Key nonlinear examples such as scalar conservation laws - Hamilton-jacobi equations - and semilinear elliptic equations - analyzed using appropriate tools including the method of characteristics - variational principles - and viscosity solutions. Simple numerical schemes: finite differences and finite elements. Important PDE form

mathematical physics - including the Euler and Navier-Stokes equations for incompressible flow.

M709 Lie Groups

Manifold - Continuous group of transformations - infinitesimal generators - Lie bracket- Lie Algebra - Applications in Kinematic of Robotics and Solution Theory of differential equations.

M710 Harmonic Analysis

The Fourier transform on L^1 - Tempered distributions – The Fourier transform on L^2 – Interpolation of Operators – The Hardy Little wood maximal function – singular Integrals – Little wood – Paly theory – Fractional integration – Singular multipliers – Inverse problems.(Global uniqueness).

M711 Optimization Theory

Introduction- classical optimization techniques- Linear programming- Non Linear programming- geometric programming- Dynamic programming

M712 Riemannian Geometry

Riemannian metric - Tangent Space - Vector bundle - Tangent bundle - normal bundle – Tangent map - Gauss Weingarten equations – Riemannian Curvature tensor Jacobi Field and Variation.

M713 Topology II

After introducing metric and general topological spaces - the emphasis will be on the algebraic topology of manifolds and cell complexes. Elements of algebraic topology to be covered include fundamental groups and covering spaces - homotopy and the degree of maps and its applications. Some differential topology will be introduced including transversality and intersection theory. Some examples will be taken from knot theory.

M714 Differential Equations

Existence and uniqueness of solutions of scalar differential equations - Existence and uniqueness theorems for system of differential equations -fixed-point methods - Properties of linear homogeneous systems - Inhomogeneous linear systems -Behaviour of solutions of nth order linear homogeneous equations - Continuous dependence and stability properties of solutions - Stability of linear and weakly nonlinear systems - Two-dimensional system - Stability by Liapunov's second method for autonomous systems
Differential Equations:Liapunov Stability and boundedness of solutions for nonautonomous systems - Existence theorems for periodic solutions and almost periodic solutions. Functional Differential Equations:Existence theorems and uniqueness - Stability of solutions - Asymptotic behaviour of solutions - Boundedness of solutions. Existence theorems for periodic solutions and almost periodic solutions.

M715 Numerical Linear Algebra

Stability, Robust stability and distance instability – Numerical solutions and conditioning of Lyapunov and Algebraic Riccat equations - Eigen pair of a symmetric quadratic Eigen value problem in an interval- computational and optimization methods for quadratic inverse problems in vibration.

M716 Information Geometry

Geodesic distance and statistical manifold Geometry of parameter spaces- Information metric and metric tensor, J- divergence and Riemannian distance.

M717 Topics in Analysis II

Definition of Fourier series – Formulation of convergence problems – The $(C,1)$ summability of Fourier series – The L^2 theory of Fourier series - convergence of Fourier series – orthonormal expansions in $L^2(a,b)$ – Bessel's inequality – parseval's theorem – Fejer theorem – pointwise convergence of Fejer theorem – some application of Fourier series.

M718 Integral Equations

Notion and examples of integral equations (IEs), Fredholm IEs, Unique solvability of the Fredholm IE, IEs as linear operator equations, Linear operator equations: the Fredholm theory, Picard's Method, The Homogeneous and Non-Homogeneous Linear Equation and Wronskians, The Sturm–Liouville Equation.

M719 Selected Topics related to Mathematical Logic

Introduction – quantifiers – propositional calculus – Methods of proof – Logically equivalence – contradiction – Logical reasoning – contra positive - Rules of Inference predicate calculus.

M720 Differential Geometry II

Differential forms. Integration on manifolds. Sard's Theorem. Derhamchomology. Morse theory. Submanifolds and second fundamental form. Applications to geometric problems.

M721 Special Course I

Topics of this course will be selected by Mathematics Department to meet new directions in pure mathematics.

2- Ph.D Degree in Applied Mathematics

M722 Fluid Mechanics II

Magneto fluid dynamics – The theory of MHD generators – Mechanics of Fluid flow Through a porous medium – Heat transfer through a porous medium – Mass transfer through a porous medium – Forced convection – Mixed convection – Double – Diffusive convection – Convection with change of phase.

M723 Advanced Quantum Mechanics II

Scattering theory - Method of second order quantization in theory of Radiation - Relativistic quantum mechanics.

M724 Mathematical Methods II

Complex Inversion Formula for Laplace Transforms – The complex inversion formula. The Bromwich contour – Use of residue theorem in finding inverse Laplace transforms – Inverse Laplace transforms of functions with branch points – Applications to boundary-value problems.

M725 Elasticity Theory II

Basic Equations of the Linear electro elasticity – static problems of electro elasticity for Bimorphs with stress concentrators – Diffraction of shear wave – Mixed dynamic problems of electro elasticity – Harmonic oscillations of continuous piezoceramic – Magnetoelasticity Induced currents – Influence of Magnetizability.

M726 Computational Method in Applied Mathematics II

Buoyant Flows – Coupled Turbulent Boundary Layers – Finite difference method for applied mathematics -Numerical methods for solving Boundary Layer Eqs. – Stability and Transition – Gird Generation.

M727 Electrodynamics II

Steady electric current in Linear conductors of continuous media – Quasistationary electromagnetic field in material media – Boundary value problem – Field of high frequencies – Substance in plasma state.

M728 Statistical Mechanics II

Physical Concepts and Exact Results – Quantum Statistics of-Many-Particle system – Application of Green's Function Technique to Coulomb systems – Equilibrium Properties in classical and Quasi classical Approximation – Quantum – Statistical Calculations of Equilibrium properties – Transport Properties – Green's Function Approach to Optical Properties.

M729 Nonlinear Dynamical Systems

Sine-Gordon system – The KdV system - The Nonlinear Schrödinger equation – Boussinesq equation – The AKNS system of nonlinear evolution equations – Exact solutions of nonlinear evolution equations – Backlund transformations and their applications to nonlinear equations of mathematical physics.

M730 Electromagnetic Theory II

Cylindrical and spherical waves- Spread of electromagnetic waves in presence of oriented surfaces - Damping and slowing-down electromagnetic waves in oriented systems - Spread of electromagnetic waves in layer medium - Electromagnetic waves in medium with random non-homogeneity.

M731 Quantum Electrodynamics II

Diagrams – Reineman Law – Calculation of integrals – diversion – Structure of diversion – explanation of real interaction.

M732 Theory of Relativistic Quantum Mechanics

Relativistic notations – Quantum mechanics and the theory of relativity – Free relativistic fields – The scalar field (Klein-Gordon equation) – Spinor field (Dirac equation and Dirac γ - matrices) – Massless vector field (Maxwell's equations).

M733 Special Course II

Topics of this course will be selected by Mathematics Department to meet new directions in applied mathematics.



3- Ph.D. Degree in Mathematical Statistics

MS701 Advanced Probability

Probability space; distribution functions and densities; Poisson limit theorem; de Moivre-Laplace theorem; measure-theoretic definition of expectation; classification of measures on \mathbb{R} ; convergence of random variables; sigma-algebras and random variables; pi-systems and Dynkin systems; discrete Markov chains; random walks; gambler's ruin problem; Markov chains on a general phase space; Borel-cantelli lemmas; Kolmogorov inequality; three series theorem; laws of large numbers. Weak convergence of measures - characteristic functions - Central Limit Theorem and local limit theorem - stable laws - conditional expectations and martingales - optimal stopping theorem - convergence of martingales.

MS702 Multivariate Statistical Analysis

Matrix algebra and random vectors - Multivariate distributions and invariance - Properties of multivariate distributions - the Multivariate normal - Inference about the mean vector - basic multivariate sampling distributions - Discrimination and Classification

MS703 Time Series Analysis

The methodology of probabilistic description and statistical analysis of (primarily stationary) random sequences and processes. Correlation functions - Gaussian processes - Hilbert-space methods including Wold decomposition and spectral representation - periodogram and estimation of spectral densities - parameter estimation and model identification for ARMA processes - linear filtering - Kalman-Bucy filtering - sampling theorems for continuous-time series - multivariate time series.

MS704 Stochastic Differential Equations

Stochastic Analogs of Classical Differential Equations - Stochastic integrals - Ito's formula and Integrals - The Filtering Problem - The Stochastic Integral as a Stochastic Process - Stochastic Differentials - Stochastic Differential Equations - Linear Stochastic Differential

MS705 Fuzzy Probability and Statistics

Fuzzy Sets - Fuzzy Probability Theory - Discrete Fuzzy Random Variables - Continuous Fuzzy Random Variables - Convergence of Random Fuzzy Sets - Aspect of Statistical Inference - Fuzzy Statistical Analysis and Estimation

MS706 Nonlinear Regression Analysis

Review of Linear Regression - The Nonlinear Regression Model: Iterative Estimation and Linear Approximations - Practical Considerations in Nonlinear Regression - Multiresponse Parameter Estimation - Nonlinear regression models and asymmetric CAPM models - nonlinear interest rate models - and regime switching models - Logistic regression model.

MS707 Advanced Biostatistics

Read, critically evaluate - and discuss biostatistical primary literature - Learn about a variety of statistical techniques frequently used in biology - Learn to apply the techniques to real data - Learn new statistical techniques - some applications of probability in genetics - Experimental designs - Estimation of effects of treatments - Comparative experiments - Fisher-Irwin test - Wilcoxon tests for paired comparisons.

MS708 Experimental Design

Linear estimation - estimability of parametric functions and BLUE-Gauss-Markov theorem- Linear Hypothesis - Analysis of variance - one way and two way classification - Principles of

design-randomization-replication-local control - Completely randomized design - Randomized block design-Latin square design. Missing plot technique-comparison of efficiency - Basic concepts of factorial experiments - factorial experiments - Duncan's multiple range test.

MS709 Reliability and Life testing

Structural properties of coherent Systems: System of components-series and parallel structure with example - dual structure function-coherent structure -preservation of coherent system in terms of paths and cuts - representation of bridge structure-times to failure - relative importance of components - modules of coherent systems, Reliability of Coherent systems: Reliability of a system of independent components, Parametric distributions in reliability: A notion of ageing (IFR and DFR only) with examples-exponential distribution-Poisson distribution.

MS710 Special Course

Topics of this course will be selected by Mathematics Department to meet new directions in mathematical statistics.



4- Ph.D Degree in Computer Science

MC701 Advanced Computational Geometry

Advanced topics in computational geometry emphasizing problems in dimensions three and higher. Convex hulls - collision avoidance problems - minimal enclosing boxes - interlocking polyhedral - space partitioning - extremal sections of convex polyhedral - reverse search and enumeration - geometric problems from the manufacturing industry including injection molding - gravity casting – stereolithography - NC-machining and tolerancing metrology.

MC702 Nonlinear Optimization

Classical non-linear optimization Methods – Numerical methods for non- linear

MC703 Computational Complexity Theory

The goals of this course are to allow graduate students to: Understand the fundamental results and problems in complexity theory - Read and understand current research papers in complexity theory and related research areas such as theoretical cryptography, approximation algorithms, and computational learning theory. Apply complexity-theoretic tools and results in their own research. Therefore- the course covers these topics- Time and Space complexity - Circuit complexity - Randomized algorithms - Counting problems – Cryptography - Interaction, proofs and complexity.

MC704 Distributed and Parallel Computing

The course shows how to use the Parallel Computing Toolbox™ to increase both the speed and the scale of existing code. Attendees who are working with long-running simulations, or large data sets, will benefit from the hands-on demonstrations and exercises in the course. Topics include: Working with a MATLAB pool - Distributed jobs - Distributed programming considerations - Prototyping parallel jobs - Parallel programming considerations - Increasing scale with multiple systems.

MC705 Data Mining and Knowledge Discovery

Introduction to data mining and knowledge discovery in databases - data cleaning - statistical techniques - association rule learning - time series and spatial data mining algorithms - clustering algorithms - data visualization.

MC706 Advanced Artificial Intelligence

Temporal and nonmonotonic logic - truth maintenance systems - probabilistic reasoning - deductive databases - automated learning – planning - and tutoring - story understanding - structure of domain dependent expert systems.

MC707 Advanced Cryptography

Cryptography based on quadratic residuacity. Advanced techniques for factoring and extracting discrete logarithms. Hyperelliptic curve cryptography. Pairings and their applications to cryptography. Code based and lattice based cryptography. Additional topics may include provable security, secret sharing, more post-quantum cryptography, and new developments in cryptography.

MC708 Software Reliability Engineering

Learn how to analyze – predict – design - and engineer the required and expected reliability of software systems. Examine case studies of systems that worked well and of systems that failed in some crucial aspect. Case study examples include the London Ambulance Dispatch System, the Lucent Telephone Switching Systems and the Mars and Voyager missions.

MC709 Information Theory

Mathematical models for channels and sources; entropy - information, data compression - channel capacity - Shannon's theorems - rate-distortion theory - and introduction to multiuser information theory.

MC710 Special Course I

Topics of this course will be selected by Mathematics Department to meet new directions in computer science.



5- Ph.D Degree in Scientific Computing

MC711 Parallel Computations for Large-Scale Problems

The aim of the course is to provide the knowledge needed for solving numerically large-scale industrially relevant - computational problems with methods using many processors efficiently -how to develop - select and adopt algorithms/data structures and how to implement and evaluate the performance of such software.

MC712 Computational Biology

This is a course in computational biology - focusing current problems in genomics. Our emphasis will be algorithmic - on discovering appropriate combinatorial algorithm problems and the techniques to solve these problems. Primary topics will include DNA sequence assembly - DNA/protein sequence comparison - hybridization array analysis - RNA and protein folding - and phylogenetic trees.

MC713 Numerical Methods for Time-Dependent Partial Differential Equations

This course will introduce a variety of numerical methods for hyperbolic (e.g. conservation laws), elliptic and parabolic partial differential equations. Notions of weak and strong convergence, accuracy and stability will be discussed where appropriate. Special topics will include a (basic) introduction to certain integral equation methods and, if time permits - certain matrix factorizations.

MC714 Quantum Computing

This course deals with the new field of quantum computation - which is computation based on quantum mechanical principles. The course is taught from a computer science perspective. It will explain the model of quantum computation - and will cover the main quantum algorithms and complexity results as well as some elements of quantum information theory.

MC715 Bioinformatics and Genomes

Organization of genomes and Fundamental bioinformatics sequence analysis techniques - Sequence Alignments - Protein structure prediction - Secondary Structure Prediction - Transmembrane Helix prediction - Fold recognition - Gene finding - Repeats - Transcriptional Regulation - Phylogeny - Flux balance analysis

MC716 Computational Methods for Finance

Prerequisites: Scientific Computing or Numerical Methods

Computational techniques for solving mathematical problems arising in finance. Dynamic programming for decision problems involving Markov chains and stochastic games. Numerical solution of parabolic partial differential equations for option valuation and their relation to tree methods. Stochastic simulation - Monte Carlo - and path generation for stochastic differential equations - including variance reduction techniques - low discrepancy sequences - and sensitivity analysis.

MC717 Special Course II

Topics of this course will be selected by Mathematics Department to meet new directions in computer science.

2-Physics Programs

1-Diploma in Medical Physics

PMD501: Basic Human Anatomy and Physiology

Organization of the body - cell structure and function, Introduction to viruses - Microbe-human interactions - The skeletal system - The nervous system - The cardiovascular system - The digestive system - and The reproductive system.

PMD502 Medical Training

A hospital training to cover all aspects of the role of medical physicist in hospitals including radiodiagnoses – radiotherapy - nuclear medicine and others.

P503 Principles of Medical Imaging

Planner imaging - Central slice theory - Fourier transformers and convolution and deconvolution – Projection - and image reconstruction- Image processing and analysis- Nuclear magnetic resonance.

P504 Fundamentals of Radiological Sciences

Electromagnetic (EM) radiation - Particulate Radiation - Radiation units - X-ray production - Basic imaging science and technology - Projection imaging concepts and detectors - General radiography – Mammography - Fluoroscopy and interventional imaging - Computed tomography – Ultrasound - and magnetic resonance imaging.

P505 Introduction to Nuclear Medicine

Structure of the atom - Atomic nomenclature - Electromagnetic radiation production mechanisms - Nuclear stability - Characteristics of radioactive decay - nuclear transformation - Nuclear reactions - Radiopharmaceutical and radioisotopes - Radionuclide generators - Detectors systems - Planner scintillation cameras (Gamma cameras) - Single photon emission computerized tomography (SPECT) - Positron emission tomography (PET) - PET radiotracers and radioisotopes- PET hot lab.

P506 Computation and Image Processing

Introduction to image processing - Imaging modalities - Digital imaging definition - Imaging tools - Image sampling - Image processing algorithms - Image compression algorithms - Image analysis - Parallel computation - fast image construction.

P507 Radiation Therapy

Radiotherapy machines - External beam radiotherapy - Treatment planning systems - Conformal radiotherapy – Intensity Modulated radiotherapy - Virtual simulation - Brachytherapy.

P508 Selected Topics Related to Medical Physics

Topics are to be determined by the supervising committee and approved by the Physics Department.

P509 Medical Accelerators

Introduction to particle physics - Charged particle acceleration - Medical electron accelerator - Radiotherapy modalities - Microwave principles for linear accelerators (Linacs) - Microwave accelerator structure - Treatment beam production - Dose monitoring and beam stabilization - Accelerator control and safety interlocking - Multi-X-Ray energy accelerator - Patient support assembly and treatment accessories - Treatment simulator - Treatment planning and portal imaging.

P510 Clinical Dosimetry Measurements

Treatment terms - Calculation parameters - Dosimetry calculations - Isodose charts - Shaping isodose distribution - Calculation points - Dose volume histogram - and photon - Electron and erapy.

P511 Radiation Physics and Protection

Overview on atomic and nuclear structure- radioactive decay and radioactivity - Binding energy and mechanisms of radioactivity- Radioactive decay modes- Beta emission- Alpha emission- Electron capture- Isomeric transition- Gamma ray radiation- Naturally occurring radioisotopes- Overview of radiation interaction with matter- Overview of radiation detection- Radiation units - Dose estimation- External radiation hazard- Internal radiation hazard- ALARA principle - Equivalent dose calculations- Effects of radiation on biological systems- Radiation damage- Stochastic and deterministic effects of radiation- Radiation safety guides- Radiation safety standards.



1- M.Sc. Degree in Solid State Physics

P601 Electromagnetic Theory I

Vector analysis- curvilinear coordinates- Electrostatics (fields and potentials) - Boundary-value problems in electrostatics (Laplace and Poisson Equations) - Multipoles and dielectrics- Magnetostatics- Time-varying Fields and Maxwell equations- Electromagnetic waves and wave propagation.

P602 Condensed Matter Physics

Electrical Properties of Dielectrics - Band Theory of Metals - Band Theory of Semiconductors and Dielectrics - Magnetic Properties of Materials - Electrical properties of metals - Magnetic properties of materials - Dielectric and related properties - Optical properties of solids.

P603 Quantum Mechanics I

Angular momentum - Internal angular momentum. Total angular momentum: LS and jj coupling - Addition of total angular momenta (Clebsch Gordan Coefficient) 3j, 6j and 9j coupling - Wigner-Eckart theorem - Invariance principles and conservation laws - Time independent perturbation theory - The variation method - The WKB approximation method.

P604 Crystal Structure

The nature of crystal structures - Geometry and chemistry of crystals – Size – Homogeneity – Perfection – Twinning – Polymorphism - Phase transitions – Isomorphism - Solid solutions - Diagrams and models - Interatomic forces and structure building - Lattices and lattice complexes - Directions of planes and lines - Some simple structures (copper, iron, comparison of cubic and hcp, diamond - sodium chloride - cesium chloride - calcium chloride - zinc blende structures and the structure of various metallic alloys) - Structures of oxides (Perovskite – spinel – corundum – ilmenite - lithium niobate – calcite – aragonite – olivine - rutile structures - forms of silica - the quartz structure) - The determination of crystal structures (single crystal and powder methods - examples of structure determinations and the refinement.

P605 Advanced Electronics

Introduction to basic signal – Spectrum - and amplifier concepts for the analog electronic circuits. The electronic devices including diodes - Bipolar junction transistors (BJTs) - Field effect transistors (FETs) and Operational Amplifiers (Op-Amps) will be discussed. In each device - its analysis is firstly presented after a particular device physics overview - and then the design some circuit applications follow. The main focus of this course is not only to develop the student ability to analyze and design basic analog electronic circuits with passive components and/or the active elements like diode - transistors and Op-Amp. Besides - some experiments are provided to help students to have a thorough grasp of the basic electronic circuit problem. Throughout this course - small signal analysis and low frequency operation are mainly considered for the students to have the first interesting impression in this important discipline of the ECE program.

P606 Statistical Physics

Thermodynamics - Kinetic theory - Probability distributions - Phase space and microcanonical ensemble - Canonical ensemble and partition functions with applications - Grand canonical ensemble and quantum statistics - Imperfect gas - Classical monoatomic liquids - Quantum statistical Physics - Transport theory.

P607 Magnetic Resonance

Magnetic properties of matter (paramagnetic susceptibility - Phenomenon of resonance) - Principles and instrumentations of electron paramagnetic resonance (EPR) - The Hamiltonian (spin Hamiltonian operator - Zeeman interaction - Hyperfine interaction) - Electron paramagnetic resonance spectra (analysis, spectra of liquid phase, calculation the spin energy levels - allowed transitions and evaluation the resonant fields) - Nuclear magnetic resonance (principle - chemical shift, spin – spin coupling, analysis) - Double – resonance technique (an ENDOR experiment - energy levels and transitions - relaxation processes in steady state - electron – electron double resonances) - Electron spin echo spectroscopy (pulsed EPR - electron spin echoes - the nuclear modulation effect - ESE- ENDOR) - Applications.

P608 Selected Topics Related to Solid State Physics

Topics are to be determined by the supervising committee and approved by the Physics Department.

P609 Methods of Experimental Solid State Physics

Experimental methods in solid state physics. Applications. An introduction to materials characterization - X-ray analysis – Microscopy - Molecular spectroscopy techniques - Thermal Techniques - Experimental measurement (Electrical conductivity – Magnetization - Dielectric and Optical properties).

P610 Thermal Analysis

Thermal events, Concepts of thermal analysis. Thermal analysis techniques (thermogravimetry (TG) - Differential thermal analysis (DTA) - Differential scanning calorimetric (DSC) - Thermometry (TP) - Thermodilatometry (TD) - Thermomechanical analysis (TMA) - combination of thermal analysis techniques) - Important theories & advanced topics - Using computers in thermal analysis - Tutorial of data analysis.

P611 Physics of Metals and Alloys

Chemical Bonding - Crystal structure – Entropy - Free energy - Free energies of metallic compounds – Solids - liquids and solidification – Alloys - Thermal phenomena in materials - Metal crystals – Periodicity - Heat treatment of alloys - Microstructure and properties - mechanical properties - Electrical conduction in metals - Advanced topics in metal analysis.

P612 Thin Films and Technological Applications

Thin film technology - Thin film nucleation - and growth models (2D, 3D, and 2D-3D combination) - Epitaxial growth of thin films - superlattice structures and quantum wells – Diffusion - Physical vapor deposition (thermal evaporation - e-beam evaporation – sputtering - MBE Laser - MBE PLD) - Chemical vapor deposition (PECVD, MOCVD) - Solution-based deposition techniques (Sol-Gel, PAD, liquid phase epitaxy - LPE and other deposition techniques) - Thin film characterization (structural, chemical and electrical characterizations) - Special topics on various thin film devices and fabrications - and a lab sessions.

P613 Semiconductor Properties and Applications

Crystal structure - Band structure - Electrical properties of S.C. Optical properties of S.C. Thin films - Thermal properties of S.C. Other types of semiconductor materials - Wide band gap semiconductors.

P614 Introduction of Nanomaterials

History and scope - Interdisciplinary nature - Structure of nanomaterials - length scales - De Broglie wavelength & Exciton Bohr radius - Jellium model - Quantum wells - Quantum wires

- quantum dots – Fullerenes – Graphite - Carbon nanotubes - Inorganic nanowires – Nanoparticles - Core-shell nanoparticles - Survey of the synthesis methods and strategies (top-down and bottom-up approaches) - chemical vapor deposition - laser ablation - sol-gel processing – lithography - Characterization of nanomaterials. Applications to nanoelectromechanical systems - Nano-magnetic materials and devices - Nano-optoelectronic materials and devices, Medicine and pharmacology applications.

M603 Numerical Analysis I

The course contains: Numerical treatment of initial value problems, Boundary value problems and eigenvalue problems for ordinary and partial differential equations. Relevant linear algebra, discretizations, convergence, stability, error propagation, finite differences, finite elements, finite volumes, method of lines, conjugates gradient methods, multigrid methods.



2- M.Sc. Degree in Nanomaterials

P601 Electromagnetic Theory I

Vector analysis, curvilinear coordinates- Electrostatics (fields and potentials)- Boundary-value problems in electrostatics (Laplace and Poisson Equations)- Multipoles and dielectrics- Magnetostatics- Time-varying Fields and Maxwell equations- Electromagnetic waves and wave propagation.

P602 Condensed Matter Physics

Electrical Properties of Dielectrics- Band Theory of Metals- Band Theory of Semiconductors and Dielectrics- Magnetic Properties of Materials- Electrical properties of metals- Magnetic properties of materials- Dielectric and related properties- Optical properties of solids.

P603 Quantum Mechanics I

Angular momentum, Internal angular momentum. Total angular momentum: LS and jj coupling. Addition of total angular momenta (Clebsch Gordan Coefficient) 3j, 6j and 9j coupling. Wigner-Eckart theorem. Invariance principles and conservation laws. Time independent perturbation theory. The variation method. The WKB approximation method.

P606 Statistical Physics

Thermodynamics, Kinetic theory, Probability distributions. Phase space and microcanonical ensemble. Canonical ensemble and partition functions with applications. Grand canonical ensemble and quantum statistics. Imperfect gas. Classical monoatomic liquids. Quantum statistical Physics. Transport theory.

P607 Magnetic Resonance

Magnetic properties of matter (paramagnetic susceptibility, phenomenon of resonance). Principles and instrumentations of electron paramagnetic resonance (EPR). The Hamiltonian (spin Hamiltonian operator, Zeeman interaction, hyperfine interaction). Electron paramagnetic resonance spectra (analysis, spectra of liquid phase, calculation the spin energy levels, allowed transitions and evaluation the resonant fields). Nuclear magnetic resonance (principle, chemical shift, spin – spin coupling, analysis). Double – resonance technique (an ENDOR experiment, energy levels and transitions, relaxation processes in steady state, electron – electron double resonances). Electron spin echo spectroscopy (pulsed EPR, electron spin echoes, the nuclear modulation effect, ESE- ENDOR). Applications.

P609 Methods of Experimental Solid State Physics

Experimental methods in solid state physics. Applications. An introduction to materials characterization, X-ray analysis, Microscopy, Molecular spectroscopy techniques, thermal Techniques, experimental measurement (Electrical conductivity, Magnetization, Dielectric and Optical properties).

P612 Thin Films and Technological Applications

Thin film technology. Thin film nucleation, and growth models (2D, 3D, and 2D-3D combination). Epitaxial growth of thin films, superlattice structures and quantum wells. Diffusion. Physical vapor deposition (thermal evaporation, e-beam evaporation, sputtering, MBE Laser, MBE PLD). Chemical vapor deposition (PECVD, MOCVD). Solution-based deposition techniques (Sol-Gel, PAD, liquid phase epitaxy, LPE and other deposition techniques). Thin film characterization (structural, chemical and electrical characterizations). Special topics on various thin film devices and fabrications, and lab sessions.

P614 Introduction of Nanomaterials

History and scope, Interdisciplinary nature, Structure of nanomaterials, length scales - De Broglie wavelength & Exciton Bohr radius, Jellium model, Quantum wells, Quantum wires, Quantum dots, Fullerenes, Graphite, Carbon nanotubes, Inorganic nanowires, Nanoparticles, Core-shell nanoparticles. Survey of the synthesis methods and strategies, top-down and bottom-up approaches, (chemical vapor deposition, laser ablation, sol-gel processing, lithography), Characterization of nanomaterials. Applications to nanoelectromechanical systems, nano-magnetic materials and devices, Nano-optoelectronic materials and devices, medicine and Pharmacology applications.

P616 Synthesis and Characterizations of Nanomaterials

Synthesis Methods and Strategies, Top-down and bottom-up approaches, (Chemical vapor deposition, Laser ablation, Electric-arc, Sol-Gel Processing, Lithography). Characterization: Electron Microscopy – SEM, TEM, EDAX, X-ray Diffraction and Electron diffraction, Atomic Force Microscopy, Scanning Tunneling Microscopy, Spectroscopy: UV-Visible spectroscopy, Photoluminescence spectroscopy, IR spectroscopy – FTIR, Raman spectroscopy, X-ray spectroscopy - Energy dispersive X-ray spectroscopy, X-ray absorption spectroscopy, X-ray fluorescence; Electron spectroscopy – UV and X-ray photoelectron spectroscopy, Auger electron spectroscopy, Electron energy loss spectroscopy (EELS).

P615 Semiconductor Devices

Optical Devices; Wide Band gap Semiconductors Indispensable for Short Wavelength Optical Devices, and Control of the Physical Properties of III–V Nitrides and II–VI Semiconductors. Electronic Devices; Silicon Carbide Electronic Devices, and Nitride Compound Semiconductor Electron Devices. Crystals and Band Structure; IV–IV Group semiconductors, II–VI Semiconductors, III–V Nitride Semiconductors, Heterostructures and Band Structure, Lattice Defects. Optical, Mechanical, and Thermal Properties of Wide Bandgap Semiconductors; Optical Properties, Quantum Structure of Wide Bandgap Semiconductors, Lattice Constants of Semiconductors. Electrical Properties of Wide Bandgap Semiconductors; Doping Technology, Mobility of Electrons and Holes, Electrical Properties of SiC, Electrical Properties of GaN.

P617 Quantum dots

Low-Dimensional Systems. Energy States in Quantum Dots. Self-Organized Quantum Dots. Growth, Structures, and Optical Properties of III-Nitride Quantum Dots. Theory of Threshold Characteristics of Quantum Dot Lasers: Effect of Quantum Dot Parameter Dispersion. Applications of Quantum Dots in Semiconductor Lasers. Basics of quantum cryptography. Electronic structure of quantum dots based on nitrides and arsenides. Micro- and nano-characterization of semiconductors. Time-resolved investigations of quantum dots. The fine structure splitting of the excitons in quantum dots. Electrical driven single photon sources. Detectors for quantum cryptography.

P618 Nanocomposites

Introduction to nanocomposites - Where are they from and where are they going. Materials science of nanocomposites - Understanding the pieces inside a nanocomposite part. Properties of nanocomposites - Identifying the property advantages of these interesting materials. Particulates - the building blocks of nanocomposites. Flow in nanocomposite systems. Solvent and in situ polymerization for maximal distribution control. Melt processes for high

performance parts. Structural and distribution characterization - seeing what is too small to be seen. Property characterization - realizing the performance of engineered parts.

P664 Selected Topics Related to Nanomaterials

Topics are to be determined by the supervising committee and approved by the Physics Department.

M603 Numerical Analysis I

The course contains: Numerical treatment of initial value problems, boundary value problems and eigenvalue problems for ordinary and partial differential equations. Relevant linear algebra, discretizations, convergence, stability, error propagation, finite differences, finite elements, finite volumes, method of lines, conjugates gradient methods, multigrid methods.

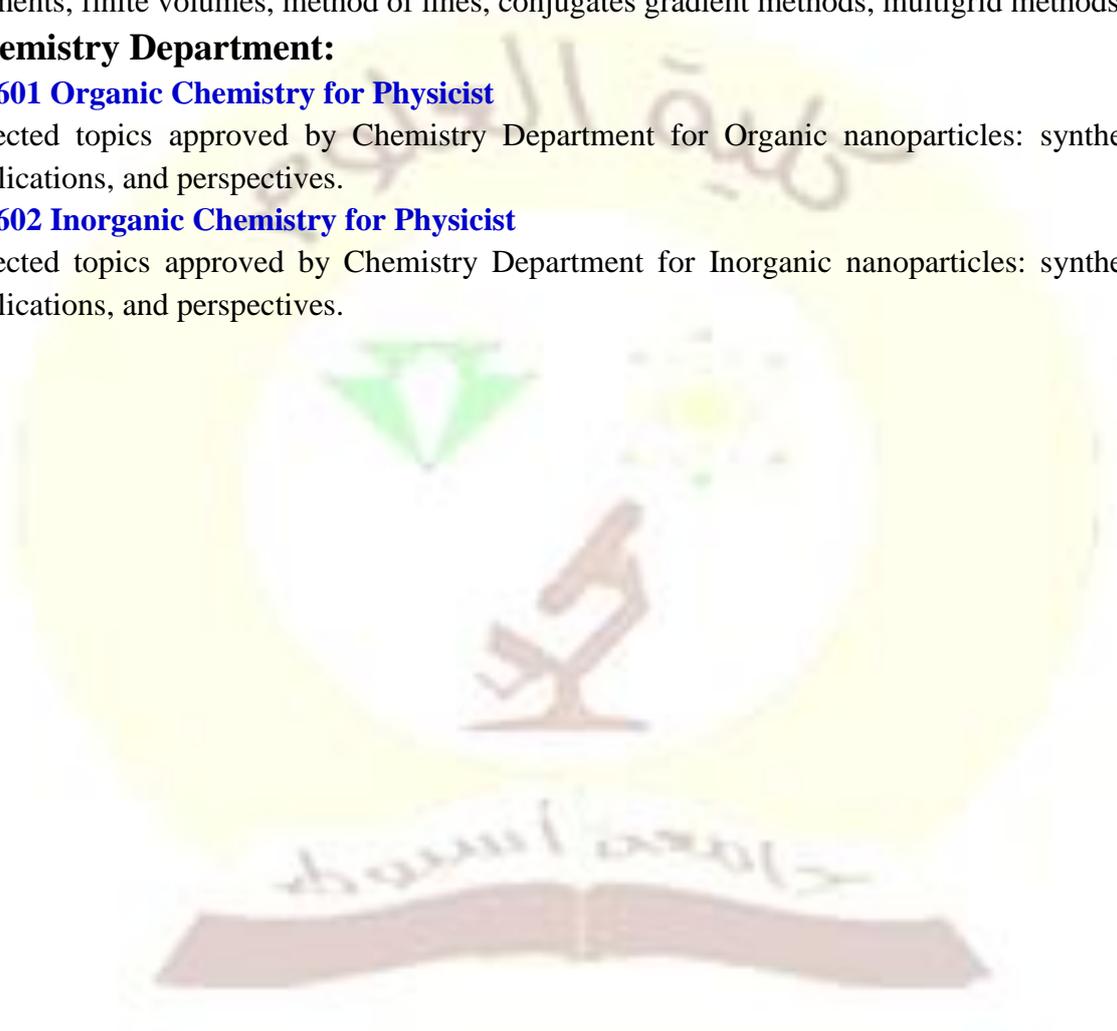
Chemistry Department:

CP601 Organic Chemistry for Physicist

Selected topics approved by Chemistry Department for Organic nanoparticles: synthesis, applications, and perspectives.

CP602 Inorganic Chemistry for Physicist

Selected topics approved by Chemistry Department for Inorganic nanoparticles: synthesis, applications, and perspectives.



3- M.Sc. Degree in Nuclear Physics

P601 Electromagnetic Theory I

Vector analysis, curvilinear coordinates. Electrostatics (fields and potentials). Boundary-value problems in electrostatics (Laplace and Poisson Equations). Multipoles and dielectrics. Magnetostatics. Time-varying Fields and Maxwell equations. Electromagnetic waves and wave propagation.

P603 Quantum Mechanics I

Angular momentum, Internal angular momentum. Total angular momentum: LS and jj coupling. Addition of total angular momenta (Clebsch Gordan Coefficient) 3j, 6j and 9j coupling. Wigner-Eckart theorem. Invariance principles and conservation laws. Time independent perturbation theory. The variation method. The WKB approximation method.

P606 Statistical Physics

Thermodynamics, kinetic theory, probability distributions. Phase space and microcanonical ensemble. Canonical ensemble and partition functions with applications. Grand canonical ensemble and quantum statistics. Imperfect gas. Classical monoatomic liquids. Quantum statistical Physics. Transport theory.

P620 Nuclear Structure I

Nuclear two body problem: Ground and excited states of the deuteron - Inter nucleon forces: nucleon-nucleon scattering, phase shift analysis, general properties of nucleon-nucleon forces. Nuclear many body problem. Structure of complex nuclei and nuclear models: liquid drop model, shell model, Collective model, unified model, cluster model.

P619 Accelerators and Reactors Physics

Part I: Introduction to particle physics. Historical background. Accelerators: Introduction to accelerator physics, Early accelerators: Cyclotrons, Other early accelerator types, Synchrotrons, Fixed-target accelerators, Future and developing technologies, Applications.

Part II: Introduction to Reactors: Early reactors, Mechanisms, Fission, Heat generation, Cooling, Reactivity control, Electrical power generation, Reactor types: Current technologies, Future and developing technologies, Applications.

P622 Nuclear Reactions I

Direct and compound nuclear reactions. Plane wave theory of direct reactions. Distorted wave Born approximation. Optical model. Spin orbit interaction. Elastic and inelastic scattering.

P621 Methods of Experimental Nuclear Physics

Topics are to be determined by the supervising committee and approved by the Physics Department.

P624 Physics of Nuclear Medicine & Instrumentations

Review of interaction of radiation with matter. Review of radiation detection. Imaging systems and collimation. Single photon emission computed tomography (SPECT). Positron emission tomography (PET). X-ray computed tomography. Hybrid imaging systems: PET-CT and SPECT-CT. Image reconstruction, processing and display. Technological approaches: position sensitive detectors and open PET imaging.

P623 Elementary Particles

Introduction to the Elementary Particles and the Standard Model - Elementary Particle Dynamics: The Four Forces, Quantum Electrodynamics (QED), Quantum Chromodynamics

(QCD) , Weak Interactions, Decays and Conservation Laws, Unification Schemes. Relativistic Kinematics: Lorentz Transformations, Four-Vectors, Energy and Momentum, Collisions Examples and Applications. Symmetries: Symmetries, Groups, and Conservation Laws, Spin and Orbital Angular Momentum, Addition of Angular Momenta, CP Violation, Time Reversal and the TCP Theorem. The Feynman Calculus: Lifetimes and Cross Sections , The Golden Rule, The Feynman Rules for a Toy Theory, Lifetime of the A, Lowest and Higher-Order Diagrams of A scattering.

P625 Methods of Mathematical Physics

Series solution of differential. Gamma and beta functions. Legendre polynomials and functions. Bessel functions. Hermite polynomials. Laguerre polynomials. Chebyshev polynomials. Gegenbauer and Jacobi polynomials. Hypergeometric functions. Other special functions.

P626 Quantum Field Theory

Classical Field Theory: Introduction; Lagrangian Field Theory; Lorentz Invariance; Noether's Theorem and Conserved Currents; Hamiltonian Field Theory.

Canonical Quantization: The Klein-Gordon Equation, The Simple Harmonic Oscillator; Free Quantum Fields; Vacuum Energy; Particles; Relativistic Normalization; Complex Scalar Fields; The Heisenberg Picture; Causality and Propagators; Applications; Non-Relativistic Field Theory.

Interacting Fields: Types of Interaction; The Interaction Picture; Dyson's Formula; Scattering; Wick's Theorem; Feynman Diagrams; Feynman Rules; Amplitudes; Decays and Cross Sections; Green's Functions; Connected Diagrams and Vacuum Bubbles; Reduction Formula.

The Dirac Equation: The Lorentz Group; Clifford Algebras; The Spinor Representation; The Dirac Lagrangian; Chiral Spinors; The Weyl Equation; Parity; Majorana Spinors; Symmetries and Currents; Plane Wave Solutions.

Quantizing the Dirac Field: A Glimpse at the Spin-Statistics Theorem; Fermionic Quantization; Fermi-Dirac Statistics; Propagators; Particles and Anti-Particles; Dirac's Hole Interpretation; Feynman Rules

Quantum Electrodynamics: Gauge Invariance; Quantization; Inclusion of Matter -- QED; Lorentz Invariant Propagators; Feynman Rules; QED Processes.

P628 Radiation Physics

Radiation sources, Radiation interactions, Counting statistics. Radiation detection and measurements (ionization of a gas, solid state detectors, photographic effect). Biological effects of radiation (human physiology, interaction of radiation with cells, genetic effects). Natural and man-made radiation (cosmic radiation, terrestrial sources, radioactivity in the body, doses). Man-made sources of radiation (external hazard, source of the hazard, time, distance and shielding, neutron sources, personal dose control, radiation survey). Internal radiation hazard (uncontained radioactivity, control of the contamination, radiotoxicity, design of areas for radioactivity work, treatment of contaminated personnel). Radiation protection in medicine (protection against sealed sources and unsealed sources). Control and disposal of radioactive materials.

M603 Numerical Analysis I

The course contains: Numerical treatment of initial value problems, Boundary value problems and Eigenvalue problems for Ordinary and partial differential equations. Relevant linear

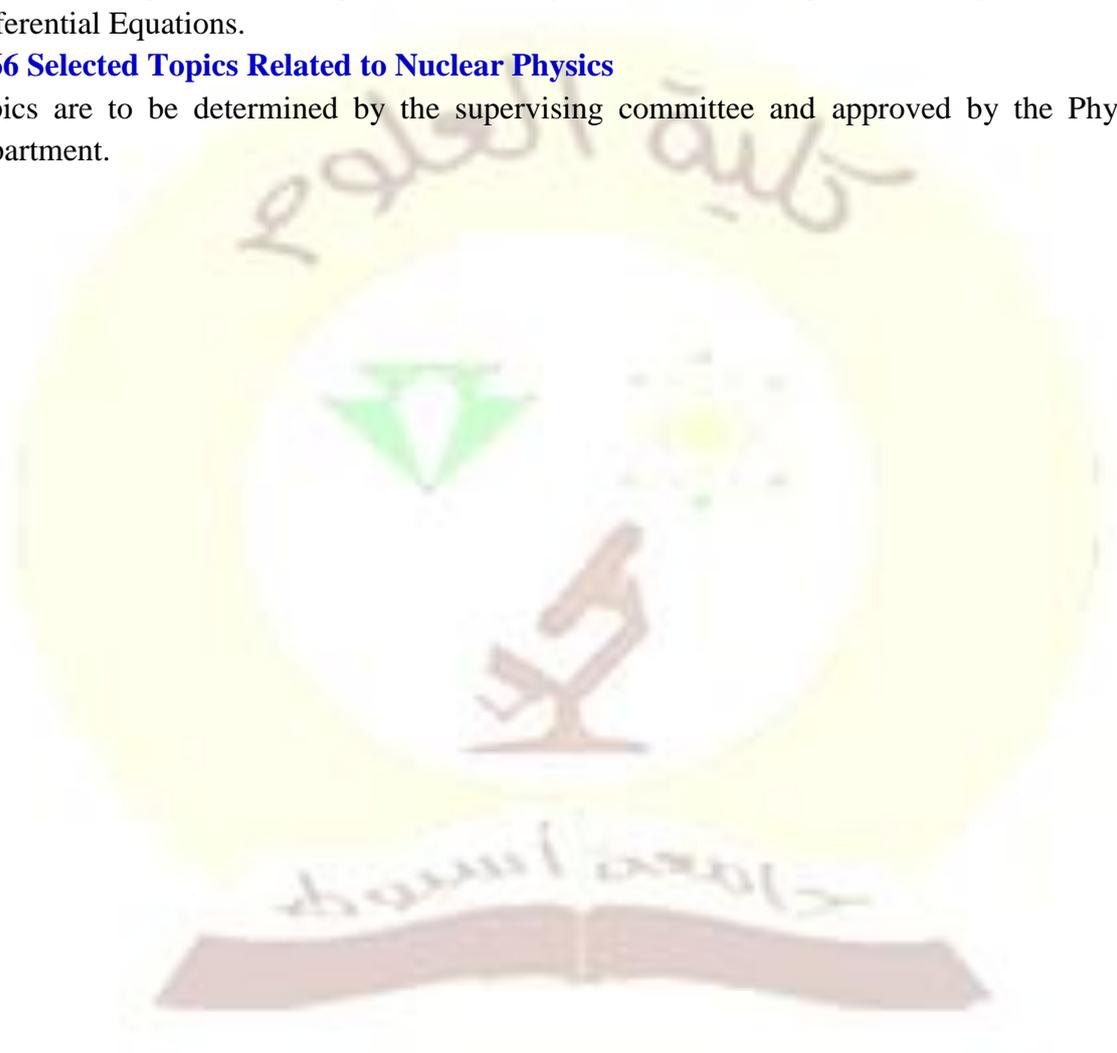
algebra, Discretization, convergence, Stability, Error propagation, finite differences, Finite elements, Finite volumes, method of lines, Conjugates gradient methods, multigrid methods.

M626 Mathematical Modeling

The main goal of this course is to learn how to make a creative use of some mathematical tools, such as difference equations, ordinary and partial differential equations and numerical analysis, to build a mathematical description of some physical problems. The course topics includes: Introduction to Modeling -Qualitative Modeling with Functions - Modeling with Dimensional Analysis - Modeling with Difference Equations - Modeling with Ordinary Differential Equations - Empirical Modeling with Data Fitting - Modeling with Partial Differential Equations.

P666 Selected Topics Related to Nuclear Physics

Topics are to be determined by the supervising committee and approved by the Physics Department.



4- M.Sc. Degree in Radiation Physics

P601 Electromagnetic Theory I

Vector analysis, curvilinear coordinates - Electrostatics (fields and potentials) - Boundary-value problems in electrostatics (Laplace and Poisson Equations) - Multipoles and dielectrics - Magnetostatics - Time-varying Fields and Maxwell equations - Electromagnetic waves and wave propagation.

P603 Quantum Mechanics I

Angular momentum, Internal angular momentum - Total angular momentum: LS and jj coupling - Addition of total angular momenta (Clebsch Gordan Coefficient) $3j$, $6j$ and $9j$ coupling - Wigner-Eckart theorem - Invariance principles and conservation laws - Time independent perturbation theory - The variation method - The WKB approximation method.

P606 Statistical Physics

Thermodynamics, kinetic theory - probability distributions - Phase space and microcanonical ensemble - Canonical ensemble and partition functions with applications - Grand canonical ensemble and quantum statistics - Imperfect gas - Classical monoatomic liquids - Quantum statistical Physics. Transport theory.

P607 Magnetic Resonance

Magnetic properties of matter (paramagnetic susceptibility, phenomenon of resonance) - Principles and instrumentations of electron paramagnetic resonance (EPR) - The Hamiltonian (spin Hamiltonian operator, Zeeman interaction, hyperfine interaction) - Electron paramagnetic resonance spectra (analysis, spectra of liquid phase, calculation the spin energy levels, allowed transitions and evaluation the resonant fields) - Nuclear magnetic resonance (principle, chemical shift, spin - spin coupling, analysis) - Double - resonance technique (an ENDOR experiment, energy levels and transitions, relaxation processes in steady state, electron - electron double resonances) - Electron spin echo spectroscopy (pulsed EPR, electron spin echoes, the nuclear modulation effect, ESE- ENDOR). Applications.

P619 Accelerators and Reactors Physics

Part I:

Introduction to particle physics. Historical background. Accelerators: Introduction to accelerator physics, Early accelerators: Cyclotrons, Other early accelerator types, Synchrotrons, Fixed-target accelerators, Future and developing technologies, Applications.

Part II:

Introduction to Reactors: Early reactors, Mechanisms, Fission, Heat generation, Cooling, Reactivity control, Electrical power generation, Reactor types: Current technologies, Future and developing technologies, Applications.

P620 Nuclear Structure I

Nuclear two body problem: Ground and excited states of the deuteron.

Inter nucleon forces: nucleon-nucleon scattering, Phase shift analysis, General properties of nucleon-nucleon forces. Nuclear many body problem. Structure of complex nuclei and nuclear models: liquid drop model, shell model, Collective model, unified model, cluster model.

P622 Nuclear Reactions I

Direct and compound nuclear reactions. Plane wave theory of direct reactions. Distorted wave Born approximation. Optical model. Spin orbit interaction. Elastic and inelastic scattering.

P621 Methods of Experimental Nuclear Physics

Topics are to be determined by the supervising committee and approved by the Physics Department.

P624 Physics of Nuclear Medicine & Instrumentations

Review of interaction of radiation with matter. Review of radiation detection. Imaging systems and collimation. Single photon emission computed tomography (SPECT). Positron emission tomography (PET). X-ray computed tomography. Hybrid imaging systems: PET-CT and SPECT-CT. Image reconstruction, processing and display. Technological approaches: position sensitive detectors and open PET imaging.

P625 Methods of Mathematical Physics

Series solution of differential. gamma and beta functions. Legendre polynomials and functions. Bessel functions. Hermite polynomials. Laguerre polynomials. Chebyshev polynomials. Gegenbauer and Jacobi polynomials. Hypergeometric functions. Other special functions.

P628 Radiation Physics

Radiation sources, Radiation interactions, Counting statistics. Radiation detection and measurements (ionization of a gas, solid state detectors, Photographic effect). Biological effects of radiation (human physiology, Interaction of radiation with cells, Genetic effects. Natural and man-made radiation (cosmic radiation, terrestrial sources, radioactivity in the body, doses). Man-made sources of radiation (external hazard, source of the hazard, time, distance and shielding, neutron sources, personal dose control, radiation survey). Internal radiation hazard (uncontained radioactivity, control of the contamination, radiotoxicity, design of areas for radioactivity work, treatment of contaminated personnel). Radiation protection in medicine (protection against sealed sources and unsealed sources). Control and disposal of radioactive materials.

P630 Neutron Physics I

Neutron properties: Chadwick's experiment, The proton-neutron nuclear model, Neutron capture, inertial mass properties, Gravitational mass properties, Neutron momentum analysis, Neutron spin and statistics.

P668 Selected Topics Related to Radiation Physics

Topics are to be determined by the supervising committee and approved by the Physics Department.

M603 Numerical Analysis I

The course contains: Numerical treatment of initial value problems, boundary value problems and eigenvalue problems for ordinary and partial differential equations. Relevant linear algebra, discretizations, convergence, stability, error propagation, finite differences, finite elements, finite volumes, method of lines, conjugate gradient methods, multigrid methods.

M626 Mathematical Modeling

The main goal of this course is to learn how to make a creative use of some mathematical tools, such as difference equations, ordinary and partial differential equations and numerical analysis, to build a mathematical description of some physical problems. The course topics include: Introduction to Modeling - Qualitative Modeling with Functions - Modeling with Dimensional Analysis - Modeling with Difference Equations - Modeling with Ordinary

Differential Equations - Empirical Modeling with Data Fitting - Modeling with Partial Differential Equations.



5- M.Sc. Degree in Plasma Physics

P601 Electromagnetic Theory I

Vector analysis, curvilinear coordinates - Electrostatics (fields and potentials) - Boundary-value problems in electrostatics (Laplace and Poisson Equations) - Multipoles and dielectrics. Magnetostatics - Time-varying Fields and Maxwell equations - Electromagnetic waves and wave propagation.

P603 Quantum Mechanics I

Angular momentum, Internal angular momentum - Total angular momentum: LS and JJ coupling - Addition of total angular momenta (Clebsch Gordan Coefficient) $3j$, $6j$ and $9j$ coupling - Wigner-Eckart theorem - Invariance principles and conservation laws - Time independent perturbation theory - The variation method. The WKB approximation method.

P606 Statistical Physics

Thermodynamics - kinetic theory, probability distributions - Phase space and microcanonical ensemble - Canonical ensemble and partition functions with applications - Grand canonical ensemble and quantum statistics - Imperfect gas. Classical monoatomic liquids - Quantum statistical Physics. Transport theory.

P607 Magnetic Resonance

Magnetic properties of matter (paramagnetic susceptibility, phenomenon of resonance) - Principles and instrumentations of electron paramagnetic resonance (EPR) - The Hamiltonian (spin Hamiltonian operator, Zeeman interaction, hyperfine interaction) - Electron paramagnetic resonance spectra (analysis, spectra of liquid phase, calculation the spin energy levels, allowed transitions and evaluation the resonant fields) - Nuclear magnetic resonance (principle, chemical shift, spin – spin coupling, analysis) - Double – resonance technique (an ENDOR experiment, energy levels and transitions, relaxation processes in steady state, electron – electron double resonances) - Electron spin echo spectroscopy (pulsed EPR, electron spin echoes, the nuclear modulation effect, ESE- ENDOR). Applications.

P613 Semiconductor Properties and Applications

Crystal structure- Band structure - Electrical properties of S.C. Optical properties of S.C. thin films- Thermal properties of S.C. Other types of semiconductor materials- Wide band gap semiconductors.

P625 Methods of Mathematical Physics

Series solution of differential - gamma and beta functions - Legendre polynomials and functions - Bessel functions - Hermite polynomials - Laguerre polynomials - Chebyshev polynomials - Gegenbauer and Jacobi polynomials - Hypergeometric functions - other special functions.

P627 Physical Electronics

The Kinetic Theory of Gases- Conduction and Breakdown of Gases - Transport Phenomenon in Gas Discharge - Emission of Electrons and Ions by Solids - The Self-sustaining Discharge - Ionization and Excitation in the Upper-atmosphere - Langmuir Single and Double Probes - Direct Power Generation- Arc Furnaces- The Geiger Counter- Introduction to Applied Plasma Chemistry- Double Barrier Discharge- Excimer formation in DBD Plasma- Plasma and Polymer Materials- Plasma Jet.

P632 Plasma Physics

Definition of plasma, orbit theory – diffusion - resistivity and conductivity - plasma oscillations - MHD waves - magnetic confinement - parametric instabilities - radio-frequency - plasma heating and Magnetosphere propagation - Landau and cyclotron damping - turbulence in Plasma - Non-neutral plasmas - Shock waves - Kinetic effects in a magnetic field - Equations of non-linear plasma - Space plasma- Plasma diagnostic techniques- spectroscopic techniques- Plasma radiation- Microwave techniques- Electron cyclotron emission- Plasma semiconductor- Thomson scattering.

P634 Physics of Corona Discharge

The highly stressed positive electrode- The highly stressed cathode- Electron attaching gases- Free electron gases- Other types of corona- The temporal development of breakdown- Crystal growth phenomenon on corona in air with liquid metal- Discharge of nanosecond duration- gas temperature variation in millisecond pulsed discharges in air- Spectroscopic investigation of corona discharge. Applications.

P636 Methods of Experimental Plasma Physics

High vacuum technique (rotary and diffusion pumps. pressure, mechanical cold cathode ionization gauges.....etc.), Electromagnets, Voltmeters and watt meters, The ohmmeter... etc. DC potentiometer and instrument calibration, Precise resistance measurements, Alternating current bridge, analog electronic instruments. Basic of digital instruments. Cathode-ray oscilloscopes, Special oscilloscopes, Graphic recording instruments, DC power supplies, signal generators.

P638 Gas Discharge

The atomic structure, Breakdown voltage, Ionization and deionization processes, Electric and thermal emission by metals, Behavior of charged particles in a gas in electric and magnetic fields, The self-sustaining discharge (glow, and arc discharges), Double probe measurements, Discharge by single and two photons laser induced fluorescence, Applications in gas discharge, variation of the breakdown voltage with ozone concentration in dielectric barrier discharge, DBD parameter for production of high ozone concentration, nanosecond discharges in water vapor.

P640 Plasma Physics Applications

Plasma coating, techniques of plasma TV screen, Plasma chemistry, Plasma nuclear fusion reactors (Tokamak ITER nuclear reactor), Laser-plasma interactions, Non-neutral plasma, High-intensity accelerators, Plasma propulsion, Plasma processing, and coherent electromagnetic wave generation, Plasma cluster, Laser induced fluorescence, Applications of low temperature plasmas for biomedical and technological biomedical.

P670 Selected Topics Related to Plasma Physics

Topics are to be determined by the supervising committee and approved by the Physics Department.

M603 Numerical Analysis I

The course contains: Numerical treatment of initial value problems, boundary value problems and eigenvalue problems for ordinary and partial differential equations. Relevant linear algebra, discretizations, convergence, stability, error propagation, finite differences, finite elements, finite volumes, method of lines, conjugates gradient methods, multigrid methods.

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6- M.Sc. Degree in Laser Physics

P601 Electromagnetic Theory I

Vector analysis, curvilinear coordinates- Electrostatics (fields and potentials)- Boundary-value problems in electrostatics (Laplace and Poisson Equations)- Multipoles and dielectrics- Magnetostatics- Time-varying Fields and Maxwell equations- Electromagnetic waves and wave propagation.

P603 Quantum Mechanics I

Angular momentum- Internal angular momentum- Total angular momentum: LS and JJ coupling- Addition of total angular momenta (Clebsch Gordan Coefficient) $3j$, $6j$ and $9j$ coupling- Wigner-Eckart theorem- Invariance principles and conservation laws- Time independent perturbation theory- The variation method- The WKB approximation method.

P606 Statistical Physics

Thermodynamics- kinetic theory- probability distributions- Phase space and microcanonical ensemble- Canonical ensemble and partition functions with applications- Grand canonical ensemble and quantum statistics- Imperfect gas- Classical monoatomic liquids- Quantum statistical Physics- Transport theory.

P607 Magnetic Resonance

Magnetic properties of matter (paramagnetic susceptibility, phenomenon of resonance)- Principles and instrumentations of electron paramagnetic resonance (EPR)- The Hamiltonian (spin Hamiltonian operator- Zeeman interaction- hyperfine interaction)- Electron paramagnetic resonance spectra (analysis- spectra of liquid phase- calculation the spin energy levels- allowed transitions and evaluation the resonant fields)- Nuclear magnetic resonance (principle- chemical shift- spin – spin coupling- analysis)- Double – resonance technique (an ENDOR experiment- energy levels and transitions- relaxation processes in steady state- electron – electron double resonances)- Electron spin echo spectroscopy (pulsed EPR- electron spin echoes- the nuclear modulation effect- ESE- ENDOR)- Applications.

P613 Semiconductor Properties and Applications

Crystal structure- Band structure- Electrical properties of S.C. Optical properties of S.C. thin films- Thermal properties of S.C. Other types of semiconductor materials- Wide band gap semiconductors.

P625 Methods of Mathematical Physics

Series solution of differential- Gamma and beta functions- Legendre polynomials and functions- Bessel functions- Hermite polynomials- Laguerre polynomials- Chebyshev polynomials- Gegenbauer and Jacobi polynomials- Hypergeometric functions- Other special functions.

P642 Laser Physics and Quantum Electronics

Introduction- Principles of laser operation- How lasers work, their properties and some applications- Atomic transitions- Atomic rate equations- Amplification- Optical feedback- Laser oscillators- Optical beams and resonators- Laser Dynamics- linear propagation- Ultra-fast lasers- Quantum electronics- laser methods for detecting explosive residues- laser transmitter / receiver- laser communicates.

P644 Laser Applications

Interaction of light with matter- Basic principle of lasers- Some specific laser systems free electron and semiconductor laser- Laser selection criteria for specific applications- Pulsed continuous- Energy and power wavelength considerations pulse width and transient detections- line shape profile- Gain profile and tune ability. Scientific applications- absorption spectroscopy- Emission techniques- Scattering techniques- Raman and coherent Raman- Pump and probe techniques- Diagnostics of excited states- Signal to noise ratio considerations. Industrial applications: (cutting, welding- drilling ranging- barcode- scanners- CD players). Medical-surgery- Kidney stone treatment- Eye treatment. Defense- Battle field- Direct energy weapon- Anti-missile research. Spectroscopy- laser annealing- Ablation- Scattering and Interferometers- Commercial-laser: printers- laser pointers.

P646 Methods of Experimental Laser Physics

High vacuum technique (rotary and diffusion pumps. Pressure- mechanical cold cathode ionization gauges.....etc.)- Electromagnets, voltmeters and watt meters- the ohmmeter etc. DC potentiometer and instrument calibration- Precise resistance measurements- alternating current bridge- analog electronic instruments- Basic of digital instruments- Cathode- ray oscilloscopes- special oscilloscopes- graphic recording instruments- DC power supplies- signal generators- The coherence length of a He-Ne laser- The argon-ion and argon pumped dye laser- laser cavity design- Transverse Mode Structure- longitudinal Mode Structure- Dye absorption and emission spectra- Fiber optics.

P648 Laser Physics and Technology

Quantum Optics- Ultra-fast lasers- laser methods for detecting explosive residues- Laser transmitter/receiver- Laser communicator- Laser measurement- consumer electronics- Fabry-Perot lasers- Distributed feedback lasers- External cavity lasers- laser diode- Quantum cascade laser- External cavity lasers- Blue laser- Semiconductor blue-laser technology- Diode-pumped solid state (DPSS) laser modules- Application of the blue laser include: telecommunications- medical laser- medical diagnostics- Low level laser therapy monitoring- Inter-band cascade laser- Polarization laser- Quantum cascade laser- Physics of hybrid silicon laser- Distributed feedback laser- Cold laser for chiropractic- laser spectroscopy- lamp-pumped lasers- Nonlinear fiber optics- Consumer electronics- The laser triggered the photonics revolution and the foundation of modern photonics.

P672 Selected Topics Related to Laser Physics

Topics are to be determined by the supervising committee and approved by the Physics Department.

M603 Numerical Analysis I

The course contains: Numerical treatment of initial value problems- boundary value problems and eigenvalue problems for ordinary and partial differential equations. Relevant linear algebra- discretizations- convergence- stability- error propagation- finite differences- finite elements- finite volumes- method of lines- conjugates gradient methods- multigrid methods.

M626 Mathematical Modeling

The main goal of this course is to learn how to make a creative use of some mathematical tools- such as difference equations- ordinary and partial differential equations and numerical analysis- to build a mathematical description of some physical problems. The course topics includes: Introduction to Modeling -Qualitative Modeling with Functions - Modeling with

Dimensional Analysis - Modeling with Difference Equations - Modeling with Ordinary Differential Equations - Empirical Modeling with Data Fitting - Modeling with Partial Differential Equations.



7- M.Sc. Degree in Theoretical Physics

P601 Electromagnetic Theory I

Vector analysis, curvilinear coordinates- Electrostatics (fields and potentials)- Boundary-value problems in electrostatics (Laplace and Poisson Equations)- Multipoles and dielectrics- Magnetostatics- Time-varying Fields and Maxwell equations- Electromagnetic waves and wave propagation.

P603 Quantum Mechanics I

Angular momentum- Internal angular momentum- Total angular momentum: LS and JJ coupling- Addition of total angular momenta (Clebsch Gordan Coefficient) $3j$, $6j$ and $9j$ coupling- Wigner-Eckart theorem- Invariance principles and conservation laws- Time independent perturbation theory- The variation method- The WKB approximation method.

P604 Crystal Structure

The nature of crystal structures- geometry and chemistry of crystals- size- homogeneity- perfection- twinning- polymorphism- phase transitions- isomorphism- solid solutions- diagrams and models- Interatomic forces and structure building- Lattices and lattice complexes- Directions of planes and lines- Some simple structures (cubic- iron- comparison of cubic and hcp- diamond- sodium chloride- cesium chloride- calcium chloride- zinc blende structures and the structure of various metallic alloys)- Structures of oxides (Perovskite-spinel- corundum- ilmenite- lithium niobate- calcite- aragonite- olivine- rutile structures- forms of silica- the quartz structure)- The determination of crystal structures (single crystal and powder methods- examples of structure determinations and the refinement.

P606 Statistical Physics

Thermodynamics- kinetic theory- probability distributions- Phase space and microcanonical ensemble- Canonical ensemble and partition functions with applications- Grand canonical ensemble and quantum statistics- Imperfect gas- Classical monoatomic liquids- Quantum statistical Physics- Transport theory.

P620 Nuclear Structure I

Nuclear two body problem: Ground and excited states of the deuteron.

Inter nucleon forces: nucleon-nucleon scattering- phase shift analysis- general properties of nucleon-nucleon forces- Nuclear many body problem- Structure of complex nuclei and nuclear models: liquid drop model- shell model- Collective model- unified model- cluster model.

P622 Nuclear Reactions I

Direct and compound nuclear reactions- Plane wave theory of direct reactions- Distorted wave Born approximation- Optical model- Spin orbit interaction- Elastic and inelastic scattering.

P625 Methods of Mathematical Physics

Series solution of differential- gamma and beta functions- Legendre polynomials and functions- Bessel functions- Hermite polynomials- Laguerre polynomials- Chebyshev polynomials- Gegenbauer and Jacobi polynomials- Hypergeometric functions- other special functions.

High temperature – High pressure Physics

Thermodynamics and statistical mechanics- Review- Interaction potentials- Pair potentials- Equation of state by a statistical mechanical theory- Equation of state at high pressures- Viscosity and thermal conductivity at high pressure and temperature- Applications to shock waves and detonation.

P631 Shock Waves and detonation

Conservation of momentum and energy- Gas dynamics, Dense – Fluid equation of state- Shock Hugoniot- Detonation products Hugoniot- Detonation products- chemical kinetics- Shock and detonation structure.

P633 Equation of State

Real gas equation of state- Virial equation of state- Intermolecular potentials- Statistical mechanical approach to equation of state- Hard sphere equation of state- Dense fluid equation of state- Equation of state of compressed solid.

P650 Computational Physics

Approximation of a function: Interpolation- Least-squares approximation- Spline approximation- Random-number generators. Numerical calculus: Numerical differentiation- Numerical integration- Roots of an equation- Extremes of a function- Classical scattering. Ordinary differential equations: Initial-value problems- The Euler and Picard methods- predictor-corrector methods- The Runge-Kutta method- Chaotic dynamics of a driven pendulum- Boundary-value and eigenvalue problems- The shooting method- Linear equations and Sturm-Liouville problem- The one-dimensional Schroedinger equation. Numerical methods for matrices: Matrices in physics- Basic matrix operations- Linear equation systems- Zeros and extremes of a multivariable function- Eigenvalue problems- The Faddeev-Leverrier method- Complex zeros of a polynomial- Electronic structure of atoms- The Lanczos algorithm and the many-body problem- Random matrices.

P652 Dense Fluids Physics

Statistical mechanical approach- Radial distribution function $g(r)$ - Relation between thermodynamic function and $g(r)$ - Integral equations for $g(r)$ - Correlation function- Hard-sphere fluid- Perturbation theories of liquids.

P674 Selected Topics Related to Theoretical Physics

Topics are to be determined by the supervising committee and approved by the Physics Department.

M603 Numerical Analysis I

The course contains: Numerical treatment of initial value problems- boundary value problems and eigenvalue problems for ordinary and partial differential equations. Relevant linear algebra- discretizations- convergence- stability- error propagation- finite differences- finite elements- finite volumes- method of lines- conjugates gradient methods- multigrid methods.

M604 Partial Differential Equations I

The topics of this course are: Non-linear PDE of elliptic hyperbolic and parabolic types and their applications - Backlund transformation and soliton theory.

8- M.Sc. Degree in Medical Physics

P619 Accelerators and Reactors Physics

Part I: Introduction to particle physics. Historical background. Accelerators: Introduction to accelerator physics, Early accelerators: Cyclotrons, Other early accelerator types, Synchrotrons, Fixed-target accelerators, Future and developing technologies, Applications.

Part II: Introduction to Reactors: Early reactors, Mechanisms, Fission, Heat generation, Cooling, Reactivity control, Electrical power generation, Reactor types: Current technologies, Future and developing technologies, Applications.

P635 Nuclear Medicine

Nuclear structures- Atomic models, Mass energy equivalence, electromagnetic spectrum, Radioactivity & Artificial Radioactivity, Radionuclide Production, Isotopes and nuclides, binding forces between nuclear particles, alpha & beta particles and gamma radiation, mechanisms of radioactive decay, half-life, Interaction of electrons, X-rays & γ -rays with matter, Radiation intensity & exposure, radiation dose, Radiation Detectors, Radiation Protection in Nuclear Medicine, Application of PET & SPECT in Radiotherapy Planning, Single photon imaging (The Gamma Camera and other Imaging Equipment), Nuclear Medicine Imaging Techniques, Single Photon Emission Computed Tomography Fundamentals (SPECT), Positron emission tomography (PET) Fundamentals.

P637 Radiation Detection and Measurements

General properties of radiation, Overview of radiation interaction with matter, Properties of radiation detectors, Gas filled detectors, Diffusion and drift of charges in gases, Proportional counters, Gieger-Muller counters, Ionization chamber, Cloud chamber, Bubble chamber, Scintillation detectors, Liquid scintillation detectors, Photomultiplier tubes, Photo-detectors, Semiconductor detectors, High purity germanium detectors, Room temperature semiconductor detectors and efficiency considerations, Slow neutron detectors, Fast neutron detectors, Nuclear electronics and signal processing.

P639 Experimental Methods in Radiation Detection

Experiments in nuclear and radiation detection including gas filled detectors, Charged particle detectors, Scintillation detectors, Semiconductor detectors, Detector efficiency, Detector resolution, Single and multichannel analyzer, Pulse shaping and processing, Analogue, linear and digital pulse functions, NIM and CAMMAC standards, Compton scattering and Compton suppression detectors, Time of flight, Angular correlation, Coincidence measurements applied to positron emitters, Detector arrays, Spectroscopic analysis.

P641 Applications of Laser in Medicine

Introduction to laser physics and laser types, Characteristics of laser sources, Tissue optical properties and light propagation in tissue, Interaction mechanisms between the laser radiation and biological tissue, Diagnostic applications in Medicine, Therapeutic applications, Femtosecond lasers in medicine.

P654 Medical Imaging

Planner imaging, Central slice theory, Fourier transformers and convolution and deconvolution, Projection, and image reconstruction, Image processing and analysis. Nuclear magnetic resonance, Nuclear magnetic imaging, ultrasound imaging, Ultrasound contrast and microscopy, Image Quality Management.

P656 Radiobiology and Radiotherapy

Types of ionizing radiation, sources of medical exposure, Radiation effects. Radiosensitivity, cell damage and cell survival curve, Repair, stochastic and non-stochastic effects, Dose response models, Radiotherapy machines, External beam radiotherapy, Treatment planning systems, Conformal radiotherapy, Intensity-modulated radiotherapy, Virtual simulation, brachytherapy.

P658 Biostatistics and Computer Simulation

Review of basic concepts of probability, Population, Sampling and data collection, Random variables and distributions, Kinds of biological random variables, Statistical inference, Hypothesis testing and confidence limits, Descriptive statistics, Central tendency, Dispersion and standard errors, Tests for nominal variables, Tests for multiple measurement variables, Categorical data analysis, Relative risk, Different types of explanatory and related response variables, Analysis of variance, Regression and correlation, Survival analysis. Introduction to Monte Carlo methods in radiation and biology, Simulation of tracking and geometry of radiation in tissues.

P660 Radiation Dosimetry

Dosimetric principles, quantities and units, Radiation dosimetry, radiotherapy with external photon and electron beams, calibration and characteristics of therapeutic photon and electron beams, Acceptance testing, and commissioning.

P662 Radiation Protection

Overview on atomic and nuclear structure, Radioactive decay and radioactivity, Binding energy and mechanisms of radioactivity, Radioactive decay modes, Beta emission, Alpha emission, Electron capture, Isomeric transition, Gamma ray radiation, Naturally occurring radioisotopes, Radiation units, Dose estimation, External radiation hazard, Internal radiation hazard, Radiation shielding and moderation, ALARA principle, Equivalent dose calculations, Effects of radiation on biological systems, Radiation damage, Stochastic and deterministic effects of radiation, Radiation safety guides, Radiation safety standards, Reports of the international commission of radiation protection (ICRP), Recommendations of the international atomic energy authority (IAEA) concerning radiation protection, Overview of the Egyptian regulations for ionizing radiation safety and protection.

MD601 Human Anatomy and Physiology

Study of human body from the medical imaging point of view: Skeletal, respiratory, Cardiovascular, Digestive, and Urinary systems, Breast and women's issues, Head and neck, and Central nervous system. The organization and function of major organ systems that constitute the human body. Examples of pathology of diseases commonly encountered in the practical of medical physics such as cancer. Basic principles of cell and molecular biology and molecular imaging.

1- Ph.D. Degree in Solid State Physics

P701 Selected Topics Related to Solid State Physics

Topics are to be determined by the supervising committee and approved by the Physics Department.

P702 Advanced Condensed Matter Physics

Phase Diagrams and Phase Transformations, Single Photon Source Materials for Communications and Computer Technology, Polymers and Advanced Ceramics, Spectroscopic Characterization, Non-Linear Optics, Physics of Quantum Structures and Nano Photonics, Synthesis, Fabrication and Processing of Materials.

P703 Electromagnetic Theory II

Guided Electromagnetic Waves: Transmission line equations, Transmission line transient waves, Sinusoidal time variations, Arbitrary impedance terminations, Stub tuning, The rectangular waveguide, Dielectric waveguide.

Radiation: The retarded potentials, Radiation from point dipoles, Point dipole arrays, Long dipole antennas.

P704 Quantum Mechanics II

Time dependent perturbation theory. Theory of scattering. Relativistic Theory. Quantization and Second quantization.

P705 Molecular Spectroscopy

Basics of molecular spectroscopy- Phenomenology- Diatomic molecules - Pure rotational spectroscopy - Vibrational spectroscopy of polyatomic molecules- Fundamentals of group theory. Infrared spectroscopy- Raman scattering - Electronic spectra of diatomic molecules- Nuclear magnetic resonance. Electron spin resonance- Mossbauer spectroscopy - High Resolution Spectroscopy.

P706 Applied Magnetic Materials

Magnetic properties of nanostructures and nanoparticles, Single domain nanoparticles, Nanospintronics: classifications, preparation and applications, Application of nanospintronics and nanoparticles in quantum communication, Sensing, Imaging, Therapy.

P707 Ceramic Materials

Types of Ceramic Materials, Synthesis of Ceramics, Characterization of Ceramics, Physical Properties of Ceramics, Semiconductor Ceramics, Superconductor Ceramics, Ferroelectric and Supersets Ceramics, Nanostructure Ceramics, Applications of Ceramics.

P708 Advanced Functional Materials

Theories and technologies in the creation and application processes of excellent new materials and functional materials:

The industrial application of molecular functional materials that also lead to biofunctional materials.

Role of surface in the functional characteristics and physical properties of materials.

Principles of scientific as well as technical methods of evaluating surface activities using examples.

Applications of inorganic materials from engineering viewpoint, including synthesis, structure.

M706 - Numerical Analysis II

Different numerical methods for large problems with different time scales. Spectral methods, wavelets, Multiple methods, Preconditioned conjugate gradient methods, Multigrid methods.



2- Ph.D. Degree in Nanomaterials

P702 Advanced Condensed Matter Physics

Phase Diagrams and Phase Transformations, Single Photon Source Materials for Communications and Computer Technology, Polymers and Advanced Ceramics, Spectroscopic Characterization, Non-Linear Optics, Physics of Quantum Structures and Nano Photonics, Synthesis, Fabrication and Processing of Materials.

P706 Applied Magnetic Materials

Magnetic properties of nanostructures and nanoparticles, Single domain nanoparticles, nanospintronics: classifications, Preparation and applications, Application of nanospintronics and nanoparticles in quantum communication, Sensing, Imaging, Therapy.

P707 Ceramic Materials

Types of Ceramic Materials, Synthesis of Ceramics, Characterization of Ceramics, Physical Properties of Ceramics, Semiconductor Ceramics, Superconductor Ceramics, Ferroelectric and Supersets Ceramics, Nanostructure Ceramics, Applications of Ceramics.

P708 Advanced Functional Materials

Theories and technologies in the creation and application processes of excellent new materials and functional materials - The industrial application of molecular functional materials that also lead to biofunctional materials - Role of surface in the functional characteristics and physical properties of materials - Principles of scientific as well as technical methods of evaluating surface activities using examples - Applications of inorganic materials from engineering viewpoint, including synthesis, structure.

P709 Advanced Fine Particle Engineering

Synthesis of organic molecules-modified inorganic particles using high temperature-pressure field in liquid: Nano crystalline oxide particles are synthesized by developed hydrothermal synthesis process providing controllability of crystal size, morphology and surface modification with organic modifiers such as polymers and biomolecules.

Synthesis of novel nanoparticles by plasma process: The chemical reaction place, where the material synthesis process progresses, is precisely controlled using plasma, and it aims at the creation of the exotic materials - Investigation of fundamentals of the magnetic field effects on materials processing: A remote, dynamic interaction controlled by a strong magnetic field is basically examined to provide novel material processing - Establishment of advanced shaping technology of ceramic using electrophoretic phenomenon of particle in liquid : The energy and environmental-related ceramics with tailored microstructure are fabricated by electrophoretic deposition process using pulsed electric field and a strong magnetic field

P710 Advanced Semiconductor Devices

Education and research on the growth and electronic property of semiconductor heteroepitaxial films and polycrystalline films as well as their application to quantum-effect devices, molecular electronics, and gas sensors. Phase transition and polarization reversal of ferroelectric crystals are also studied - Photonic Devices: Physical Properties, Visible LEDs, Ultraviolet Devices, White Light Emitting Devices, Laser Diodes (LDs) - Electronic Devices: High Frequency Power Devices, High Breakdown Voltage, High Current.

Density Power Devices, New Functional Devices.

Novel Nano-Heterostructure Materials and Related Devices: Nanostructure Devices and Materials, Novel AlGaIn/GaN Heterostructure Devices.

P724 Selected Topics Related to Nanomaterials

Topics are to be determined by the supervising committee and approved by the Physics Department.

BP701 Biological Science

Cell, basic of molecular biology, transcription, translation, regulatory pathways, DNA damage and Repair, recombination DNA technology.

Nanoscience: explain concepts of nanotechnology and nanoscience including their importance in the development of Biomedical methods and technology.

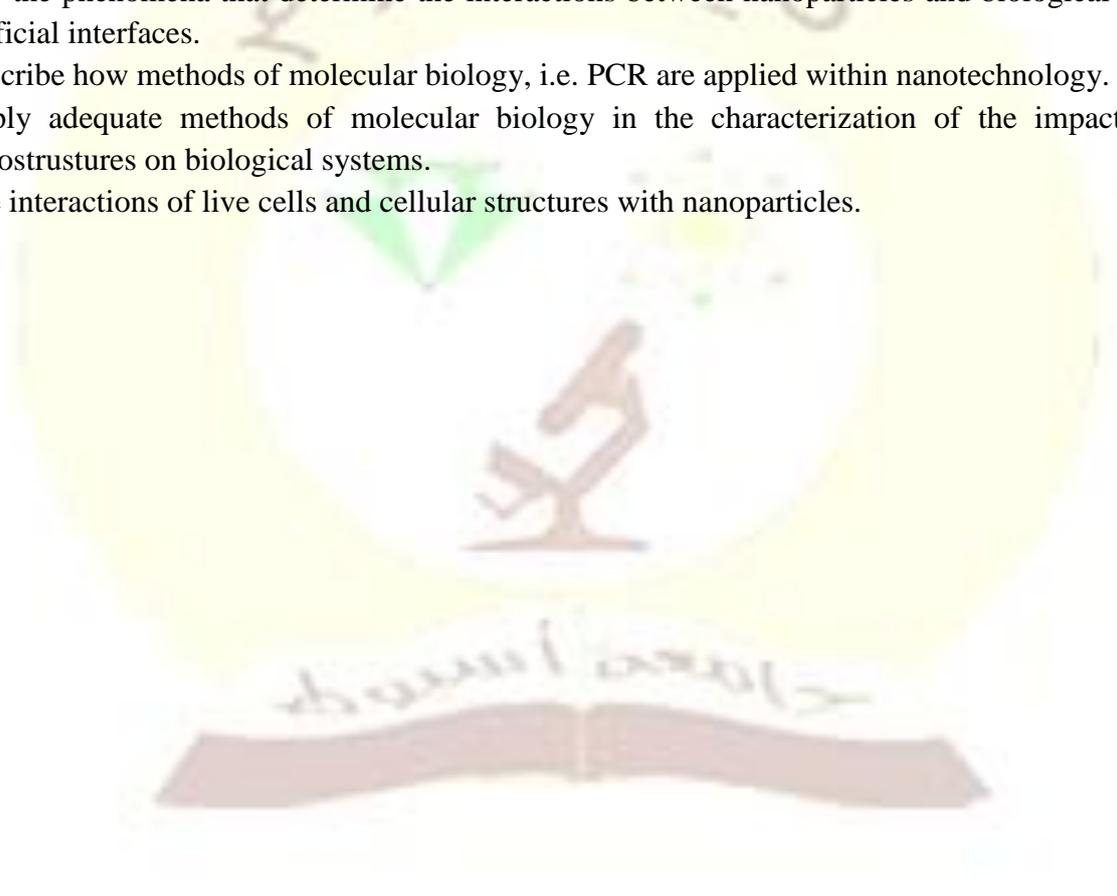
Analyze the interdisciplinary nature of nanotechnology using examples from biology, medicine, chemistry, physics.

Discuss the different technologies used in the synthesis and analysis of nanostructures and also the phenomena that determine the interactions between nanoparticles and biological and artificial interfaces.

Describe how methods of molecular biology, i.e. PCR are applied within nanotechnology.

Apply adequate methods of molecular biology in the characterization of the impact of nanostructures on biological systems.

The interactions of live cells and cellular structures with nanoparticles.



3- Ph.D. Degree in Nuclear Physics

P704 Quantum Mechanics II

Time dependent perturbation theory. Theory of scattering. Relativistic Theory. Quantization and second quantization.

P711 Nuclear Structure II

Structure of deformed nuclei. Overview of angular momentum coupling Formulas. Second quantization. Particle hole excitation at closed shells: TDA and RPA approximations. Application of the Study of 1p - 1h Excitations.

P712 Nuclear Reactions II

Improvements within the framework of the DWBA. Distorted-Wave Impulse Approximation. Coupled equations for inelastic scattering. Microscopic theory of inelastic nucleon scattering from nuclei. Scattering from deformed rotational Nuclei. Two-nucleon transfer reactions. Heavy-ion reactions.

P713 Accelerators and Reactors Physics II

Part I: Linear Accelerators, Principle and operation, applications. Storage Rings, principle and operation High intensity hadron accelerators (Meson and neutron sources). Electron and low intensity hadron accelerators. Colliders: Electron-positron colliders, Hadron colliders, Electron-proton colliders, Light sources, Hypothetical accelerators.

Part II: Advanced reactors. Fusion reactors, Nuclear fuel cycle, Safety, Accidents, Natural nuclear reactors, Applications.

P714 Elementary Particle Physics II

Quantum Electrodynamics: The Dirac Equation, Solutions to the Dirac Equation, Bilinear Covariants, The Photon, The Feynman Rules for Quantum Electrodynamics, Casimir's Trick and the Trace Theorems, Cross Sections and Lifetimes, Renormalization.

Electrodynamics of Quarks and Hadrons: Electron-Quark Interactions, Hadron Production in e^+e^- Scattering, Elastic Electron-Proton Scattering, Inelastic Electron-Proton Scattering, The Parton Model and Bjorken Scaling, Quark Distribution Functions.

Quantum Chromodynamics: Feynman Rules for Chromodynamics, The Quark-Quark Interaction, Pair Annihilation in QCD, Asymptotic Freedom, Applications of QCD.

Weak Interactions.

Gauge Theories.

P726 Selected Topics Related to Nuclear Physics

Topics are to be determined by the supervising committee and approved by the Physics Department.

M706 - Numerical Analysis II

Different numerical methods for large problems with different time scales. Spectral methods, wavelets, Multiple methods, Preconditioned conjugate gradient methods, Multigrid methods.

4- Ph.D. Degree in Radiation Physics

P704 Quantum Mechanics II

Time dependent perturbation theory. Theory of scattering. Relativistic Theory. Quantization and second quantization.

P713 Accelerators and Reactors Physics II

Part I

Linear Accelerators, Principle and operation, applications. Storage Rings, principle and operation High intensity hadron accelerators (Meson and neutron sources). Electron and low intensity hadron accelerators. Colliders: Electron-positron colliders, Hadron colliders, Electron-proton colliders, Light sources, Hypothetical accelerators.

Part II

Advanced reactors. Fusion reactors, Nuclear fuel cycle, Safety, Accidents, Natural nuclear reactors, Applications.

P715 Radiation Physics II

The radiation field, Radiation interactions with matter, Radiative transport, Radiation dosimetry, Shielding and dose calculations.

P716 Neutron Physics II

Neutron scattering and two-particles interactions. Neutrons and nuclear structure. Neutron and nuclear energy energetics of nuclear transformation and decay, Nuclear fission, Neutron transport and diffusion, Neutron moderation, nuclear fission chain reactions, criticality, Nuclear fusion, and controlled nuclear fusion.

Neutron optics: Wave-particle duality, Neutron propagation in condensed matter, Neutron diffraction, Neutron interference, Neutron polarization.

P728 Selected Topics Related to Radiation Physics

Topics are to be determined by the supervising committee and approved by the Physics Department.

M706 - Numerical Analysis II

Different numerical methods for large problems with different time scales. Spectral methods, wavelets, multiple methods, preconditioned conjugate gradient methods, multigrid methods.

5- Ph.D. Degree in Plasma Physics

P703 Electromagnetic Theory II

Guided Electromagnetic Waves: Transmission line equations, transmission line transient waves, Sinusoidal time variations, Arbitrary impedance terminations, stub tuning, The rectangular waveguide, dielectric waveguide.

Radiation: The retarded potentials, Radiation from point dipoles, Point dipole arrays, Long dipole antennas.

P704 Quantum Mechanics II

Time dependent perturbation theory. Theory of scattering. Relativistic Theory. Quantization and second quantization.

P705 Molecular Spectroscopy

Basics of molecular spectroscopy- Phenomenology- Diatomic molecules - Pure rotational spectroscopy - Vibrational spectroscopy of polyatomic molecules- Fundamentals of group theory. Infrared spectroscopy- Raman scattering - Electronic spectra of diatomic molecules- Nuclear magnetic resonance. Electron spin resonance- Mossbauer spectroscopy - High Resolution Spectroscopy.

P717 Methods of Experimental Plasma Physics II

Low-pressure arc, cold-cathode plasma formation, ambipolar diffusion in afterglow plasmas, Langmuir probe measurements of electron temperature and plasma density, Fabry-Perot spectroscopy for ion energy measurements, optical spectroscopy for species identification, microwave interferometry and cavity resonances for plasma density determination, momentum generated by a plasma thruster, determination of plasma aluminum oxide coating for semiconductors, electric conductivity measurements of low and high temperature plasma, design plasma TV screen.

P718 Plasma Physics II

Recombination processes in low temperature after glow plasma. Chemistry in glow discharges of H₂ / O₂ mixtures. Composition and Thermodynamic properties of H-He Plasma. Collective and nonlinear plasma phenomena. Modeling and simulation techniques. Plasma diagnostic methods. High frequency discharges. Non-equilibrium plasmas. Micro-plasmas at high pressures. Thermal plasmas. Complex and dusty plasmas, ion-ion plasmas. Plasma power and pulsed power technology. Thermodynamics and transport phenomena. Astrophysical, geophysical and other natural plasmas. Medical, biological, environmental and aeronautical applications. Interaction of R.F Plasma with Stainless steel.

P719 Fusion Energy Technology

Fusion basics, Fusion Plasmas, The Iter tokamak design, Danger of fusion reactors, Radiation, nuclear explosion with fusion reaction, The cooling system, The fuel system, The diverters, Systems for enhancing pre-ignition conditions of thermonuclear fusion reactions, Fusion ignition, Magnetic fusion energy, Methods and device for realizing stable plasma confinement, stellarators, Inertial confinement, Bubble Fusion.

P730 Selected Topics Related to Plasma Physics

Topics are to be determined by the supervising committee and approved by the Physics Department.

M706 - Numerical Analysis II

Different numerical methods for large problems with different time scales. Spectral methods, Wavelets, Multiple methods, Preconditioned conjugate gradient methods, Multigrid methods.



6- Ph.D. Degree in Laser Physics

P702 Advanced Condensed Matter Physics

Phase Diagrams and Phase Transformations, Single Photon Source Materials for Communications and Computer Technology, Polymers and Advanced Ceramics, Spectroscopic Characterization, Non-Linear Optics, Physics of Quantum Structures and Nano Photonics, Synthesis, Fabrication and Processing of Materials.

P703 Electromagnetic Theory II

Guided Electromagnetic Waves: Transmission line equations, Transmission line transient waves, Sinusoidal time variations, Arbitrary impedance terminations, Stub tuning, The rectangular waveguide, Dielectric waveguide.

Radiation: The retarded potentials, radiation from point dipoles, point dipole arrays, long dipole antennas.

P704 Quantum Mechanics II

Time dependent perturbation theory. Theory of scattering. Relativistic Theory. Quantization and second quantization.

P705 Molecular Spectroscopy

Basics of molecular spectroscopy- Phenomenology- Diatomic molecules - Pure rotational spectroscopy - Vibrational spectroscopy of polyatomic molecules- Fundamentals of group theory. Infrared spectroscopy- Raman scattering - Electronic spectra of diatomic molecules- Nuclear magnetic resonance. Electron spin resonance- Mossbauer spectroscopy - High Resolution Spectroscopy.

P720 Methods of Experimental Laser Physics II

Nd: Yag pumped dye lasers, optically pumped parametric Oscillator Lasers, Nitrogen pumped dye lasers, diode lasers, Argon Ion lasers, etc.). Analyze a mass spectrum taken from laser adsorption and electron impact ionization, Mass spectroscopy. Laser induced fluorescence of iodine, He-Ne, Ar ion, tunable laser. He-Ne Laser Opto-galvanic Spectroscopy.

P721 Magnetic Resonance II

Magnetic properties of matter, Magnetic resonance theory, Spin Hamiltonian and hyperfine interactions, Electron paramagnetic resonance (EPR), Nuclear magnetic resonance (NMR), Double resonance technique, echo spectroscopy ESR-ENDOR, Application in science, imaging and therapy.

P722 Laser Applications II

Wave equation, Fresnel equations and photon population inversion polarization, Geometrical optics using matrix methods, Fourier Optics, Cavity modes and Gaussian beams, Fabry-Perot and Michelson interferometers, Basic rate equation models for 3 and 4 level systems, Simple laser theory (single- and multi-mode operation), Mode-locking and Q-switching, Diffraction and Fourier optics, Electro- and Acousto-optic effects, Nonlinear Optics. Fiber optics, Transverse mode structure, Longitudinal mode structure, Dye absorption and Emission spectra. Super-fast laser cooling, Laser-Tissue interactions: (Biological and Medical Physics, Biomedical Engineering), Laser crystals.

P732 Selected Topics Related to Laser Physics

Topics are to be determined by the supervising committee and approved by the Physics Department.

M706 - Numerical Analysis II

Different numerical methods for large problems with different time scales. Spectral methods, wavelets, Multiple methods, Preconditioned conjugate gradient methods, Multigrid methods.



7- Ph.D. Degree in Theoretical Physics

P702 Advanced Condensed Matter Physics

Phase Diagrams and Phase Transformations, Single Photon Source Materials for Communications and Computer Technology, Polymers and Advanced Ceramics, Spectroscopic Characterization, Non-Linear Optics, Physics of Quantum Structures and Nano Photonics, Synthesis, Fabrication and Processing of Materials.

P703 Electromagnetic Theory II

Guided Electromagnetic Waves: Transmission line equations, transmission line transient Waves, Sinusoidal time variations, Arbitrary impedance terminations, Stub tuning, the rectangular waveguide, Dielectric waveguide.

Radiation: The retarded potentials, radiation from point dipoles, point dipole arrays, long dipole antennas.

P704 Quantum Mechanics II

Time dependent perturbation theory. Theory of scattering. Relativistic Theory. Quantization and second quantization.

P711 Nuclear Structure II

Structure of deformed nuclei. Overview of angular momentum coupling Formulas. Second quantization. Particle hole excitation at closed shells: TDA and RPA approximations. Application of the Study of $1p - 1h$ Excitations.

P712 Nuclear Reactions II

Improvements within the framework of the DWBA. Distorted-Wave Impulse Approximation. Coupled equations for inelastic scattering. Microscopic theory of inelastic nucleon scattering from nuclei. Scattering from deformed rotational Nuclei. Two-nucleon transfer reactions. Heavy-ion reactions.

P721 Magnetic Resonance II

Magnetic properties of matter, Magnetic resonance theory, Spin Hamiltonian and hyperfine interactions, Electron paramagnetic resonance (EPR), Nuclear magnetic resonance (NMR), Double resonance technique, echo spectroscopy ESR-ENDOR, Application in science, imaging and therapy.

P734 Selected Topics Related to Theoretical Physics

Topics are to be determined by the supervising committee and approved by the Physics Department.

M706 Numerical Analysis II

Different numerical methods for large problems with different time scales. Spectral methods, Wavelets, Multiple methods, Preconditioned conjugate gradient methods, Multigrid methods.

M708 Partial Differential Equations II

Basic constant-coefficient linear examples: Laplace's equation, the heat equation, and the wave equation, analyzed from many viewpoints including solution formulas, maximum principles, and energy inequalities. Key nonlinear examples such as scalar conservation laws, Hamilton-jacobi equations, and semilinear elliptic equations, analyzed using appropriate tools including the method of characteristics, variational principles, and viscosity solutions. Simple numerical schemes: finite differences and finite elements. Important PDE form mathematical physics, including the Euler and Navier-Stokes equations for incompressible flow.

Chemistry Programs

1- Professional Diploma in Biochemistry

C501 Food Chemistry and Analysis

Chemical/biochemical reactions of carbohydrates, lipids, proteins, and other constituents in fresh and processed foods are discussed with respect to food quality. Reaction conditions and processes that affect color, flavor, texture, nutrition, and safety of food are emphasized. Activation and control of enzymatic reactions in fruits and vegetables; consequences of water migration on food quality; gelatinization- retrogradation in starch- based foods (e.g., pudding, bread, and rice); initiation and control of non- enzymatic browning (e.g., pretzels, meat); and food emulsions (e.g., salad dressings, commutated meats products)

C502 Analytical Biochemistry

Classical and modern biochemical methods for the isolation and analysis of biological molecules, with an emphasis on proteins and nucleic acids. Principles and theory of techniques, application of the techniques during lab periods. Methods include affinity chromatography, electrophoresis, centrifugation, immunoblotting, spectrophotometry, fluorimetry, HPLC, quantitative PCR, mass spectrometry, and bioinformatics. Basic lab skills and concepts will be reinforced and use of the scientific method will be incorporated into the lab experiments. Proper scientific communication skills by writing lab reports.

C503 Endocrinology

General Principles of Endocrinology What are hormones, types of release, homeostasis and feedback, causative vs. permissive, organizational vs. activational. Techniques for Studying Endocrinology Extirpation/replacement, RIA, etc. General Principles of Endocrinology – Peptide Hormones. General Principles of Endocrinology Steroids, catecholamines and prostaglandins .The Hypothalamic-Pituitary System I Anatomy, Tropic Hormones. The Hypothalamic-Pituitary System II Tropic hormone regulation. The Hypothalamic-Pituitary System III Tropic hormone regulation; Vasopressin, and Oxytocin. Melatonin and Thyroid Hormones I Biochemistry and Mechanisms of Action. Thyroid Hormones II Biological functions. Topics in Endocrinology and Review . Reproduction I – Males Spermatogenesis, Testicular function, Sex Differentiation. Reproduction II – Females Ovarian cycles, Pregnancy, Lactation. Reproduction III – Comparative Aspects Vitellogenesis, Sex determination, Clinical Diseases. Reproduction IV: Seasonal Breeding Metabolism I – The Endocrine Pancreas Pancreatic Anatomy, Insulin and Glucagon. Metabolism II – Pancreatic Functions Metabolism, Gluconeogenesis, Diabetes, Feeding. Gastrointestinal Hormones Pepsin, Gastrin, Secretin, and Cholecystokinin. Calcium and Phosphate Homeostasis Parathyroid hormone, Calcitonin. Adrenal Steroids Adrenal anatomy, Aldosterone, Adrenal Medulla.

C505 Practical biochemistry I

Selected experiments in biochemistry emphasizing the theoretical courses of the first semester

C506 Practical biochemistry II

Selected experiments in biochemistry emphasizing the theoretical courses of the second semester.

B518 Biotechnology

Basic principles of genetic engineering : Methods of creating recombinant DNA molecule, splicing, properties of restriction endonucleases and their mode of action, construction of DNA library, genomic vs cDNA library, chemical synthesis of gene, cloning vectors (lambda phage plasmid, M-13 phage, cosmid, shuttle vectors, yeast and viral vectors, expression vectors) - Selection/screening - An analysis of genomic DNA by Southern hybridization, Northern and Western blotting techniques - Restriction mapping : Restriction fragment length polymorphism (RFLP) - DNA sequencing techniques : plus and minus, dideoxynucleotide, Maxam and Gilbert etc - Preparation of radiolabelled and synthetic probes - Amplification of DNA by polymerase chain reaction (PCR) Site directed mutagenesis - Gene transfer methods for animals and plants; Agrobacterium mediated gene transfer, electroporation and particle gun. Transgenic animals and transgenic plants - Application of genetic engineering in medicine and agriculture, vaccine production.

B520 Advanced Molecular Biology

Concept and definition of the gene, complexity of the eukaryotic gene - Structural organization of the DNA in the nuclear material- General properties of histones, nucleosomes and solenoid structure - DNA synthesis : The enzymes of DNA replication in prokaryotes and eukaryotes, mechanism of replication in bacteria and viruses, reverse transcriptase, salient features of eukaryotic nuclear and mitochondrial DNA replication - RNA synthesis : The enzymes of transcription in prokaryotes and eukaryotes, mechanism of transcription in bacteria, heteronuclear RNA, post transcriptional processing of RNA, role of ribozymes - Protein synthesis : Concept of the genetic code, structure of t-RNA and t-RNA, enzymes of translation in prokaryotes and eukaryotes, mechanism of protein synthesis, post translational processing of proteins - Regulation of gene expression in prokaryotes, structure and mechanism of different operons.

MC525 Bioinformatics

This course introduces fundamental concepts and methods for bioinformatics and the advanced applications. The topics covered include bioinformatics database, sequence and structure alignments, protein folding and protein structure prediction, protein-protein interaction, Monte Carlo simulation, and structural determination of macromolecules (X-ray crystallography and NMR). Emphasis is placed on the understanding of the concepts taught and on their practical utilization, with the objective of helping student use the bioinformatics tools/methods to solve problems in their own research.

MS504 Biostatistics with Statistical Software

Explain the scope and uses of statistics in biology and medicine, State types and sources of biological and medical data, various types of variability associated with bio-medical data, e.g. response and reactions to drugs, vital statistical indices, the standardized rates, the meaning of genetics, the simple Mendelian ratio, the fundamental principles of bioassay, the relative potency, simple assays, direct and parallel lines. Use of appropriate statistical softwares.

Z502 Enzymology

Isolation and purification of enzymes. Classification, nomenclature and general properties like effects of pH, substrate and temperature on enzyme catalysed reactions. Kinetics of catalysed reaction: Single substrate reactions, bisubstrate reactions, concept of Michaelis - Menten, Briggs Haldane relationship, Determination and significance of kinetic constants, Limitations

of Michaelis-Menten Kinetics, Activation energy and Arrhenius concept. Michaelis pH functions. Inhibition of enzyme activity –

Enzyme catalysis : enzyme specificity and the concept of active site, determination of active site. Stereospecificity of enzymes. Mechanism of catalysis : Proximity and orientation effects, general acid-base catalysis, concerted acid - base catalysis, nucleophilic and electrophilic attacks, catalysis by distortion, metal ion catalysis. Theories on mechanism of catalysis. Mechanism of enzymes action : mechanism of action of lysozyme, chymotrypsin, carboxypeptidase and DNA polymease. Multienzymes system, Mechanism of action and regulation of pyruvate dehydrogenase and fatty acid synthetase complex.

Coenzyme action. Enzyme regulation: General mechanisms of enzyme regulation, Allosteric enzymes, sigmoidal kinetics and their physiological significance, Symmetric and sequential modes for action of allosteric enzymes. Reversible and irreversible covalent modification of enzymes, cascade systems. Immobilised enzymes and their industrial applications.

MD503 Biological Fluids

An introduction to the study of urine and body fluid analysis. Includes the anatomy and physiology of the kidney, physical, chemical and microscopic examination of urine, cerebrospinal fluid, and other body fluids as well as quality control, quality assurance and safety.

MD504 Medical Biomarkers

Liver function and diseases (in metabolism, storage and detoxification) viral infections fatty degeneration HCC, Kidney function and disfunction, cardiac action and cardiac enzymes, Bone markers and tumor markers.

MD505 Physiological Biochemistry

Composition and function of blood, plasma and blood corpuscles, functions of plasma proteins, structure and function of haemoglobin, abnormal haemoglobins, Blood coagulation – mechanism and regulation. Blood groups. Structure of nephron, composition and mechanism of urine formation, glomerular filtration, tubular reabsorption of glucose, water and electrolytes, tubular secretion. Regulation of water and electrolyte balance, role of kidneys and hormones in their maintenance. Hydrogen ion homeostasis, acid-base balance- metabolic and respiratory acidosis and alkalosis. Respiratory unit, exchange and transport of respiratory gases in the body, role of 2,3 DPG, Bohr effect and chloride shift. Classification of muscles, Structure of skeletal, smooth and cardiac muscles. Actin, myosin, tropomyosin, troponin, Z disc and H line components. The sliding filament mechanism and subcellular ion movements during the contraction cycle in skeletal muscles. Structure of neuron, nerve impulse, origin and transmission, neuromuscular junction, mechanism of nerve conduction. Reflex action and reflex arc.

MD506 Intoxication of biological systems

Environmental chemical pollution, organophosphorus pesticides, heavy metals, pigments- food water and beverages contaminates, preservation, drugs endotoxins and mycotoxins excreted urine.

MD507 Microbiology and immunochemistry

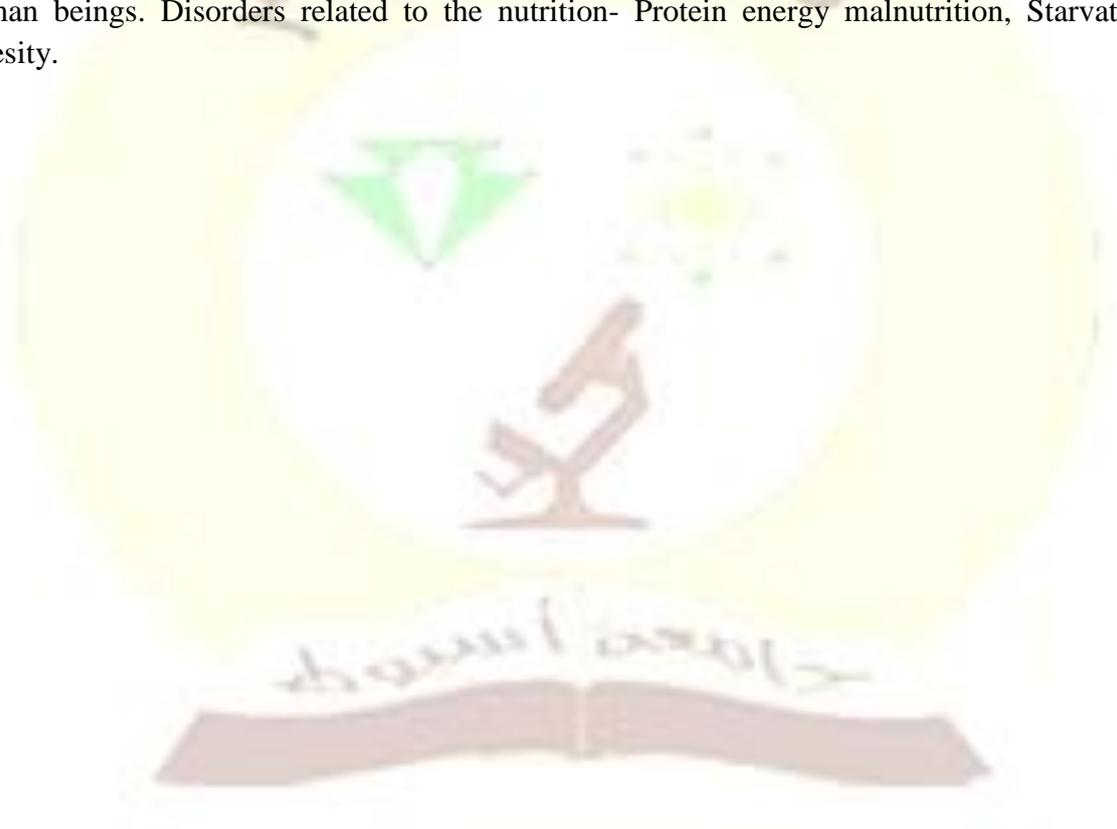
Microbiology: An Introduction to the study of bacteria, viruses, fungi, and protozoa, Topics include History of Microbiology, Prokaryotic and Eukaryotic cells, Classification, Microscopy, Staining techniques, Microbial growth and nutrition.

MD508 Environmental health community

Types of environmental diseases, causes, protection.

MD509 Human Nutrition

Direct and indirect calorimetry, energy value of the foods, thermal equivalent of oxygen, respiratory quotient, calorogenic action of the foods, basal metabolic rate definition and its measurement, factors affecting BMR, energy requirements of the human beings. Nutritional aspects of the carbohydrates-- Different dietary types, requirements, utilization and functions. Special role of the non starch polysaccharides. Nutritional aspects of the lipids-- Different dietary types, requirements, utilization and functions. Essential fatty acids. Nutritional aspects of the proteins-- classification of amino acids and proteins, essential amino acids, nutritive value of proteins and the methods for its determination, amino acid imbalance, protein requirements, utilization and functions. Nutritional aspects of the vitamins and minerals. Food processing and loss of nutrients during processing and cooking. Naturally occurring Anti-nutrients. Balanced diet-- Recommended dietary allowances for different categories of the human beings. Disorders related to the nutrition- Protein energy malnutrition, Starvation, Obesity.



3- Professional Diploma in Quality Control

C511 Measurement and Testing Techniques

An in-depth discussion of equipment, principles and techniques of measurement assurance.

C512 Quality Function Management and TQM

A study of the functions and responsibilities of the quality organization. TQM and ISO concepts, and the tools for continuous improvement are analyzed for sequence of use and deployment.

C513 Customer Satisfaction and Quality Assurance

An in-depth study of current methods for obtaining customer satisfaction. Examines the techniques for determining customer needs and the development of customer service strategy quality control criteria.

C514 Advanced Experimental Design

Analysis of statistical experimental design strategies. Planning of experiments for the best strategy and objectives.

C515 Statistical Quality Control and Sampling

The application of advanced statistical methodologies to the analysis and solution of quality and management problems, including probability theory, control charts, sampling, regression analysis and the design of experiments. Focus on statistical process control and related quality technologies.

C516 ISO 9000 and the Audit Function

A study of the ISO 9000 series of quality system standards with emphasis on manufacturing and service industry applications. The studies address the standards interpretation, documentation and implementation including preparation for and creation of internal and external audits.

C517 Advanced Probability and Statistics

A study of measures of central tendency and dispersion, important discrete and continuous probability distributions, sampling theory, hypothesis testing and estimation. Linear regression and correlation will also be covered. The use of statistics in testing, inspection, and production will be identified.

C518 Software Reliability

A study of the theory and application of reliability concepts as they relate to software design and implementation.

C519 Human factors in quality assurance

Human Factors in QA is a comprehensive survey of human factors theory, research, and applications which are of particular relevance to quality assurance. Emphasis will be placed on operator constraints in the design of work processes, workplaces, and instrumentation.

C520 Biomedical Quality Control Methods

In depth study of quality control disciplines as applied to medical device, pharmaceutical and/or biologics regulated environments. Topics include influencing discipline and applying models; methods that monitor, maintain and/or improve product or service quality; operational efficiency.

C521 Reliability

An overview of reliability engineering. Use of mathematical models of prediction, confidence assessment, and systems reliability. Emphasis on practical applications for product or system design.

C522 Statistical Quality Control for Service Professionals

Techniques for applying Statistical Quality Control (SQC) in controlling processes and delivering customer services are learned. Students will examine methods for establishing and maintaining SPC, QC auditing, and sampling, and continuous improvement in the service, health care, and public sectors.

C523 Good Manufacturing Practices

FDA Good Manufacturing Practice regulations as applied to medical device (21 CFR 820) and pharmaceutical production (21 CFR 210,211). Device design covers development, manufacturing, quality records, management and organizational requirements. Pharmaceutical includes personnel, facilities and equipment, process and product controls, laboratory, reporting.

C524 Six Sigma Principles and Applications

In depth study of the application of the six sigma process; covers content of the methodology areas of Define, Measure, Analyze, Improve and Control (DMAIC) including team concepts, project management, advanced statistical process control and techniques, and measurement systems analysis.

C525 Quality Assurance of the Service Delivery Process

Analyzes' processes used to deliver service and methods used to assure satisfaction. Examines the relationship of Strategic Quality Planning, the Delivery Process, and the usage of TQC and Quality Assurance to achieve strategic goals.

4- Professional Diploma in Applied Forensic Chemistry

C531 Modern Analytical Technique

Different types of chromatography and the application towards forensic evidence - Produce data using chromatographs, GC, HPLC, and TLC, on forensic evidence - Compare and interpret different types of forensic evidence results from instrumentation - Mass Spectroscopy- Classify different types of mass spectroscopy and the application towards forensic evidence- Illustrate the parts of a mass spectrometer and the application - Produce data using mass spectrometers, GCMS and LCMS, on forensic evidence - Compare and interpret different types of forensic evidence results from instrumentation - Prepare samples for instrumental microscopy- Differentiate when instrumental techniques are used and needed - Identify fibers, paints, and inks using instrumental microscopy- Different types of fingerprinting and casting techniques used to collect and preserve impression evidence as well as interpretation of evidence found- Impression Evidence- Distinguish between different techniques used to collect and preserve fingerprints and other impressions- Prepare fingerprints and casts by using different methods - Analyze fingerprint patterns Compare casting molds to donor.

C532 Forensic Chemistry

General Forensic Laboratory Procedures- Demonstrate good laboratory practices used in a forensic science laboratory - Identify important collection and preserving of evidence techniques -Dramatize and apply labeling and collection of different types of evidence – Statistics- Classify the use of statistics in forensic chemistry -Select the correct statistical technique for different types of evidence and data. Apply statistics in forensic data - Sample Preparation - Express how sample preparation is applied in forensic chemistry - Generalize different type of sample procedures for evidence - Identify what preparation needs to be done for particular types of evidence- Complete presumptive tests done of forensic evidence - The overall goal of this module is to understand different types of commonly used instrumental techniques in forensic chemistry and to apply the techniques to evidence- Spectroscopy- Classify different types of spectroscopy and the application towards forensic evidence- Illustrate the parts of a spectrophotometer and the application - Produce data using spectrophotometers, FTIR, UV-Vis-NIR, Raman, and Fluorescence, on forensic evidence - Compare and interpret different types of forensic evidence results from instrumentation.

C533 Environmental Forensics 1

What is Environmental Forensic Science- Toxicity- Identification of Hydrocarbons Fate of Chemicals: Partitioning- Fate of Chemicals: Biotransformations- Environmental Transport Models- Groundwater Transport Models- Atmospheric Dispersion Models.

C534 Biochemical Analysis

Biochemical analysis of urine, blood and food: pH, organics, inorganics, proteins,...

C535 Applied Statistics for Data Analysis

Introduction to Scientific Evidence and Statistics- Measures of central tendency and the normal distribution- Probability- Discrete random variables and probability distributions- Estimation of mean and standard deviation and the normal distribution-Hypothesis testing for one or two population means, Student t-test-Hypothesis testing for small sample sizes and

multinomial experiments, Fisher's exact test- Analysis of Variance and multiple comparison tests-Simple linear regression

C536 Laboratory QA/QC

Introduction to QA/QC- Key Elements of a QA/QC Program- Personnel and Training - Validation of Analytical Procedures- Equipment -Test Article Tracking- Standard Operating Procedures-Study Protocols-The Final Report-Archiving, Archivist, Storage and Retrieval Specializations- Inspection and Compliance.

C537 Forensic Analysis of DNA

DNA Introduction-Quality Assurance and Performance Optimization - DNA Isolation-Assessment of Extracted DNA and Amplification- Introduction to Data Collection and Interpretation- Significance of a Match and Calculating Statistics Evaluation and Triage of DNA Samples- Paternity and Identification.

C538 Organic and Food Analyses

Isolation, fractionation, and identification of the desirable and objectionable organic flavor constituents in food; chemical mechanisms for the formation of flavor components in food; methods for measuring organic and flavor stability of food and food components; manufacture of food flavors.

C539 Spectral Analysis and Applied Spectroscopy

Introduction to structure elucidation - Separation techniques and isolation of compounds - Ultraviolet and Infrared Spectrophotometry. Introduction to Mass spectrometry- Advanced topics and tools in Mass spectrometry -Introduction to Nuclear Magnetic Resonance spectroscopy- Two-dimensional homo- and heteronuclear NMR. Advanced topics and tools in NMR spectroscopy- Organic solid state analysis techniques- Practical applications of structure elucidation techniques.

C540 Environmental Forensics 2

Design of a uranium mine environmental monitoring program- Assessment of a maritime oil spill event - Use of spreadsheet-based plume modelling software to model groundwater contamination-Assessment of the processes acting on the distribution and concentration of a dissolved phase hydrocarbon plume.

C541 Medicinal Chemistry of Drugs of Abuse

Drug Classes and Controlled Substances Act -Drug Dependence and Addiction - CNS Depressants- Alcohol- Opioids- Cannabinoids- Hallucinogens- CNS Stimulants - CNS Volatile Substances

C542 Special Topics in Forensic Science

Selected topics related to forensic science.

MD501 Principles of Forensic Science

Basic disciplines of forensic science- History and Nature of Forensic Science, Crime Scene Investigation, Latent Prints, Trace Evidence, Biological Evidence, Forensic DNA Analysis, Illicit Drugs, Forensic Toxicology, Firearms and Tool marks, Death Investigation, Questioned Documents, Fire and Explosive Examination.

MD502 General Toxicology

Principles of Toxicology- Mechanisms of Toxicology- Risk Assessment- Absorption, Distribution, Metabolism and Excretion of Toxicology-Toxicokinetics-Genetic Toxicology-Chemical Carcinogenesis-Developmental Toxicology-Toxic Responses of the Blood-Toxic Responses of the Immune System-Toxic Responses of the Liver - Toxic Responses of the

Kidney-Toxic Responses of the Respiratory System-Toxic Responses of the Nervous System-Toxic Responses of the Reproductive System.

MD504 Histochemistry

Chemical components of carbohydrates, proteins, lipids, nucleic acids, ... in the cells and tissues including methods for their detection. Detecting methods of some enzymes in animal tissues.

MD511 Forensic Medicine

Death- Medicolegal Investigation of Death- Sudden Natural Death in Adults

The Autopsy- Post-Mortem Interval- Identification of the Dead- Wounds of Medicolegal Importance I- Wounds of Medicolegal Importance II- Thermal Injury and Fire Deaths
Suicide- Head and Neck Injury- Drowning by Immersion- Asphyxia Related Deaths- Case Study.



5- Professional Diploma in Applied Organic Chemistry

C551 Spectroscopic analysis

U.V and vis. Spectroscopy: theory and instrumentation, Jablonski diagram, application in organic chemistry, problems in U.V spectroscopy. Emission Spectroscopy.

I.R spectroscopy: Theory and instrumentation, application in organic chemistry, problems in I.R. spectroscopy: Mass spectroscopy: Theory and instrumentation, Applications in organic chemistry - Advanced techniques in mass spectra (GC/MS, isotopes in/MS), Problems in mass spectrometry - NMR Spectroscopy: Theory and instrumentation, Application of HNMR in organic chemistry, NMR of other elements (^{13}C , ^{31}P). Advanced techniques in NMR spectra, problems in NMR spectroscopy. General Problems in Spectroscopic analysis of organic compounds.

C552 Chromatographic Techniques

Column Chromatography, Paper and thin-layer chromatography, Gas Chromatography, Supercritical fluid, High performance Liquid chromatography, Ion-Exchange chromatography, Gel chromatography, Chiral chromatography, electrophoreses

C553 Textile and fibers chemistry

Definition of Fiber. Microstructure of fiber, Burning Test for qualitative identification of fibers; Identification of fibers by solubility – Classification of Fibers: A- Natural fibers: 1- cellulosic family (cotton), 2– Protein fibers – (wool, hair and camel hair). Morphology of fiber; Chemical structure; Chemical reactions related to industry, B- Thermoplastic fiber: This is related to polymers and polymer chemistry.

C554 Dyes and pigments chemistry

Historical Introduction, Relation between colour and molecular constitution, Classification of chromogenes, Nomenclature of Dyes, Colour Index – pigments – Chemical Classification of Dyes: Azo Dyes: ((Structural features, Industrial production and types.); Carbonyl dyes; and Reactive dyes. Application classification of Dyes: Direct dyes; and Disperse dyes- Dyes in Biochemistry, Biology, Medicine and Analytical chemistry, Ecology and Toxicology of Colorants.

C555 Polymers

Classes of polymers; Natural polymers, Synthetic polymers. Polymer Reactions: Condensation polymerization, Addition polymerization, Ring opening polymerization, Molecular weight of polymers, Characterization Techniques, Methods of polymer synthesis, Industrial Polymerization processes, Application of Polymers, Liquid crystalline polymers, Conducting polymers – Nanopolymers and its new applications.

C556 Petroleum and petrochemicals

Crude oil characteristics, Distillation of crude oil, Catalytic cracking. Alkylation, Catalytic Reforming, Hydrocracking, Gasoline blending, Isomerization, Petrochemical industries.

C557 Statistics

The basic concepts of probability, common distributions, statistical methods, regression analysis, and data analysis, This course provides principles of Analysis of Variance (ANOVA), including randomization and blocking, single and multiple factor designs, crossed and nested factors, quantitative and qualitative factors, random and fixed effects, split plot and

repeated measures designs, crossover designs and analysis of covariance (ANOVA).
Applications using SPSS program

C558 Practical applied chemistry

Selected experiments concerned with various techniques and separation methods.

C559 Drug Synthesis

The structures and mechanisms of a variety of drug classes, Topics include cardiovascular agents, diuretics, hormones, vitamins, anti-inflammatory, steroids and chemotherapeutics and etc.

C560 Review article

Review article in the field of Applied Chemistry

C561 Industrial Inorganic Chemistry

Fuel gases. Glass industry, Cement industry, Fertilizer Industries, Semi-Conductors.

C562 Food analysis

Elementary analysis of food stuff, water, carbohydrates, proteins, lipids, vitamins, minerals, trace elements, food additives, preservatives and contaminants.

C563 Environmental organic chemistry

Agrochemicals, carbon cycle, Nitrogen cycle, Air pollution, Water pollution.

C564 Synthetic organic chemistry

Metal intermediates organic synthesis, new reagents in organic synthesis.

C566 Nanomaterials and applications

Nanostructures (Definitions, characteristics and important properties), Preparation and characterization of nanomaterials, Industrial applications of nanoparticles and nanocomposites

6- Environmental Analytical Chemistry Diploma

C571 Fundamentals of Environmental Chemistry

General principles and techniques, Analytical environmental data: assessment and interpretation. The environment (biogeochemical cycles, environmental pollution, environmental standards); Environmental analysis (aims, types, stages of); Sampling and storage; Sample treatment; Analytical methods; Standardization and calibration Specific applications: speciation (importance, definition, determination of trace metal.

C572 Instrumental Methods of Analysis

Molecular spectroscopy. Electroanalytical methods of analysis. Separation methods. Environmental sampling and analysis.

C573 Pollution and its Control

Introduction to the study of pollution and its control. Relationship between wastes and pollution. It further aims to develop basic scientific and technical skills for pollution assessment with respect to the source, composition and characteristics of the wastes. Available technologies for pollution control. Protection of water quality from municipal, urban, agriculture and industrial sources will be elaborated.

C574 Problem and Activity- Orientated Environmental Analysis

Environmental analysis-strategies and concepts. Ecotoxicological concepts for evaluating risk.

C575 Environmental Chemistry of Selected Xenobiotics and Heavy Metals

Pathways of pollutants, food chains and properties of materials. General decomposition pathways. Hydrocarbons: PAHs and PCBs. Dibenzodioxins and dibenzofurans. Pesticides and tensides. Heavy metals and their aspects.

C576 Laboratory Work, Environmental Analysis 1 & 2

Selected experiments concerned with various topics of environmental analysis

C577 Quality Assurance/Quality Control Principles

Good laboratory practice. Total quality management and cost of quality. Calibration and detection limits. Metrology in chemistry and traceability of analytical measurements results. Validation of analytical methods. Measurement uncertainty. Control charts. Certified reference materials

C578 Cement Analysis

Portland cement and its major constituents phases (Alite – Belite – Aluminate – Ferrite). Properties of Portland clinker and cement. Macroscopic and surface properties Scanning electro microscopy, X-ray diffraction. Quantitative phase composition from bulk chemical analysis. Determination of quantitative phase composition. Reactivities of clinker phases.

C579 Water Analysis

The Hydrosphere, Water Pollution, Biochemical Oxygen Demand (BOD), Acidification, Salinity, Coastal Pollution, Groundwater Pollution, Waste Treatment, Solids in Waters, Electrochemical measurements, Hardness, Alkalinity, Dissolved Oxygen (DO), Chemical Oxygen Demand (COD),

C580 Fertilizers Analysis

Chemistry of Fertilizers: Organic fertilizers, Inorganic fertilizers. Nitrogen fertilizers: production of synthetic ammonia, ammonium phosphate, ammonium polyphosphate, urea,

ammonium sulphate, nitrate and chloride fertilizers. Phosphate fertilizers: triple superphosphate, ammonium monohydrogen phosphate - Potassium, magnesium and sodium fertilizers: potassium chloride (pure), potassium magnesium sulphate. Calcium fertilizers. Multinutrient fertilizers: ammonium phosphate nitrate, urea, ammonium phosphate, ammoniated superphosphate. Fertilizing with sulphur; Analysis of Fertilizers: Analysis of phosphorus in fertilizer. Total nitrogen, total phosphorus and total potassium (K₂O). Fertilizer metal analysis. Heavy metal chelates. Organic fertilizer analysis. Liquid fertilizer analysis. Solid fertilizer analysis.

C581 Fuel Analysis

Analytical techniques used for identification and/or quantification of chemical properties of crude oils, gasoline, transmission fluids, aviation fuels, diesel and heating fuels and other specially petroleum products. Elemental analysis of fuels using ICP-AES, XRF techniques (determination of sulfur in gasoline and diesel -EDXRF, WDXRF). Sulfur determination in fuels. Mercury determination in crude oils.

Mang 501 Executive Development Skills

Executive development skills aim to expose and equip students with the essential skills to manage their lives effectively both personally and professionally

Mang 502 Oral and Written Communication

The course focuses on developing an understanding of the communication skills, venues, and processes commonly used by effective professionals. Topics include the need to focus on audience, purpose, resources and constraints; choosing appropriate channels; preventing or minimizing relational conflict and resolving substantive conflict; and developing and maintaining communication credibility.

M533 chemometrics

What is chemometrics?; Basic statistics. Single processing and time-series. Optimization and experimental design. Pattern recognition and classification. Modeling. Analytical database.

1- M.Sc. Degree in Analytical Chemistry

C601 Analytical Separation Science

Fundamental principles and typical applications of modern separation techniques -Advanced practical aspects of separation techniques -Modern Liquid Chromatography instrumentation in detail including interfacing of liquid chromatography separation techniques to other analytical systems - Modern instrumentation relative to the appropriate techniques in depth - The interfacing of gas Chromatography to other analytical system - the practices of gel electrophoresis and capillary electrophoresis.

C602 Advanced Instrumental Analysis

Surface Analysis: microscopic techniques-scanning probe, atomic force, chemical force microscopy, X-Ray diffraction: powder and crystal methods, identification and structure determination, X-ray fluorescence, Applications - Thermal methods of analysis - analytical applications of NMR spectroscopy.

C603 Bioanalysis

Enzymatic analysis principles – mechanisms of enzyme activity, detection methods and reaction rate determinations – immobilized enzymes – enzymes as analytes. Immunosensors - Nucleic acid based assays – principles of DNA structure – aptamers – DNA profiling - PCR reactions – detection methods.

C604 Environmental Analysis (I)

General principles and techniques - analytical environmental data: assessment and interpretation - the environment (biogeochemical cycles, environmental pollution, environmental standards) - environmental analysis (aims, types, stages of) - sampling and storage - sample treatment - analytical methods - standardization and calibration - specific applications: speciation (importance, definition, determination of trace metal).

M605 Chemometrics (I)

The aim of this course is to introduce some modern statistical methods in chemistry - analyzing and understanding data - with spreadsheet programs and other accessible software, it is now possible to do this routinely. topics to be covered will include data acquisition, experimental design, filtering and fitting data to mathematical models - the approach will be fairly simple and open to students without a lot of sophisticated mathematical background.

C606 Nanochemistry-an Introduction and Potential Application

The nano world (general definition, philosophy)- Physico-chemical considerations (band structures, typical and useful “nano effects”) - Colloids (typical syntheses of nanoparticles) - Fullerenes, C-nanotubes (synthesis, forms, variants, properties, applications)- Oxide-nanotubes + fibers (synthesis, forms, variants, properties, applications) - Other inorganic nano materials (synthesis forms, variants, properties, applications) - Bio-nano-link - Risk discussion and future perspectives.

C607 Thermal Analysis

Thermogravimetric analysis – differential thermogravimetric analysis – differential thermal analysis - differential scanning calorimetry - applications in industrial and research fields.

C608 Selected Topics related to Analytical Chemistry

Lectures and reading in areas not normally treated in standard courses - discussion of topics of current interest in analytical chemistry.

C609 Quantum Chemistry

Approximation methods- the hydrogen molecule - refined treatment of hydrogen molecules – resonance – odd electron systems - spin functions – method of direct valence bonds.

C610 Bioinorganic Chemistry

Metals in Biological Systems- Non-Metals in biological systems- Inorganic drugs Metaloenzymes and vitamin B₁₂ .

C611 Femtochemistry

Introduction to femtochemistry and lasers - experimental methods of femtochemistry - applications: molecular systems, isolated molecules, molecules in clusters, molecules in condensed phases, molecules with biological functions.

C612 Biophysical Chemistry

Introduction to basic principles of macromolecular structure – stability and interactions – protein structure – thermodynamics and kinetics of protein folding – nucleic acid structure and stability – principles of intermolecular recognition – modern techniques to study the structures, functions and interactions of biologically macromolecules.

C614 Laboratory Quality Control/ Assurance System

Lab quality system elements - lab quality assurance manual, good lab practices- internal quality control checks - procedures used to calculate and assess data quality.

2- M.Sc. Degree in Inorganic Chemistry

C621 Recent Application of Organometallic Chemistry

Organometallic compounds in homogenous catalytic reactions – catalytic reactions in alkenes: hydrogenation of alkenes – hydroformylation of alkenes- hydrosilylation of alkenes – alkene polymerization and oligomerization - palladium catalytic reactions.

C622 Organic Stereochemistry

Elements of symmetry - Chirality in carbon compounds - Stereochemical relation in nonorganic compounds

C623 Structural Inorganic Chemistry and Crystal Structure

Structural chemistry of some selected non-transition and transition metals including their oxides, hydroxides, sulphides, oxysulphides, nitrides carbides, carbonyls and coordination compounds. Principles of X-ray diffraction of crystals – reciprocal lattice - unit cell dimensions – determination of the space group and its significance – structure analysis and determination of atomic position – experimental methods (trial and error, heavy atom method, patterson methods, direct methods) – refinement of the analysis

C624 Kinetics and Mechanism of Inorganic Reactions

Possible mechanisms for ligand replacement reactions SN1 & SN2 mechanisms - ligand displacement reactions in square and octahedral complexes – base hydrolysis – methods of kinetics studies, e.g. stopped flow, flash – photolysis and others.

C625 Applications of Spectroscopy Inorganic Chemistry

The following methods can be applied to investigate coordination compounds: Nuclear magnetic resonance spectroscopy (NMR) –electron spin resonance spectroscopy (ESR) – nuclear quadruple resonance spectroscopy (NQR)- Mossbauer spectroscopy

C626 Magnetochemistry of Inorganic Compounds

Magnetic susceptibility – paramagnetism – temperature –dependence and mechanism – temperature independent paramagnetism exchange reactions

C627 Application of Group Theory in Chemistry and Spectroscopy

Symmetry and chemical bonding – symmetry adapted linear combinations (SALCs) – formulating SALCs with projection operators – SALCs of Pi systems – vibrational modes and their symmetries - symmetry – based selection rules crystal field and molecular orbital theories and symmetry – terms of free ions with configurations-splitting terms

C628 Recent Methods and Advances in Calculating Stability Constants of Complexes

Thermodynamics of coordination bond formation – stability constants – factors which determine stability: nature of the central metal ion – nature of the ligand – nature of the solvent methods for the determination of stability constants: spectrophotometric – pH (Bjerrum`s methods) – polarographic method – ion exchange methods and advanced methods stability correlations: thermodynamic interpretation

C629 Thermal Analysis

Thermogravimetric analysis – differential thermogravimetric analysis – differential thermal analysis – differential scanning calorimetry - applications in industrial and research filed

C630 Luminescence Spectra of Inorganic Compounds

Luminescence of lanthanide complexes – antenna effect luminescence of coordination polymers – quenching of fluorescence photochromic complexes and their applications

C631 Femtochemistry and Laser Spectra

Introduction to femtochemistry and lasers – experimental methods of femtochemistry - application: molecular systems, isolated molecular, molecules in clusters, molecules in condensed phases, molecules with biological functions

C632 Selected Topics related to Inorganic Chemistry (1)

- i) Metal hydrides: saline hydrides –lanthanide hydrides – actinide hydrides – hydrides of d-block transition metals – preparation of hydrides and chemical properties
- ii) Chemistry of boranes: structure and bonding in boranes –borane anions and polyhedral borane anions and carboranes – metal complexes of carborane anions .



3- M.Sc. Degree in Organic Chemistry

C633 Advanced Organic Synthesis

Heterocycles Synthesis, Heterocycles in Ring Elaboration, Cross Coupling Reactions, Metal, Mediated Cycloaddition and Metathesis Processes, Formation of C-C Bonds by Aldol/ Enolate Reactions, Formation of C-C Bonds by Radical Process.

C634 Spectroscopic analysis

The course provides fundamental theoretical background for and emphasizes practical application of: UV/Vis spectroscopy; FT-IR spectroscopy; fluorimetry, atomic absorption, ^1H and ^{13}C -NMR spectroscopy, 2D- NMR ; Mass spectrometry.

C635 Advanced physical organic chemistry

Structure, mechanism, reactivity of organic compounds based on(molecular orbital theory, Frontier molecular orbital theory, conformation analysis, stereoelectronic effects, thermodynamics, and equilibrium-kinetics), Linear free, energy relationships Acids and bases catalysis, Nonclassical ions and pericyclic reactions, Transition state theory, kinetic isotope effects, reactive intermediates, The Huckel MO theory, Aromaticity (NMR analysis of aromaticity, homo- and heteroaromaticity), An examination of the methods used to probe the mechanisms of organic reactions and of the chemistry of some important reactive intermediates, Topics will include isotope effects, kinetics, linear free energy relationships, solvent effects, a continuing discussion of orbital symmetry, Molecules rearrangements, Excited States and Strained Molecules.

C636 Advanced Stereochemistry

Stereoisomerism in aliphatic compounds (General revision), The stereochemistry of Ring Systems, Stereochemistry of biphenyl compounds, Stereochemistry of some elements other than carbon

C637 Dyes and textiles

Dyestuff chemistry: Historical Introduction, Relation between color and molecular constitution, Classification of chromogenes, Nomenclature of Dyes, Color Index Chemical Classification of Dyes: Azo Dyes:(Structural features, Industrial production and types.), Carbonyl dyes, and Reactive dyes, Application classification of Dyes: Direct dyes; and Disperse dyes Fiber and Fiber Chemistry: Introduction.; Definition of Fiber; Microstructure of Fiber, Burning Test for qualitative identification of fibers; Identification of fibers by solubility, Classification of Fibers: A- Natural fibers:1- cellulosic family (cotton). 2– Protein fibers (wool, hair and camel hair). B- Morphology of fiber; 1- Chemical structure; 2- Chemical reactions related to industry, C- Thermoplastic fiber: This is related to polymers and polymer chemistry.

C638 Selected Topics in Organic Chemistry

Topics chosen according to special interests of faculty and student.

May include one or more of the following topics:

Heterocyclic Chemistry, Photochemistry, Natural Product Chemistry, Free Radical Reactions, Pericyclic Reactions, Organic Materials, Stereoselective Synthesis, Retrosynthesis Approach, Reactive Intermediate in Organic Chemistry.

C639 Advanced NMR spectroscopy

^1H and ^{13}C chemical shifts and spin-spin coupling constants, Magnetically and chemically equivalent nuclei, second order ^1H spectra, Homo and heteronuclear decoupling, One-dimensional NMR spectra, Multiplicity, edited ^{13}C NMR spectra, Nuclei other than ^1H and ^{13}C , Two-dimensional NMR Spectroscopy, Application of NMR spectra in solving structural and stereochemical problems.

C640 Organometallics in organic Synthesis

Organometallic mechanisms Organometallics in Organic Synthesis Palladium catalyzed C-C coupling reactions, Metal carbene complexes

C641 Polymers synthesis and characterization

Polycondensation, Radical Polymerization, Ionic Polymerization, Anionic Polymerization, Cationic Polymerization, Ring Opening, Metathesis Polymerization.

C642 Statistics

The basic concepts of probability, common distributions, statistical methods, regression analysis, and data analysis. This course provides principles of ANALYSIS of VARIANCE (ANOVA), including randomization and blocking, single and multiple factor designs, crossed and nested factors, quantitative and qualitative factors, random and fixed effects, split plot and repeated measures designs, crossover designs and analysis of covariance (ANOVA). Applications using SPSS program

C643 Advanced heterocyclic chemistry

Synthesis of heterocycles from 1,4-dicarbonyl compounds (furans, pyrroles, thiophenes and pyridazines), Synthesis of heterocycles from 1,3-dicarbonyl compounds (pyrroles, isooxazoles, pyrazoles and pyrimidines), Synthesis of heterocycles from 1,5-dicarbonyl compounds (pyridines and dihydropyridines), Heterocycle formation through cycloaddition reactions (1,3-dipoles and [2+3] cycloaddition reactions), Rate of cycloaddition and regioselectivity.

C644 Chromatographic analysis

Specific chromatographic methods: Electrophoreses, Thin-layer chromatography (TLC), Centrifugal TLC - Gas Chromatography (GC), High-performance liquid chromatography (HPLC), Size-exclusion chromatography (SEC), Liquid chromatography (LC), Supercritical liquid chromatography, Affinity chromatography, Chiral chromatography.

C645 Green Organic Chemistry

Introduction to Green Chemistry, Principles and concepts of green chemistry, Innovative green Technologies: Microwave, Ultrasound etc, Green synthetic methods: Solventless Reactions and Reactions in Water, Natural catalyst, Biocatalysis, Ionic liquids, solvents of the future (synthesis, applications, recycling...), Reactions using solar energy, Photochemistry reactions, Reactions with microwave Reactions ultrasounds, Sustainability, Challenges and Prospects of Green Chemistry.

C646 Biocatalysts and enzymes in organic synthesis

Introduction, Acyl transferases, Lipases, Esterases, Peptidases and amidases, Acylase, Carbohydrate processing enzymes, Glycosidases, Glycosyltransferases, Other carbohydrate processing enzymes, Other hydrolytic enzymes, Epoxidases, Nitrilases and nitrile hydratases, Other hydrolases, Reduction, CO, CN reduction , Other reductions, Oxidations, C bond

formation, Aldolases, Oxynitrilases, Other enzyme systems, Novel biocatalysts, Engineered enzymes, Evolved enzymes, Catalytic antibodies, Enzyme models and mimetics, Conclusion.

C647 Computational Organic Chemistry

Quantum Mechanics for Organic Chemistry (Approximations of the Schrodinger Equation, the Hartree - Fock Method, Electron Correlation, Post-Hartree - Fock Methods, Density Functional Theory (DFT), Geometry Optimization, Population Analysis, Computed Spectral Properties).

C648 Molecular Photochemistry

Molecular photochemistry of organic molecules, Photophysical radiationless transitions, Energies of photochemical conversion, Radiation and molecular orbitals, Mechanistic organic photochemistry, Energy transfer, Photochemical reactions, Photo-addition, Photo-substitution and Photo-fragmentation reactions, Isomerization and rearrangements, Chemiluminescent organic reactions, Photooxidation of alkenes, Photochemistry in nature and applied photochemistry.

C649 Selected Topics in analytical chemistry

Designed to acquaint students with advanced topics in his field of specialization.

C650 Selected Topics in Inorganic Chemistry

Designed to acquaint students with advanced topics in his field of specialization.

C651 Organic electrochemistry

Practical problems in electrosynthesis, Cathodic reduction of hydrocarbons, Cathodic reduction of halogenated organic compounds, Cathodic reduction of nitro compounds, Cathodic reduction of saturated carbonyl compounds, Cathodic reduction carboxylic acids, Mechanism and reaction of Kolbe reaction.

Anodic oxidation of amines, oxygen and sulfur containing compounds, Electrolysis of heterocyclic compounds, Electrolysis of metallic organic compounds, Comparison between electrochemical and analogous chemical reaction, Industrial electroorganic chemistry, Electrochemical polymerization.

4- M.Sc. Degree in Physical Chemistry

C653 Advanced Electrochemistry I

A review of the fundamental electrochemistry. Transport processes in electrochemistry, ion transport in solutions, solids, melts and polymers. Structure of the metal solution interface. Electrochemical and physical methods for probing metal/solution interface. Electrochemical deposition; adatoms, underpotential deposition, surface dynamic, nucleation and growth of metals.

C654 Theoretical Chemistry

Variation method - Simple Hückel method and applications - Matrix formulation of the linear variation method - The extended Hückel method - The SCF – LCAO – MO method and extensions.

C655 Surface Chemistry

I) Solid Surfaces:

- Structure of Solid Surfaces :Surface Structure of Metals- Surface Structure of FCC Metals - Surface Structure of hcp Metals -Surface Structure of bcc Metals -Energetics of Solid Surfaces- Relaxation and Reconstruction of Surfaces- Particulate Metals- Other Single Crystal Surfaces - Adsorption of Molecules on Surfaces: Introduction to Molecular Adsorption- Adsorption Kinetics - The Rate of Adsorption- PE Curves and Energetic of Adsorption- Adsorbate Geometries and Structures on Metals- The Desorption Process - Langmuir Isotherm- derivation from equilibrium considerations- derivation from kinetic considerations- Variation of Surface Coverage with Temperature and Pressure – Applications - Classification of Over layer Structures-Low Energy Electron Diffraction - Reflection High Energy Electron Diffraction -Surface Structures.

II) Other Surfaces:

Surface tension and surface films – Surfactants-Detergents – Lubricants – Photographic materials – plastic – Elastomers – Water treatment (ion exchange resins) and dyes.

C656 Solid State Chemistry

Structures of solids – Metallic solid – Bonding model – Free electron model (Jellium model) – Density of state – Nearly free electron model – Brillouin Zone - Classification of solids according to energy gap-Hall carrier – The role of impurities (n- , p-type semiconductor , transistor n-p types , Intrinsic and extrinsic semiconductors – Imperfection – Concentration and energies of formation of semiconductors – Vacancy - Electrical properties of metals – Drude theory – Conductivity of metals and temperature dependence-energy gaps and ionicity – Magnetic properties of solids – Superconductivity - The phase diagrams for solutions of materials and alloys- Crystal structure analysis- Chemical thermodynamics.

MS606 Computational Statistics

Modern methods of computational statistics and their application to both practical problems and research -Methods of random variate generation -simulation of random vectors -Topics include Monte Carlo simulation –bootstrapping- numerical optimization in statistics -the MCMC techniques

C657 Theories and Mechanism of Catalytic Reactions

The modern theories of the homogeneous and heterogeneous catalytic processes – The dehydration and dehydrogenation reaction mechanisms of alcohols of different types –

Catalytic oxidation reactions mechanism – Catalytic addition and polymerization reactions mechanism.

Femtochemistry and Lasers spectroscopy - Nuclear - The phase diagrams for solutions of materials and alloys- Crystal structure analysis - Photo catalysis.

C658 Crystal Structure Analysis

Types of solids – external structure of solids – introduction to space group symmetry – internal structure of solids – basic crystallographic calculations – X-ray powder diffraction – crystal structure of elements and inorganic compounds – defects in solids – solid solutions - study of crystal structure using computer programs – X-ray single crystal analysis - X-ray emission technique (XRF).

C659 The Modern Aspects of Polarography and Voltammetry

Pulse polarography and voltammetry - Differential pulse polarography and voltammetry - Linear sweep voltammetry - Cathodic and anodic stripping voltammetry - Thermodynamic interpretation of the half wave potentials - Polarography and voltammetry of simple metals ions - Polarography and voltammetry of complex metals ions - Organic polarography, structure and linear free energy relationship - Voltammetric studies on the adsorption stages and interfacial orientations of some nucleic acid bases , nucleoside, nucleotides and oligo nucleotides - Effect of the catalyst adsorption and of the double layer structure on the catalytic waves of hydrogen evaluation.

C660 The Modern Aspects of Colloidal Chemistry

Introduction to Colloidal Dispersions - Charge in Colloidal Systems - Colloid Stability - Surfactant Aggregation and Adsorption at Interfaces Micro-emulsions - Polymers and Polymer Solutions - Polymers at Interfaces - Effect of Polymers on Colloid Stability - Wetting of Surfaces - Aerosols - Practical Rheology - Scattering and Reflection Techniques - Optical Manipulation - Electron Microscopy

C661 Nuclear and Radiochemistry

Atomic nuclei – radioactive decay processes – nuclear reactions – equation of radioactive decay and growth – radio tracers – nuclear forces – nuclear structure -Interaction of radiation with matter – radiation detection and measurements - techniques in nuclear chemistry – nuclear models – nuclear processes as chemical probes. The trans uranium elements.

C662 Advanced Chemical Kinetics

Forces between atoms - molecules and ions - Molecular collisions and non-thermal reactions - Unimolecular reactions - Reactions in solutions - Empirical correlation and linear free energy relationships.

C663 Application of Group Theory in Chemistry and Spectroscopy

Theory of group theory – Symmetry elements – Point group symmetry – Character tables – Transformation matrices of symmetry species – Transition moments of IR and Raman – Selection rules of C_{3v} point group – Multiplication table of C_{2v} character table – Multiplication table of C_{3v} character table – Overtones and combination-tones – Fermi resonance.

C664 The Phase Diagrams for Solutions of Materials and Alloys

The phase rule – phases – components – system degree of freedom and equilibrium. One component system (H₂O system and SiO₂ system). Two component condensed systems. Simple eutectic system (liquid us and solidus –eutectic –lever rule). Binary systems with

compounds - Binary systems with solid solutions - Binary systems with solid – solid phase transitions - Binary systems with phase transitions and solid solutions . Some technologically important phase diagrams. The system Fe-C, iron and steel making. The system CaO-SiO₂, Cement manufacture. The system Na₂O-SiO₂, glass making. The system ZrO₂-Y₂O₃, Yttria – stabilized Zirconia solid electrolyte. Purification of semiconducting Si by zone refining. The system Li₂O-SiO₂, metastable phase separation and synthetic opals.

C665 Quantum Chemistry

Hydrogen molecule : Approximation methods: The perturbation method - The variation method - The hydrogen molecule: Coulombic and exchange integrals - Symmetric and antisymmetric solutions - Evaluation Coulombic integrals - Energy of molecular hydrogen system - Refined treatment of hydrogen molecules: Use of atomic orbitals - Molecular orbital methods - Ionic terms - Method of Coolidge and James - Resonance: Columbic energy in the hydrogen molecule -Resonance energy in the hydrogen molecule - Resonance energy in the other molecules - Odd electron systems: The hydrogen molecule ion - Odd electron bonds - Spin functions: Pauli principle -The hydrogen molecule -Electron spin and valence - Interaction energy of electrons - Method of directed valence bonds.

C666 Thermal and Surface Analysis and their Applications

Thermal analysis: Thermo gravimetric analysis – Differential thermal analysis – Calorimetric thermal analysis– Applications of thermal analysis to alloys- Identification of phase changes and crystallization positions for amorphous states – Thermal analysis of polymers – The use of thermal analysis.

Surface analysis: Electron spectroscopy, X-ray techniques, Surface imaging and detection.

C668 Selected Topics related to Physical Chemistry I

Designed to acquaint students with advanced topics in his field of specialization.

5- M.Sc. Degree in Biochemistry

C671 Bioenergetics & the Metabolism of Carbohydrate and Lipids

Bioenergetics: The role of ATP, Biological oxidation, The Respiratory Chain & Oxidative Phosphorylation, Carbohydrates of Physiologic Significance, Overview of Metabolism & the provision of Metabolic Fuels, The Citric Acid Cycle: The Catabolism of Acetyl-CoA, Glycolysis & the Oxidation of Pyruvate, Metabolism of Glycogen, Gluconeogenesis & the Control of Blood Glucos, The Pentose Phosphate Pathway & Other Pathways of Hexose Metabolism, Oxidation of Fatty Acids: Ketogenesis, Biosynthesis of Fatty Acids, Metabolism of Acylglycerols & Sphingolipids, Lipid Transport & Storage, Cholesterol Synthesis, Transport & Excretion.

C672 Instrumental Chemical Analysis

Chromatography (TLC Column, HPLC, Gas Ion Chromatography, Electrophoresis).
Spectrometry: ¹H, ¹³C- NMR ,2D NMR techniques, Mass spectrometry.

C673 Biochemistry of Extracellular & Intracellular Communication

Membrane Structure & Function, The Diversity of the Endocrine System, Hormone Action & Signal Transduction, Nutrition, Digestion & Absorption, Micronutrients: Vitamins & Minerals Free Radicals & Antioxidant Nutrients, Intracellular traffic & Storing of Proteins, Glycoproteins The extracellular matrix, Muscle & the Cytoskeleton, Plasma Proteins & Immunoglobulins, Red & White Blood Cells.

C674 Metabolism of Proteins & Amino Acids

Biosynthesis of the nutritionally non-essential amino acid, Catabolism of proteins & Amino acids Conversion of amino acid to specialized proteins, Porphyrins & Bile pigment.

C675 Structures & Functions of Proteins and Enzymes

Amino acids & Peptides, Proteins: determination of primary structure, Proteins: Higher orders of Structure, Myoglobin & Hemoglobin, Enzymes: Mechanism of Action, Enzymes: Kinetics, Enzymes: Regulation of Activity, Bioinformatics & Computational Biology.

C677 Biocatalysts and enzymes in organic synthesis

Introduction, Acyl transferases, Lipases, Esterases, Peptidases and amidases, Acylase, Carbohydrate processing enzymes, Glycosidases, Glycosyltransferases, Other carbohydrate processing enzymes, Other hydrolytic enzymes, Epoxidases, Nitrilases and nitrile hydratases, Other hydrolases, Reduction, CO, CN reduction, Other reductions, Oxidations, Hydroxylation, Dihydroxylation, Baeyer–Villiger oxidations, Other oxidations, C–C bond formation, Aldolases, Oxynitrilases, Other enzyme systems, Novel biocatalysts, Engineered enzymes, Evolved enzymes, Catalytic antibodies, Enzyme models and mimetics, Conclusions.

C678 Chemistry of Natural Products

Polyketides, Steroids(The Sterols), Amino acids and peptides(β -Lactams, Glycopeptides), Alkaloids derived from ornithine, Alkaloids derived from lysine, Alkaloids derived from nicotinic acid, Alkaloids of polyketide origin, Alkaloids derived from anthranilic acid, Alkaloids derived wholly or in part from phenylalanine or tyrosine, Isoquinoline alkaloids, Alkaloids derived from tryptophan, Monoterpenoid indole alkaloids, Terpenoid alkaloids, Steroidal alkaloids, Putrescine alkaloids, Spermine and spermidine alkaloids, Peptide alkaloids, Purines, Pteridines and analogues

C679 Macromolecular Recognition

Structures and functions of nucleic acids, folding and catalysis of nucleic acids, motifs and domains of proteins, principles of protein-protein interactions, chemistry of protein/DNA and protein/RNA interfaces, conformational changes in macromolecular recognition.

C680 Green organic chemistry

Introduction to Green Chemistry, Principles and concepts of green chemistry, Innovative green Technologies: Microwave, Ultrasound etc, Green synthetic methods, Solventless Reactions and Reactions in Water. Natural catalyst, Biocatalysis, Ionic liquids, solvents of the future (synthesis, applications, recycling,...), Reactions using solar energy, Photochemistry reactions, Reactions with microwave Reactions ultrasounds, Sustainability, Challenges and Prospects of Green Chemistry

C681 Xenobiotics Metabolism

Nutrition and Xenobiotic Metabolism, Nutrition and Alcohol, Nutrients as Toxins, Natural Toxins in Plant Products- Pesticides: Man Made and Natural, Emerging areas of concern in toxicity of plant products, Toxic Factors in Animal Products, Chemical Carcinogenesis and Diet

MD676 Molecular Biology & Cancer Biology

Nucleotides and Nucleic Acids Chemistry, DNA Replication and Repair, Gene Expression and Transcription, Protein Synthesis and Modifications, Cell cycle; Regulatory factors, Apoptosis, Oncogenes and Carcinogenesis, Recombinant DNA Technology, Principals Gene Therapy and Human Genome project

MD682 Histology

Introduction, Microtechniques & Cytology, Cytogenetics, Blood, Epithelium, Connective tissue, Cartilage, Bone, Muscle, Nervous tissue, Vascular system, Lymphatic system.

MD683 Physiology

1- Endocrine System. 2- Nervous System, 3- Digestive System, 4-Urinary System.

C684 Selected Topics related to Biochemistry

According to the supervision committee

1- Ph.D. Degree in Analytical Chemistry

C701 Quality Management in Analytical Chemistry

Basic concepts and definition of quality - quality control and quality management systems - quality policy - ISO 9000 standard - quality manual - quality auditing- introduction to ISO 14000 standard on environmental management systems and techniques for quality. improvement- introduction to ISO/IEC 17025 standard for testing Labs.

M702 Chemometrics (II)

This course includes the basic statistics in chemometrics, single processing and time-series, optimization and experimental design, pattern recognition and classification, modeling and analytical database.

C703 Environmental Analytical Chemistry (II)

Modern approaches to the analysis of contaminants in environmental samples - methods of sampling and analysis of organic contaminants - (especially mass spectrometric methods of analysis) - traditional classes of contaminants such as petroleum hydrocarbons (TPH), polycyclic aromatic hydrocarbons (PAH), polychlorinated biphenyls (PCBs), organochlorine pesticides - herbicides and emerging classes of contaminants such as endocrine disrupters, polar compounds and various polychlorinated mixtures.

C704 Selected Topics related to Analytical Chemistry

Lectures and reading in areas not normally treated in standard courses. Discussion of topics of current interest in analytical chemistry.

C705 Laboratory Safety

Aspects of laboratory safety relating to chemical, electrical, optical, mechanical, cryogenic and radiological hazards. Safety equipment, techniques (including first aid), and facilities.

C706 Analytical Chemistry Lab

Topics serve the specialty

C707 Bioanalytical Chemistry and Chemical Sensors

Principles of electrochemical and optical biosensors - protein immobilization methods – bioassay design.

C708 Advanced Analytical Chemistry

Discussion of recent advances in analytical chemistry and their applications to the environmental, material and biomedical fields. Topics will be selected from the current literature.

C709 Pharmaceutical & Toxicological Analysis

Importance of analysis from drug discovery to development. Analysis of drug substances and formulated drugs, impurity profiles, metabolism studies, therapeutic drug monitoring, and drugs abuse – the requirements of regulatory authorities: GLP, GPM and ICH – preparative scale separations and simulated moving beds - analytical method selection for research and routine assays – handling of body fluids, stability and bio hazards, whole blood plasma, serum, urine, extraction and other pre-analysis methods.

C710 Selected Topics related to Analytical Chemistry

Selected topics related to analytical chemistry.

2- Ph.D. Degree in Inorganic Chemistry

C720 Supramolecular Coordination Compounds

Definition and development of supramolecular chemistry – classification of supramolecular host – guest compounds – supramolecular host design – nature of supramolecular interactions – applications of supramolecular coordination chemistry (microporous materials- magnetic materials – non-linear optics) different topologies and assembled structures of coordination polymers.

C721 Photochemical Reaction of Inorganic Compounds

Photophysical properties of excited states : absorption spectra and electronic transitions – properties of electronically excited states – radiative and non-radiative decays- criteria for classification of the excited states – solvent effects and dipole moments of the excited states – acid – base reactions of excited states – photochemical reaction of metal complexes - photosubstitution reaction – photoredox reactions- photoisomerization reactions – photochemical cleavage of water – photochemical cleavage of water – photochromism of metal complexes – photoelectrochemical solar cells

C722 Stereochemistry of Coordination Compounds

Topographical stereochemistry of mononuclear coordination units – coordination units with achiral monodentate and bidentate ligands topological stereochemistry of polynuclear coordination units – polynuclear complexes with simple bridging ligands – bridging ligands for molecular helices, chains and knots

C723 Bioinorganic Chemistry

Study of DNA using inorganic agents – oxygen utilization – supply and storage of iron – oxidation reduction processes – metalloenzymes and vitamin B12.

C724 Application of Polarography and Cyclic Voltammetry to Inorganic Compounds

Application of polarography and cyclic voltammeter different types of complexes and inorganic compounds.

C725 Selected Topics related to Inorganic Chemistry

Selected topics related to inorganic chemistry.

3- Ph.D. Degree in Physical Chemistry

C730 Advanced Electrochemistry II

- Oxides and semiconductors; electrochemical properties, photoelectrochemistry of semiconductors; oxide particles and oxide layers.
- Intrinsically conducting polymers; chemically and electrochemically synthesis, surface film formation, electrical and optical properties, copolymerization.
- Nanoelectrochemistry; atomic dimensions, co-deposition, compositionally multilayers, core-shell composites.

C731 Concepts of Modern Catalysis

Introduction to Catalysis Homogeneous Catalysis- Bio-catalysis- Heterogeneous Catalysis- Why is Catalysis Important?- Catalysis and Green Chemistry- Environmental Friendliness- The Chemical Industry- Catalysis as a Multidisciplinary Science-The Many Length Scales of a “Catalyst”- Time Scales in Catalysis - Kinetics of Catalytic Reactions - Catalyst Characterization: X-Ray Diffraction -X-ray Photoelectron Spectroscopy -Extended X-Ray Absorption Fine Structure - Electron Microscopy- Mossbauer Spectroscopy- Ion Spectroscopy- Temperature-programmed Reduction, Oxidation and Sulfidation- Infrared Spectroscopy- Surface Science Techniques- Low Energy Electron Diffraction - Scanning Probe Microscopy- Scanning Tunneling Microscopy -The Atomic Force Microscope.

- Solid Catalysts - Oil Refining and Petro-chemistry - Environmental Catalysis.

C732 Advanced Kinetics for Modern Chemical Reactions and their Theories

The modern theories for identification of the reaction rate pathway – Methods of identification of the mechanism of reactions using the kinetic studies - Kinetics of chain reactions – Kinetics of fast reactions – The kinetic equations and solid state reaction mechanisms.

C733 Thermodynamics for Multi-Compound Reactions in Solution

Thermodynamics and properties of liquid solutions – Component properties for real solutions – The free energies of the solvent components – The free energies of the solutions of the solvents components - Solutes activity and applications on Gibbs and Dom equations – The probability functions.

C734 Advanced Nuclear Chemistry

Chemical reactions following nuclear transformation (hot atom chemistry) – production and use of nuclear energy – nuclear reactors – nuclear reactor kinetics and control – radiation protection and shielding – radio nuclides in medicine and biology. Radiation chemistry of water – gases and hydrocarbons – radiation chemical applications in science and industry. Nuclear chemistry in geology and astrophysics.

C735 Nanostructured Materials, Preparation, Characterization and Application

Basics of nanostructured materials: Introduction - Properties of Nanocrystals- Geometric Structure - Magnetic Properties of Nanocrystals - Electronic Properties - Optical Properties - Other Properties.

Synthesis of Nanocrystals: Physical Methods - Chemical Methods - Nanocrystals of Different Shapes.

Programmed Assemblies: One-Dimensional Arrangements -Rings and Associated Arrangements - Two-Dimensional Arrays-Metal Nanocrystals-Semiconductor and Oxide

Nanocrystals - Other Two-Dimensional Arrangements- Mechanism of Organization -Three-Dimensional Superlattices- Superclusters- Colloidal Crystals

Properties: Melting Point and Heat Capacity- Electronic Properties - Catalysis and Reactivity - Optical Properties - Magnetic Properties - Tools: Electron microscopies: Transmission electron microscopy - Secondary electron microscopy - Probe microscopies: Atomic force microscopy - Scanning tunneling microscopy - Dip pen nanolithography - Microcontactprinting - Applications: Nan wires - Quantum dots - Medicine; Biological labeling – Lasing - Energy; Photovoltaic's - Lighting; Light emitting diodes - Memory; the Coulomb staircase - Island occupation number.

C736 Statistical Thermodynamics

The microscopic state of a system – The Boltzmann distribution – Evaluation of B – Calculation of mechanical thermodynamic properties for independent particles - Calculation of thermodynamic properties involving T for independent particles – Molecular partition function for an ideal gas – Translational contribution to the thermodynamic properties of ideal gases –Vibrational contributions to the thermodynamic properties of ideal gases - Rotational contributions to the thermodynamic properties of ideal gases - Electronic contributions to the thermodynamic properties of ideal gases – Nuclear partition function - Thermodynamic properties of ideal gases – Direct calculation of equilibrium constants for ideal gases reactions – Equipartition – Special topics: Ensembles – Non ideal gases – Heat capacities of solids – Special topics: Calculation of the most probable distribution.

C737 Mass Transfer in Electrochemistry

Quantitative treatment of mass transfer during electrolysis – Hydrodynamic boundary layer theory and its applications – Dimensionless groups – Applications of dimensional analysis – Application of mass transfer process – Electro wining – Electro refining – Electroplating – Electroforming of metals – Mechanism of electro polishing and leveling process – Electro-organic synthesis and applications.

C738 Femtochemistry and Laser Spectroscopy

Introduction to femtochemistry and Lasers - Experimental methods of femtochemistry – Application: molecules systems, isolated molecules, molecules in clusters, molecules in condensed phases, molecules with biological functions.

C739 Selected Topics in Physical Chemistry II

The selected topics are chosen by the supervisor.

4- Ph.D. Degree in Organic Chemistry

C750 Asymmetric synthesis

Why is asymmetric synthesis important, Chiral auxiliaries in asymmetric synthesis, Nucleophilic chiral amines as catalysis in asymmetric synthesis, Asymmetric aminohydroxylation of alkenes, Asymmetric hydrogenation of alkenes, Asymmetric reduction, Catalytic asymmetric synthesis, Asymmetric 1,3-dipolar cycloaddition.

C751 Toxins and medicinal chemistry

Toxins: What makes a chemical toxic?- How can toxic substances harm the body?, What are the different forms of toxic materials?- What are exposure limits?, How can exposure be measured and monitored?- How can exposure be reduced?, Medicinal Chemistry: Introduction - Biopharmaceutical Properties of Drug Substances, Pharmacologic Activity, Drug Design, Drug/Receptor Interactions, Drug Resistance and Metabolism, Metal-Based Drugs, Computer Aided Drug Design, Drug structure and solubility, Combinatorial chemistry, Drugs from natural sources, Receptors and messengers, Enzymes, Nitric oxide, drug and analogue synthesis .

C752 Supramolecular chemistry

Historical Notes, Keywords and Definitions, Different Types of Supramolecular Interactions, Discipline of Self- assembly, Examples: (Grids, from Ligand Design to Self- assembly Process), Application.

C753 Homogeneous and heterogeneous catalysis

Introduction to catalysis, Heterogeneous and homogeneous catalysts, Mechanism in homogeneous and heterogeneous catalysis, Advantages and disadvantages of homogeneous and heterogeneous catalysts, Examples of homogeneous and heterogeneous catalyzed reactions.

C754 Selected Topics in organic reaction mechanism

Designed to acquaint students with advanced topics in his field of specialization.

C755 Modern Physical Organic Chemistry

New mechanisms of organic reactions, Rearrangements and neighboring group effects, Applications of the Hammett equation and its extended forms, Approaches to molecular orbital theory, Woodward- Hoffmann rule

C756 Advanced natural products chemistry

Natural products: Alkaloids: Definition, Isolation, Purification, Structure determinations. Terpenoids: Classification, structures and syntheses. Steroids: Sterols, Structure, Synthesis; Vitamin D, Bile acids, Steroid sex hormones, Corticoids (Adrenocortical Hormones), Flavones, Anthocyanins and Porphyrins.

C757 Environmental organic chemistry

Short historical accounts, principles of environmental chemistry, chemical properties relationship, molecular structure and physical, pollutants from petroleum, PCB's, dioxins, pesticides, polymers, soaps and detergents abiotic transformations and degradation of chemical species through, hydrolysis, oxidation, phototransformation and degradation processes, Thermodynamic and kinetic aspects, chemistry of natural waters and water pollution, the atmosphere and pollution chemistry of - soil contamination, transport and distribution of pollutants in the environment and among the -environmental compartments

comparison between “classical” and “green” industrial processes for the -synthesis of chemicals, Ideal reaction, atom efficiency, environmental factor E, use and selection of the better reaction solvent.

C758 Advanced Biochemistry

Emphasis on experimental approaches and problem solving, Topics include protein structure-function, protein folding and modification, Enzyme kinetics, and the study of metabolic processes (pathways and their regulation) with a molecular genetic approach, Gene structures and techniques for studying them, replication, control of gene expression, post-translational processing, membrane associated energetic.

C759 Photochemistry and Chemistry of organic laser

Photochemistry and Pericyclic Reactions:

Molecular Orbital Theory and Frontier orbital concepts, static and dynamic properties of excited states, classification and theory of Pericyclic reactions, spin multiplicity, sensitization and quenching, techniques of photochemistry, kinetics of alkenes and related compounds, aromatics, carbonyl compounds, imines, nitrile compounds, Photooxidation of alkenes, Photochemistry in nature and applied photochemistry.

Chemistry of Organic Laser:

Laser as a valuable tool for chemists, Nature of Laser, Production of and types of lasers, Nitrogen, Iodine, Exciplex and dye lasers, Structure and properties of laser dyes, Synthesis and spectral properties of various classes of laser dyes (coumarin, xanthene, oxazine laser dyes).

5- Ph.D. Degree in Biochemistry

C761 Drug-Drug Interaction

Types and Mechanisms of Drug–Drug and Drug–Nutrient Interactions, Drug Interaction Risk Factors and the Unknown, Effects of Nutritional Status on Drugs, Effects of Drugs on Nutritional Status, Unclassified Interactions, Types of drug interactions, Pharmacokinetic, Pharmacodynamic.

C762 Drug Delivery

Introduction to drug delivery, Drug delivery: the basic concepts/principles, Controlled drug delivery systems, Traditional oral drug delivery, Nanotechnology in drug delivery, Drug modification, Transdermal drug delivery, Nasal and pulmonary drug delivery, Stimulated drug delivery, protein delivery, Gene delivery, Design of drug delivery systems, simulation.

C763 Nano Biotechnology

Introduction: From Nanotechnology to Nanobiotechnology, Nanostructured Materials (Nanomaterials), Interaction between Nanomaterials and Biological System, Nanofabrication and Materials Characterization, Nanotechnology in Biological and Biomedical Applications, Nanotechnology in Tissue Engineering.

C764 Genetic Engineering

Restriction Endonucleases and other DNA Modifying Enzymes, Cloning vectors, Plant Transformation vectors and Expression Vectors for high level protein expression, Cloning strategies, E. coli transformation, Selection and screening of recombinant transformants, Labelling and detection of nucleic acid sequences, Genomic DNA libraries and cDNA libraries, Nucleic acid sequencing methodologies and Dye chemistries, Site Directed Mutagenesis.

ZC765 Immunology

Introduction to the immune system: Overview of the Immune System, Elements of Innate and Acquired Immunity, Immunogens and Antigens, Antibody Structure and Function, Antigen, Antibody Interactions, The genetic Basis of Antibody Structure (Immunoglobulin Genes)

Antigene recognition and B AND T cell development: Biology of the B Lymphocyte, Biology of the T Lymphocyte, Role of the MHC complex in The Immune Response, Activation and Function of T and B Cells.

The immune system in health and disease: Cytokines, Tolerance and Autoimmunity, Immunodeficiency Disorders and Neoplasias of the Lymphoid System, Transplantation, Tumor Immunology.

C766 Selected Topics related to Biochemistry

According to the supervision committee

ZC767 Microbial Ecology

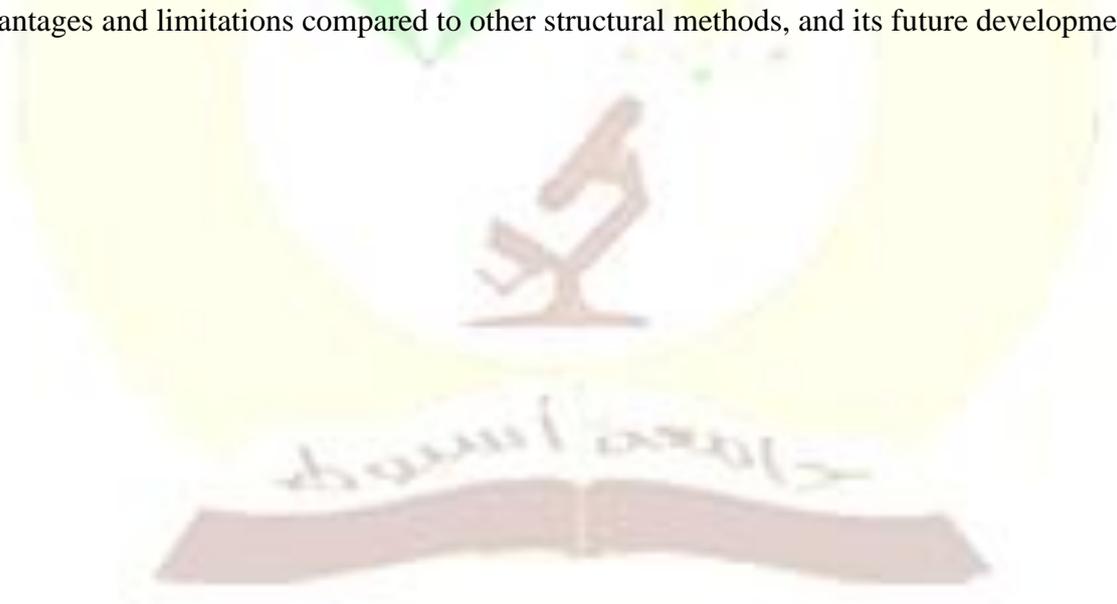
Development and significance of microbial Ecology, Biodiversity of microbial life, Quantitative and physiological ecology, Natural habitats: Air, water, soil, Biogeochemical cycling: specific nutrient Roles, Microbial interactions with plants and animals, Advanced population interactions, Microbial ecosystems and communities, Field and application methodology, Ecology of Biodeterioration and interactions with xenobiotics, Mineral and energy recovery/ Fuel and biomass production, Microbial control of pests/Biological control.

C768 Drug Synthesis and Design

Practical methods to make drugs currently in use and to design future drugs, Treats both chemical synthesis and biologics like monoclonal antibodies, Topics include fragment-based screening, solid phase synthesis, directed evolution, bioconjugation as well as efficacy, metabolism, and toxicity. Recommended preparation.

C769 3D reconstruction of macromolecules using single particle electron microscopy.

Single-particle electron microscopy has now used method in the examination of macromolecular structure. Using a small amount of purified protein, isolated molecules are observed under the electron microscope and the data collected can be averaged into a 3D reconstruction. Single-particle electron microscopy is an appropriate tool for the analysis of proteins that can only be obtained in modest quantities, like many of the large complexes currently of interest in biomedicine. Whilst the use of electron microscopy expands, new methods are being developed and improved to deal with further challenges, such as reaching higher resolutions and the combination of information at different levels of structural detail. More importantly, present methodology is still not robust enough when studying certain tricky proteins like those displaying extensive conformational flexibility. The course describes a brief outline of the methods currently used in the 3D analysis of macromolecules using single-particle electron microscopy, intended for those first approaching this field, techniques, software, some recent work, the spectacular improvements to the technique in recent years, advantages and limitations compared to other structural methods, and its future developments.



Geology Programs

Diploma Geology Programs

1-Diploma in Applied Geophysics

G501 Geodynamics

Global patterns leading to the plate-tectonic concept, Structure of the crust and upper mantle, Geomagnetic reversals and oceanic anomalies, Patterns of seismicity, Hot spots and their traces, Geometry of plate motion, Plate motion reconstructions and the supercontinent cycle, Driving mechanisms, Divergent, Convergent, Transform

G502 Electric and Electromagnetic Prospecting

Electric Prospecting: Electrical properties of rocks (Electric potentials, Electric conductivities, lab. measurements of resistivity), Self-Potential method: Origin of potentials- equipment-field procedure and applications, Telluric current methods: Theory, field procedure and applications, Resistivity methods Elementary theory and concept of apparent resistivity, Galvanic resistivity methods and various electrode arrangements, Field procedure and the factor affecting the measured data - Characteristic parameters of geoelectric section, Analysis of stratified n-layered earth resistivity model. Graphical methods of interpreting the resistivity data, Resistivity contour maps and geoelectric sections, Applications of resistivity methods, Induced polarization methods: theory, methods of measurements, field procedure and applications

Electromagnetic EM Prospecting: Introduction, fundamentals and definitions, Classification of electromagnetic methods, Advantages of EM methods and their applications and comparison with electrical methods, attenuation of EM field, combination of EM fields, EM methods for tilt angle measurements, AFMAG and VLF methods (theoretical bases, field procedures, data processing and interpretations, case studies), EM methods for phase and amplitude measurements. Turam method (theoretical bases, field procedures, data processing and interpretations, case studies).

G503 Seismic Prospecting

Fundamentals of seismic wave propagation: Reflection, Refraction and Transmission. Manmade energy sources and receivers used on land, sea, and in boreholes. Factors affecting seismic wavelets. Reflection and transmission coefficients. Absorption. Multiples. Seismic Refraction methods. Noise analysis. Seismic field layouts. Common Reflection Point techniques. Static and dynamic corrections. Velocity concepts in reflection seismology and velocity analysis. Introduction to seismic data processing and preparation of seismic stacked Sections. Seismic migration and conversion to depth.

G504 Gravity and Magnetic Prospecting

Basic principles of gravity and magnetic methods, Gravity and magnetic data corrections, Regional residual separation, Interpretation of Bouguer gravity anomaly maps, Interpretation of total magnetic intensity maps.

G505 Digital Data Processing

Mathematical Methods Applications in Geophysics: Probability, Fourier and Laplace transforms, Z-Transformation, Special Mathematical Equations, Partial Derential

Equations, Numbering and sampling theory, Noise processing of field measurements, Practical applications in different geophysics data.

Computer Application in Geophysics: Necessity of Computer Application in Geophysics, Types of Geophysical data and Analysis Steps, The Flow Chart, Hardware and Software used in geophysics

G506 Well Logging and Petrophysics

Basic concepts in log interpretation. Self-potential log, Gamma-ray log, Natural gamma-ray log. Caliper log, Sonic and other porosity logs, Density log, Neutron log, Lithology and porosity interpretation, Clay correction, Electric logs, Induction logs, Micro resistivity logs, Water and hydrocarbon saturation evaluation, Cost control and data quality in well-logging, Log presentation standards.

G507 Earthquake Seismology

Elasticity and elastic properties of rocks, Elastic waves, Seismic waves, Earthquakes: causes and classification, Wave trajectories -Wave conversion- Distribution of earthquakes, Faulting and its relation to earthquakes, Energy of earthquakes, Intensity and Magnitude of earthquakes, Analysis of ground motion, Earthquake hazards, Earthquake mitigation.

G508 Telluric and Magnetotelluric Methods

Introduction, The theoretical basis for electromagnetic induction, Earth's electromagnetic environment, Telluric current methods: Theory, field procedure and applications, The magnetotelluric response function, Distortion of magnetotelluric data: its identification and removal, The two- and three-dimensional forward problems, The inverse problem, Instrumentation and field procedures, Case histories and geological applications

G509 Special Topics in Geophysics

Some interested topics selected from different geophysical methods and their applications.

G510 Radioactive and Geothermal Methods

Principles:

Measurements & instruments - Quantitative interpretation - Qualitative interpretation - Applications

2- Diploma in Petroleum Geology & Hydrogeology

G511 Petroleum Geology-2

Concise revision of the elements of a 'Petroleum system' (source- migration- reservoirs- traps and seals) - The subsurface environment – Reservoir calculations - Sedimentary basins and petroleum systems – Methods of production - Nonconventional petroleum resources - Some details about oil and gas production in Egypt.

G512 Petroleum Reservoirs (Siliciclastic, Carbonate and Fracture)

Classification of siliciclastic reservoirs – Detailed characterization of siliciclastic reservoirs - Classification of carbonate reservoirs – Detailed characterization of carbonate reservoirs - Classification and evaluation of naturally fractured reservoirs.

G513 Groundwater Hydrology

Groundwater Flow Patterns – Introduction - Regional groundwater flow 1 - Background to head and fluid potential - Regional groundwater flow 2 - Recharge due to precipitation or irrigation - Hydrological processes - Darcy's law, Fluid mass balance, and derivation of flow equations - Groundwater/Surface water Interactions - Groundwater flow - Transient systems and groundwater storage - Continuity and flow nets - Numerical modeling of groundwater Flow - Flow of groundwater to wells

G514 Advanced Hydrochemistry

Sorption – Introduction - Interactions in the liquid phase - Equilibrium reactions - Kinetics of various chemical processes - Thermodynamic fundamentals - Calculation of the reaction rate - Theories of ion dissociation and ion interaction - Reactive mass transport - Interactions at the liquid-gaseous phase boundary - Transport models - Henry-Law - Numerical methods of transport modeling - Interactions at the liquid-solid phase boundary

G515 Well Hydraulics

Well components, design and well screens – Introduction - Water well planning, construction, sitting and drilling fluids - Fluids properties and classification - Pumping test analysis - Formation of aquifer systems - Well and Aquifer coefficients - Flow classification - Borehole logs - Types of fluid motions - Radial flow to a well - Types of aquifers - Well and aquifer analysis - Types of water wells and drilling methods

G516 Groundwater Aquifer Systems in Egypt

Nubian Sandstone Aquifer – Overview - The Nile aquifer - Water resources in Egypt - The Moghra aquifer - Water bearing formations - The fissured carbonate aquifer - Lithostratigraphy and sedimentary basins in Egypt - The Coastal aquifer - Quaternary deposits in Egypt - The Basement aquifer - Structure and depositional systems - Groundwater resources development and management options - Main hydrostratigraphic units in Egypt

G517 Sequence Stratigraphy-2

Concise revision of basic principles of sequence stratigraphy - Basin forming processes – Relative sea-level, tectonics and eustasy – Accommodation - Filling of accommodation - Concise introduction to sequence stratigraphic tools (seismic, well logs and outcrop tools).

G518 Sedimentary Rocks and Sedimentary Environments

The concept of facies, facies models, facies associations and how these related to depositional environments. Walther's Law and Uniformitarianism. Facies models for continental (fluvial), transitional (coastal, deltaic, estuarine) and marine (shelf and deep water) depositional

environments. The role of climate and plate tectonics in the development of facies and facies associations, with focus on Egyptian examples. Provenance and transport processes of clastic sedimentary rocks and unconsolidated sediments. Classification systems for sedimentary rocks. Processes and facies of carbonate rocks - Diagenetic processes and features in sedimentary rocks.

G519 Advanced Structure Geology

An overview of the causes and mechanisms of tectonic deformation within the lithosphere and the analysis of the principal types of geological structure and their implications for applied earth science and earth resources engineering.

Deformation: components of deformation principal strains, strain ellipsoid and strain ellipse - Pure shear and simple shear - **Deformation mechanisms:** grain boundary silding, fracturing/cataclasis, diffusive mass transfer, and crystalline plasticity - **Brittle-ductile and ductile shear zones - Folds and folding - Global tectonics:** geometry of structures.

Associations of sedimentary, igneous and metamorphic rocks in zones of divergent, convergent and strike-slip tectonics - Egyptian case study

Mapping Geologic Structure (practical)



3- Diploma in Economic Ores & Minerals

G521 Ore Genesis

Classification of ore deposits. Igneous ore forming processes. Magmatic – hydrothermal- ore forming processes. Sedimentary/ surficial processes. Global tectonics & metallogeny - Ore deposits in Global tectonic context.

G522 Exploration of Mineral Deposits

Preliminary and detailed exploration. Methods of subsurface exploration - Exploratory systems - Categories of mineral reserves and degrees of geological assurance of the deposit – Sampling - Geological documentation of mineral deposits - Hydrogeological and engineering-geological investigations of mineral deposits - Exploration during mining operations - Prospecting and exploration of placer deposits - Reserves calculation - Economic evaluation of mineral deposits.

G523 Mineral Processing

Various ore-dressing operations: comminution, sizing and sorting, jigging, tabling, flotation, magnetic and electrostatic separations. Extraction of mineral species. Various separation processes for beneficiation of minerals, including adsorption, electrolysis, electrowinning, leaching, and solvent extraction by precipitation and by reaction. Typical examples from the local mineral processing industry.

G525 Advanced Mineral Deposits of Egypt

Minerals associated with mafic – ultramafic rocks – mineral deposits in felsic associations - stratiform volcanogenic massive sulphides – precious vein type deposits- deposits in sedimentary – rocks -deposits in orogenic metamorphic association.

G526 Advanced Geostatistics

Theory of regionalized variables, semivariogram modeling, spectral analysis, kriging, multiple regression, multivariate extension of elementary statistics, discriminant functions, cluster analysis, principal component and factor analysis, analysis of directional data.

G527 Mineral Economics

Review of mineral commodities with regard to history, geologic occurrences, consumption, trade, price, financial control and the future positions of key mining countries - Study of fundamentals including business organization in the mineral industries, governmental control, national mineral policies, depletion allowance, taxation, tariffs, stockpiling, conservation and secondary usage - Global mineral reserves and resources - Egyptian mineral policies, mineral taxation and mineral profits - Assessment of the environmental impact of mineral exploitation and Use

G528 Structural Geology for Economic Geologists

Methods of geometrical analysis, structural geological data and data management, projections and diagrams, practical strain analysis, fold shape analysis ,petrographic identification of pervasive structural elements, regional fold and fault systems, structural geological maps and structural interpretation.

4- Professional Diploma in Medical Geology

G529 Air Pollution and Health

Atmospheric Chemistry cycles - Types and sources air pollutions - (Particles, Carbon gases, Sulfur gases - nitrogen gases. Ozone and Chlorofluorocarbons (CFC), Lead and other pollutants) - Acid rains - Air pollution and weather - Natural aerosolic mineral dust and human health - Radon and environmental Health – Introduction - Nature and measurement - Health effect of radiation and radon - Radon epidemiology - Source of natural radiation - Factors controlling release and transfer of radon gas - Radon migration pathways - Factors affecting radon in building - Radon Potential Mapping Methods - Radon site investigation methods -Health impact of volcanic activity - An introduction to volcanic toxicology - The health effects of Tephra dispersal - The health effects of volcanic gases emissions - Volcanic Dispersal of metal and trace elements - Volcanism and radiation hazards -Toxic exposure with other eruptive events - Volcanic monitoring and health protection

G530 Environmental Geochemistry

Foundations and development of medical geology - Geochemical classification of the elements - Contribution to medical geology from public health and environmental medicine - * Natural distribution and abundance of elements - Natural background - A chemically variable earth - Mineral chemistry of rocks - Diversity in the chemistry of rocks - The biogeochemical cycle - Establishing geochemical base lines - Total analyses and bioavailability - Future challenges - Biological Functions of the elements - Essentiality of elements - Major, Minor and trace elements in biology - Brief description of the function of major - minor and trace elements - Metals and geo-environment -Biological monitoring of metals - Factors influencing the absorption and bioavailability of some metals in the environment -

I. Arsenic: Ingestion - Inhalation

II. Cadmium: Ingestion – Inhalation - Dermal Contact

III. Lead: Ingestion - Inhalation

Md530 Soil and Health

A- Introduction - B- Deficiencies of essential trace elements

I. Soil and Iodine deficiency –II. Selenium deficiency

Md531 Environmental Metallotoxicology

General View - Special Target - II- Biochemical responses of Metals - III- Toxicodynamics - V- Risk assessment and management - VI- Toxicity investigation - VII- Therapy and management of Toxicity.

Selected investigations related to the topics covered by the lecture course.

Md532 Minerals and Health of Human and Animal

A. Introduction: The Asbestos Minerals - Mineralogy of Asbestos - Diseases related to exposure to Asbestos (Fibers, Lung Cancer, Mesothelioma, Asbestosis) - The Silica minerals and amorphous Silica - Mineralogy of Silica - Diseases related to exposure to silica dust (Silicosis, Silicotuberculosis, Cancer) – Coal - Mineralogy of coal Diseases related to exposure to coal dust (Coal workers "Pneumoconiosis, coal workers" silicoaia) - The Silicate minerals (other than Asbestos) - Mineralogy some silicates - Health effect of selected silicate minerals (Talc and pyrophyllite, the clay minerals, micas, and Zeolites)

Mineralogy of bone: The skeleton and mineralized tissues - Crystal chemistry of mineral in mineralized tissues. - The crystal structure of calcium apatite - Analysis of apatite biominerals – Osteoporosis - Mineral and mineralized tissue research and medical geology

B. Minerals and Animals: Introduction - Recognition of Problems - Mineral and trace element availability -Salt and mineral licks (P, Ca, Al, F, Mn, Co, Cu, Zn, As, Se, Mo, I)

Md533 Water and Health

I- Introduction: (Global water budget-Fluid storage and movement- Subsurface water-Consequences of groundwater withdrawal- Impact of urbanizations on groundwater systems).

II. Water Pollutions: General principles - Industrial Pollutions - Organic matter - Agricultural pollution - Reversing the damaged surface and groundwater - Groundwater pollution

III- Health impact of water pollution: I. Arsenic in groundwater and the natural environment - Introduction - Sources of arsenic in the natural environment - Arsenic in groundwater - Common features of high- arsenic groundwater provinces - Mitigation of high-arsenic groundwater Problems.

V. Fluoride in natural waters: Introduction - History of fluoride research and links with health - The hydro- geochemical cycle of fluorine - Case studies to illustrate high- fluoride groundwater systems - Remediation of high- fluoride groundwater

VI- Water hardness and health effect: Definition of water hardness - Natural hydro-chemical evolution of groundwater - The hard- water story - Studies at an individual level - Physiological importance of magnesium - Magnesium intake - Water magnesium and body magnesium status - Calcium in drinking water and Cardiovascular disease - Water hardness and other health effects.

G534 Waste Disposal and Pollution

I- Waste disposal: Solid wastes- general - Municipal waste disposal open Dumps - Sanitary Landfills - Incineration - Ocean Dumping

II-Reducing Waste Volume: - Handling (Non toxic) organic matter – Recycling -Other

III- Liquid- Waste Disposal: Secure landfills - deep-well disposal - other strategies

V- Sewage Treatment: Septic systems - Municipal sewage Treatment

VI-Radioactive Wastes: Nature of Radioactive Wastes - Historical Suggestion: Space, Ice, and plate tectonics - Seabed disposal - Bedrock Caverns for liquid waste - Bedrock Disposal of solid High- level wastes No high- level Radioactive waste –Introduction -Inorganic geochemistry techniques for solids (NAA,

G535 Inorganic Geochemistry Techniques

X-ray fluorescence spectrometry) - Inorganic geochemistry for liquids (Atomic absorption spectroscopy - Atomic emission spectroscopy, ICP-Ms) - Organic geochemistry techniques - Chromatography

Lab Work: Use of available analytical equipments like Atomic absorption spectroscopy (AAS), flame photometer, Chromatography and Scanning electron- microscope (SEM)

G537 Geological Impact on Nutrition

Geological sources of nutrition - Mineral elements needed for good health - Dietary sources of essential mineral elements - Mineral element bio-availability - Quantitative estimates of mineral needs and safe exposures - Clinical assessment of mineral status - Ecological aspects of mineral Nutrition.

Short Research Project: A short research project in a selected area of medical geology has to be completed by the students during the two semesters

G540 GIS

GIS (Geographic Information System)

- Introduction; geographic data. Maps and automation; the maps as model of geographic data; cartographic and GIS data structures; Input, storage and editing; Analysis; Measurement; classification; GIS in Human health studies.



5-Professional Diploma in Applied Environmental Geosciences

G539 Applied Geochemistry

Distribution of chemical elements - Major biogeochemical cycles - Isotope geochemistry - Geochemistry of the earth's surface - Analytical geochemistry.

Practical: Analysis methods of different chemical elements in water Isotope dating. Effects of pollutants at the ecosystem level.

G540 Geographic Information Systems (GIS)

Components of GIS, Devices and file types specific of GIS - GIS data and data sources, Georeferencing and modeling of the real world - Spatial data vs. Attribute data, Raster Data vs. Vector Data - Reference systems and datums, Topology and spatial analysis - Geostatistics and interpolation - Database management, Arc-objects, GIS-customization - Modeling in Arc GIS.

Practical: Displaying Data, Editing data, Working with georeferenced data - Elements of GPS, How GPS works, Collecting random points reading, Importing reading to PC On-screen digitizing and vector data manipulation. Designing a GIS database, Populating a geo-database

G541 Remote Sensing & Image Processing

Fundamentals and concepts of Satellite image acquisition - Satellites and sensors - Satellite orbit and coverage characteristics - Multi-spectral classification - Remote sensing applications.

Practical: Stitching images together, creating a new map composition - Using spectral characteristics, unsupervised classification - Preparing the classification for analysis, stream sensitivity Multiple functions in the modeler - Using matrix and criteria functions.

G542 Applied Sedimentology & Quaternary Geology

Part (I) Applied Sedimentology: Rock to Sediment - Sediment to Sediment - Sediment to Rock

Part (II) Quaternary Geology: Quaternary sediments and related geo-dynamics - The role of Quaternary geosciences in the environmental engineering - Geographical relationship between Quaternary and surficial deposits of the Earth - Physical resource stratigraphy, Types of Quaternary sediments - Geotechnical response to climatic and local environmental conditions.

Practical: Sediment parameters - Sediment accumulation rates - Sediment properties in monitoring the environment

G543 Soil Mechanics and Stabilization Techniques

Soil Properties, Soil Classification tests and common systems - Soil structure, Soil exploration and sampling, Swelling and swelling pressure - Consolidation, Stress-strain relations, Stability of Slopes, Shallow Foundations - Mechanical stabilization, Addition of cement, Chemical stabilization - Mineral polymerisation, Injection, Temporary stabilisations techniques

Practical: Soil classification tests - Stabilizations techniques - Stress-strain relations and shear strength - Shear strength of soil - Soil exploration and sampling

G544 Environmental Geosciences

Part One: Introduction to environmental geology - Rivers and flooding, Landslides, Slope Failure, & Mass Wasting - Earthquakes & Their Effects, Volcanic Activity - Water Pollution, Waste Management, Coastal Hazards, Energy, Global Changes - Earth's internal structure dynamics

Part two: Interactions in the lithosphere-hydrosphere-atmosphere-biosphere system - Introduction to biogeochemistry, to global environmental changes - Distribution of mineral resources: energetic and non-energetic - Energy, fossil fuel, nuclear fuel, alternative sources - Mineral resources and non-energetic ores - Man-made hazards in the physical environment.

Practical: Landslides and Mass wasting - Earthquakes, epicenters, damage characterization - Water Pollution - Fossil Fuel, aging methods - Non-energetic ores

G545 Information Technology

Introduction to MATLAB: basic concepts, arrays and matrices, matrix operations, 2D- and 3D-plots - Brief Introduction to SPSS - Key Terms Related to Data Analysis - Multiple Regression - Factorial ANOVA and ANCOVA- Cluster Analysis

Practical: Arrays and matrices in Matlab - Selecting and Interpreting Inferential Statistics - Summaries of Data and Two-Sample T-Tests - Exploratory Factor Analysis and Principal Components Analysis Logistic Regression and Discriminant Analysis.

G546 Applications of GIS & Remote Sensing in Environmental Geosciences

GIS and RS principles - The electromagnetic spectrum - GIS/RS applications in NRM and environmental geosciences - RS data interpretation for land resource inventory - RS and GIS for soil resource change analysis - GIS tools for landscape and environmental management analysis - Map generalization aspects, Internet technology basics.

Case study - Map production - project for different environmental issues

G547 Hydrogeology

Fundamentals, Natural groundwater flow - Groundwater abstraction techniques - Groundwater flow equations and useful solutions - Groundwater chemistry, Pumping test analysis - Hydro-geochemical processes, Natural isotopes in groundwater - Groundwater contamination, Groundwater sampling, analysis and quality norms

Pumping test analysis - Groundwater flow equations - Groundwater quality evolution sampling, analysis and quality norms

G548 Environmental Impact and Risk Assessment

Principles, structure and contents of EIA studies: general principles, comparison of the different kinds of procedures - Environmental screening of projects: aim, typology of screening procedures (lists of project types, manual check-lists, and computer assisted screening), examples, and documentation (procedures of several organizations: BADC, EU) - Scoping of projects: identification of data, analysis of the proposed action, search for possible alternatives, techniques to identify the relations between the proposed action and the expected environmental impacts (check-lists, matrices, networks), identification of the significant impacts (use of criteria and standards), determination of the contents (items to analyze and techniques to use) of the complete EIA - Overview of the most common negative environmental impacts of water resources projects and some corresponding mitigating measures - More detailed analysis of the impacts of water resources projects on human health,

by creating a favorable natural environment for the transmission of pathogens and diseases -
An environmental analysis of a project in an early planning phase.



M.Sc. Geology Programs

1- M.Sc. Degree in Applied Geophysics

G601 Earthquake Seismology

Revision of earthquake seismology definitions, Causes and characteristics of earthquakes, Types of telemetry devices and techniques, Processing of data from several stations using computers, Instruments structures and buildings, The effect of resonance, The effect of foundation on structures, Soil acceleration of seismic waves, The role of architecture in seismic hazard, The acceleration and strong ground motion, Relation between duration and acceleration, The vulnerability of different structures according to the materials, Case histories.,

G602 Gravity and Magnetic Prospecting

Basic concepts, laws, units, and definitions, Physical properties of rocks and minerals affecting the gravity and magnetic measurements, Similarities and differences in field vectors, origin, components, and fluctuations, between gravity and magnetic methods, Measuring instruments, Ground surveying designs, data acquisition, corrections, reduction techniques, Data processing, Isolation, gradient techniques, and continuations, Anomalies` pattern analysis and qualitative data interpretation, Quantitative interpretation of Potential field methods, Applications and case histories.

G603 Electric and Electromagnetic Prospecting

Principles of electric & electromagnetic methods (Electrical properties of rocks, Mechanism of electrical conduction in materials, Representative resistivity values, Conductivity mechanism, Fundamentals of the current flow in the earth, Potential distribution in a homogeneous medium, Apparent and true resistivity, Potential and current distribution across boundary (D.C. Resistivity method (Electrode configurations, Electric sounding & Electric profiling, field procedures, Applications & Ambiguities, Qualitative & Quantitative Interpretation, Mise – A- la- Masse Method) - Electrochemical methods (self-potential method, induced polarization method) Electromagnetic methods (Classification of electromagnetic systems, Principles of electromagnetic, Magnetotelluric Methods Vertical loop (VLEM), Slingram & Turam Systems, Very Low Frequency (VLF), Audio Frequency Magnetics (AFMAG), Time-Domain systems (TDEM), Airborne Method, Ground Penetrating Radar (GPR).

G604 Seismic Prospecting

Equation of wave motion -Seismic waves - Seismic signal - Seismic impulse and impulse response - Seismic sources - Impulse of the source - Seismic reflection series. Sampling of seismic signal. Techniques of seismic acquisition: Procedures of field recording - A/D recording - Seismic noise - Seismic noise filtering - Seismic signal enhancement - Correlations - Fourier analysis convolution - Deconvolution filters -Static and dynamic corrections - Signal stacking -Seismic sections - Seismic velocities analysis- Migration of the seismic sections

G605 Geodynamics2

Introduction, Radial structure of the earth (The interior imaged by seismic waves, Earth's shape, mass, and gravity field, Radial variations of density and pressure, Temperature, composition and convection), Plate tectonics (Geomagnetism and paleomagnetism, Seafloor spreading, Earthquakes between and within plates, Plate motions), Lithosphere and

asthenosphere (Isostasy: Gravity, topography, crustal structure, Thermal and flexural isostasy: the lithosphere)

G606 Inverse Theory and Inversion Concepts

Introduction (The difference between observed and predicted data , Why both are needed , Reasons why the inversion problem is "non-unique", Significant "prior knowledge," for geophysical work to be done at a site and preliminary appreciation for various ways of examining models that are built), Inversion and forward modeling, Fitting the data, A crucial concept: non-uniqueness, Parametric problems (Significant prior information about the geosciences problem ,(Optimal model, Choose decision criteria ,Usable results.

G607 Marine Geophysics

An introduction to modern geophysics, Plate tectonics, earthquake and faulting, isostasy and gravity, heat and mantle dynamics, ocean ridges and transform faults, hydrothermal vents, trenches and oceanic islands, subduction zones, accretionary and erosion wedges, sedimentary basins and continental rifts. Exploration of the oceans using geophysical methods

G608 Data Analysis Techniques in Geophysics

Definition of the frequency and time domains, Fourier series and fourier transform, Laplace transform and Z transform, Hankel transform - Hilbert transform, Convolution – Cross-correlation and auto-correlation, (F-K) filter and Band Pass filtering, Construction of filters&Optimum filter, Deconvolution and migration of seismic data - Conventional processing procedures, Interactive processing - Seismic data representation in 2,3 and 4 dimensions, Structural interpretation for seismic reflection data (folds, faults and unconformities), Criteria and applications of fault types (dip and strike.)

G609 Seismic Stratigraphy

Detection of sedimentary features in seismic sections: Erosion surfaces, transgressions and regressions, on-lap, top-lap, down-lap concepts -Detection of seismic facies' and seismic sequences: parallel, convergent, divergent, sigmoid, and chaotic layering - Detection of sea level changes - Creation of fans and basins.

G610 Well logging and Petrophysics2

Responses of resistivity and porosity logs. Oil water contacts – Gas oil contacts. Empirical relations, determination of lithology from cross plots. Porosity and permeability estimation from logs. Gross, net and effective pay thicknesses of formations from composite logs. Use of well logs in detecting over pressured zones. Detection and evaluation of fractured reservoirs. Shale volume estimation from different logs. Shale effect on porosity and matrix. Volumetric model of shaly formations containing hydrocarbons. Elemental analysis from Spectral Gamma Ray and ECS logs. Interpretation in clean, shaly and complex formations.

2- M.Sc. Degree in Petroleum Geology

G612 Petroleum Geochemistry

Introduction, world energy, global supply and demand of oil and natural gas, perspectives - Hydrocarbons chemistry, physicochemical properties, composition of oil and gas - Origin of fossil fuels, carbon cycle, chemical composition of biomass - Organic matter in sediments, accumulation, preservation, transformation, formation of kerogene - Formation of oil and gas, abiogenic petroleum concept - Non-conventional fossil fuels, shales, tar-sands, hydrates - Analytical methods in petroleum geochemistry - Geochemical evaluation of analytical data

G613 Petroleum System2

Concise review of the processes of a 'Petroleum System' (generation, migration and accumulation) - Identifying and naming of a 'Petroleum System' - Temporal aspects of a 'Petroleum system (age, critical moment and preservation time) - Event chart – Burial history chart - Size of a 'Petroleum System' – Mapping a 'Petroleum System'.

G614 Geophysical Exploration

Gravity Exploration: measurement techniques, data reduction, interpretation and applications

Magnetic Exploration: magnetic anomalies of simple shapes - measurement techniques, data reduction, interpretation and applications

Seismic Exploration: travel time curves, normal move-out, resolution of seismic data - data processing: CMP gathers, time corrections, filtering, stacking, migration - interpretation: e.g., hydrocarbon traps, geological structures - seismic refraction - refraction along horizontal, dipping and non-planar interfaces interpretation methods and applications

G615 Advanced Sequence Stratigraphy and Sedimentary Basin Development

Revision of basic principles of sequence stratigraphy - Sequence stratigraphic tools (seismic stratigraphy, well log sequence stratigraphy, outcrop sequence stratigraphy) and high resolution sequence stratigraphy - Sedimentary extensional, compressional and strike-slip basins development in relation to petroleum entrapment.

G616 Carbonate Reservoir Rocks

Carbonate depositional systems in relation to petroleum entrapment - Carbonate diagenesis and carbonate reservoir characterization - Examples of carbonate reservoirs in Egypt and the Middle East.

G617 Formation Evaluation

Applications to obtain water salinities, shale volumes and clay type - SP, GR and caliper - Acoustic Measurements - Neutron Porosity Measurement - Density Measurements - Deep Reading Resistivity (Rt) - Estimating porosity and lithology - Shallow Reading Resistivity (RXO) - Computing the value of VSH - Quick Look Interpretations for reservoir characterization - Estimating water saturations - Computing SW in the presence of shale - The carbonates challenge - Wireline formation Testing (WFT) - Pressure Gradient Interpretations - Magnetic Resonance Imaging (MRI) - Borehole imaging

G618 Phanerozoic Eon of Egypt

Phanerozoic Eon of Egypt - Paleozoic rocks of Egypt - Mesozoic rocks of Egypt - Cenozoic rocks of Egypt - Evaluation of Egypt throughout the Phanerozoic Eon

G619 Siliciclastic Reservoir Rocks

Siliciclastic depositional systems in relation to petroleum entrapment- Siliciclastic diagenesis and siliciclastic reservoir characterization - Examples of siliciclastic reservoirs in Egypt and the Middle East.

G620 Advanced Sedimentology

Petrology of clastic and carbonate deposits- tectonic and paleoclimatic records-paleocurrent and provenance analysis -Diagenesis & diagenetic effects on subsurface fluid flow, and volcanic sedimentation - An in-depth study of all the sedimentary processes and sedimentary structures involved in the formation of sediments and sedimentary rocks - Field observation, field and laboratory sampling, and data analysis of clastic sedimentary rocks; Advanced laboratory techniques.

G621 Environmental Sedimentology

Introduction - Overview of the basics of sedimentology, present physical, chemical, and ecological perspectives on the processes and sedimentary environments (mountain, [fluvial](#), lake, arid, urban, deltaic and [estuarine](#), temperate coastal, tropical coastal, and continental shelf environments).



3- M.Sc. Degree in Stratigraphy & Paleontology

G623 Applied Stratigraphy

Radiometric stratigraphy - Facies stratigraphy - Event stratigraphy & sequence stratigraphy - Fluid inclusion stratigraphy - Quantitative stratigraphy

G624 Applied Micropaleontology

Microfossils as thermal metamorphic indicators - Micropaleontology & biodiversity - Microfossils, stable isotopes & ocean-atmosphere history - Microfossils in stratigraphy - Microfossils as ecological pollution indicators

G625 Advanced Vertebrate Paleontology

Explores the fossil evidence for the evolution and diversification of vertebrates during the geologic history of Earth - Types of vertebrate fossils (fishes, coccoliths, dinosaurs, birds and mammals) - Museum exhibits for the vertebrate fossils

G626 Origin and Evolution of Earth

Geologic time & fossils - Evolution of Earth crust - Precambrian Eon - Paleozoic Eon - Mesozoic Eon - Cenozoic Eon

G627 Remote Sensing and Image Processing

Earth Resource and environmental satellites - Thermal Infrared images - Radar technology and terrain interaction - Digital image processing - Land use and Land cover: Geographic Information Systems - Natural Hazards

G628 Advanced Plant Fossils

Review- Palynomorphs & palynofacies - Extraction techniques - Palynology & oil industry - Applied palynology

G629 Advanced Invertebrate Paleontology

The fossils record and notes of evolution - Rates of evolution, adaptive radiation and extinction, competition & its effects - The diversification of invertebrate life - Different invertebrate phyla.

G630 Paleogeography & Paleoclimatology:

Plate tectonics- global history ,driving mechanisms- Paleogeography Reconstructions - Global plate model, Paleo GIS - Paleoclimate Reconstructions - Climate & climatic variation - History of the Earth's climate- The Ice Age cycles sea level changes, volcanic activity , change in atmosphere and solar radiation.

4- M.Sc. Degree in Sedimentary Geology

G631 Advanced Sedimentology

Petrology of clastic and carbonate deposits- tectonic and paleoclimatic records-paleocurrent and provenance analysis-Diagenesis& diagenetic effects on subsurface fluid flow, and volcanic sedimentation. An in-depth study of all the sedimentary processes and sedimentary structures involved in the formation of sediments and sedimentary rocks - Basic principles of field observation, field and laboratory sampling, and data analysis of clastic sedimentary rocks; introduction to laboratory techniques

G623 Applied Stratigraphy

Radiometric stratigraphy - Facies stratigraphy - Event stratigraphy & sequence stratigraphy - Fluid inclusion stratigraphy - Quantitative stratigraphy

G 644Advanced Geochemistry of Sedimentary Rocks

Processes controlling the composition of natural waters and minerals in sedimentary realms will be examined with emphasis on subsurface environments. Interpretation of analytical data and theoretical treatments are used to understand geochemical cycling from weathering to precipitation of new minerals

G635 Quaternary Sedimentology

Methods used to identify, map, date and correlate Quaternary deposits and interpret Quaternary history. Covers glacial, fluvial, coastal, lacustrine and eolian chronologies, oxygen-isotope records from ocean sediments and continental ice cores, volcanic activity, and Quaternary climate change.

G636 Sedimentary Basin Analysis

Physical state of lithosphere, mechanisms of sedimentary basin formation by stretching, strike-slip, flexure and compression, effects of mantle dynamics, basin infill mechanisms and depositional systems, basin stratigraphy, subsidence and thermal history, changes of reservoir and petrophysical parameters during burial and tectonic processes, and application to the petroleum system, leading towards the play concept

G637 Clay Mineralogy

Classification and structural mineralogy of the major groups of clay minerals based on AIPEA nomenclature. Species variation within groups discussed in terms of substitution, layer stacking arrangement and ion exchange capacity. Dehydration-rehydration reactions and clay organic complexes. Study origin, and geologic importance of clay minerals. Industrial and other applications of clays.

G638 Advanced Geotectonics

Introduction/ Basic tenets of plate tectonics- Tectonics of divergent boundaries compositions& styles of sedimentation- Tectonics of convergent boundaries& compositions and styles of sedimentation- tectonics of transform boundaries& compositions and styles of sedimentation

G640 Environmental Sedimentology

Overview of the basics of sedimentology, present physical, chemical, and ecological perspectives on the processes of sedimentary environments.

G642 Advanced Depositional Systems

Advanced facies analysis-advanced insight into the characteristics and depositional mechanisms of sedimentary systems as well as a full understanding of the controls on these systems-Clastic depositional systems-Carbonate depositional systems, and depositional systems of other sediments (evaporates, phosphatic sediments...etc).



5- M.Sc. Degree in Structural Geology

G639 Advanced Structural Analysis

Measurement and representation of orientation data - Analysis of planar and linear structures - Tectonic analysis of joints and faults - Tectonic analysis of folds - Cross-folding and superposed folds - Kinematic indicators and their interpretation

G641 Applied Structural Geology (Case Study)

Use real geologic maps for a given area at variety of scales - Use publications to collect appropriate structural data from a range of sources - Describe the detected major structural elements in a report on the area - Apply procedures for deciphering geological history

G643 Petrofabric Analysis

Fabrics: mechanisms and fabric elements homogeneous vs. heterogeneous domain, Isotropy and anisotropy, Penetrative or pervasive deformation.

Fabric data and statistics: representation techniques, analysis - Subsurface conditions - effective pressure, temperature, brittle - ductile transition – relative strength and ductility- deformation mechanism maps - overview of deformation within the crust and mantle

G645 Global Tectonics

Relative motions of two plates on a sphere - Divergent margins and rifting - Transform faults - Convergent margins - Tectonic s of triple junctions - Anatomy of orogenic belts

G646 Advanced Structural Geology and Tectonics

Rheology & deformation mechanisms - Fractures, Faults and faulting - Brittle-ductile and ductile shear zones - Folds and folding - Global tectonics) geometry of structures, associations of sedimentary, igneous and metamorphic rocks in zones of divergent, convergent and strike-slip tectonics - Eastern Desert of Egypt case study: extensional, contractional and strike-slip tectonics, granite emplacement, mineralization and the development of sedimentary basins.

G647 Tectonic Evolution of the Arabian-Nubian Shield

Introduction and geologic setting of the ANS - Late Cryogenian–Ediacaran geochronologic data base - Post-amalgamation basins - Late Cryogenian–Ediacaran magmatism - Gneiss domes and belts - Middle Cryogenian–Ediacaran arc- and terrane-forming events - Late Cryogenian–Ediacaran structure - Late Cryogenian–Ediacaran mineralization - Gondwana assembly

G648 Tectonic Provinces of Egypt

Tectonic subdivision of Egyptian territory - Structural history of the Gulf of Suez region - Evolution of the Red Sea and Gulf of Aqaba - Northern Egyptian Folded Belt

G650 Geographic Information Systems and Production of Geologic Maps and Cross Sections

Modern techniques of Cartography& GIS - Up to date software packages of geologic mapping - Construction of balanced geologic cross-sections

G652 Morphotectonics and Analytical Geomorphology

Geomorphology and structures - Continental and global lineaments - Tectonic landforms - Quantitative analysis of geomorphic processes

G654 Engineering Geology

Soil and rocks geological background and importance for the applications. Production of concrete, aggregate for concrete, soil and rock for road construction, methods for

stabilization, paving and facing stones, bricks and ceramics, membranes, dams, water and frost problems in soil including remediation techniques. Pores and fractures, chemical reactivity of soils.



6- M.Sc. Degree in Hydrogeology

G649 Groundwater Modeling

Pre- and post-processing of data – Introduction - Finite Element Method - Darcy's law, Fluid mass balance, and Derivation of flow equations - Evaluation of simulated equivalents of the observations - Model conceptualization - Estimating parameters and updating results - Finite Difference Method - Solute Mass Balance - Numerical Solvers - Model Execution, Calibration and Parameter Sensitivity - Numerical Approach to Boundary Conditions - Model Prediction, Capabilities, and Historical Perspective - MODFLOW - The groundwater-flow process

G651 Water Quality Modeling

Mass transfer mechanisms – Introduction - Diffusion and distributed solutions - Types of physical-chemical pollution of surface and groundwater - Dissolved oxygen and Bacteria - Reaction Kinetics - Eutrophication and Temperature - Physical and chemical monitoring - Coupling equilibrium, chemistry and mass balance - Biological and microbiological modeling - pH modeling - Mass Balance, Steady-State solution - Non-Point source modeling - Toxic substances Modeling

G652 Surface Water/Groundwater Interaction

Interaction of groundwater/surface water in different landscapes – Introduction - Mountainous terrain - Riverine terrain - Natural processes of groundwater/surface-water interaction - Coastal terrain - Glacial and dune terrain - Karst terrain - The hydrologic cycle and interactions of groundwater and surface water - Effects of human activities on the interaction of groundwater/surface water - Interaction of groundwater and streams - Effects of climate change on the interaction of groundwater/surface water - Interaction of groundwater and lakes - The interface between groundwater and surface water as an environmental identity - Interaction of groundwater and wetlands - Use of environmental tracers to determine the interaction of groundwater/surface water - Chemical interactions of groundwater and surface water

G653 Hydrogeophysics

Magnetic and EC methods – Introduction - Seismic and hydrological properties - Fundamentals of environmental geophysics - Geophysical Well Logging - Characterization and monitoring in a heterogeneous subsurface - Airborne hydrogeophysics - Geophysical methods in groundwater investigations - Hydrogeophysical case studies in the vadoze zone - Electrical and hydrogeological properties of rocks and soils - Properties of saturated porous media - DC resistivity and induced polarization methods - Evaluation and interpretation of geophysical data - GPR methods for hydrogeological studies

G655 Field Hydrogeology

Surface water, Stream gauging, seepage meters - Overview, field methods - Surveying seawater intrusion - Hydrogeologic Overview; Spatial Mapping; Campus - Geophysics, Resistivity methods - Field evaluation of aquifers - Overview, lab methods - Depth to water, piezometric surface; Levels - Theory of lab measurements, groundwater flow - Wells: Drilling and well completion - Theory of lab measurements, hydraulic parameters - Sampling ; Water chemistry - Data analysis, interpretation and reporting - Pumping test; field methods

G657 Coastal Aquifers and Saltwater Intrusion

Seawater intrusion through heterogeneous aquifers – Introduction - Conceptual and mathematical modeling - Coastal aquifers, worldwide phenomena - Analytical solutions - Fresh groundwater systems in coastal aquifers - 2-D modeling techniques - Geometry of coastal aquifers - 3-D modeling techniques - Groundwater pump and upconing - Impacts of climate change and seawater level rise on coastal aquifers - Saltwater intrusion mechanisms and processes - Groundwater management in coastal – aquifers – salinization

G659 Water Resources in Arid Environments

Integrated use of surface water – Introduction - Unconventional water resources - Environmental aspects of arid environments - Draught and demand management - Introduction to general worldwide water status and climate change - Economic aspects of water distribution and storage - Climate change and water scarcity - Water legislation, water priorities, water sector coordination - Artificial recharge and full cost recovery - Transboundary waters and regional agreements, water regulations and policies - recycle, re-use, runoff management - water awareness campaigns, water economy and technical issues - Irrigation and efficient use in agriculture

G660 Applications of GIS in Water Resources

GIS data for water resources - An overview - ArcGIS hydrology analysis - GIS: Data formats, data input – Arc Hydro - Data sources and Data acquisition - Data management in GIS - Vector vs raster and raster analysis - Geo-Database - Spatial relationships and Topology - Modeling in GIS - Working with tables in GIS - Populating a Geo-Database - Spatial data analysis

G662 Evaluation of Groundwater Resources

Hydraulic testing, Models – Introduction - Hydraulic testing, Methods - Flow equation - Hydraulic testing, Applications - Mass transport equations - Water resources Monitoring - Boundary conditions - Contaminants measures and control - Analytical vs numerical solutions - Water resources development - Response of ideal aquifers to pumping - Modeling techniques and management - Groundwater evaluation and management strategies

G664 Karst and Fractured Aquifers

Developing conceptual models – Introduction - Fractured rocks - Karst landscapes--Form and process - Groundwater flow in fractured rocks - Karst Landforms - Geometry of a fractured aquifer - Karst hydrogeology principles - Flow dynamics and physics - Sediments and Solutes - Modeling karst - Contamination in karst - Exploitation and management of karst and fractured aquifers - Paeoclimate and water origin

G666 Aqueous Geochemistry and Groundwater Contamination

Weathering - Introduction, chemical review - The solid-solution interface - Thermodynamics & Kinetics - Solute transport - Solution complexation reactions - Mass transport in groundwater flow - Acid-base & carbonate chemistry - Multiphase fluid systems - Carbonate chemistry - Geochemical modeling - Redox reactions - Mineralogy and soil chemistry

7- M.Sc. Degree in Igneous & Metamorphic Rocks

G661 Petrology of Metamorphic Rocks

Metamorphic Processes Classification and nomenclature of metamorphic rocks (Metamorphic facies versus metamorphic grade) - The role of the protolith Chemography and Thermobarometry - (Depicting rock composition in 3D space – AFM Diagrams - Chemical zoning and its impact on calculated P-T.) - Equilibrium thermodynamics and calculations - Tectonothermal histories through time - Dating metamorphic processes and events - Fluids and Metamorphism - Metamorphic Mineral Reactions

G663 General Characteristics of Metamorphic Terrains:

Definition - Types of metamorphic terrains - Metamorphic zones in contact aureoles - Heating of the different types of country rocks adjacent to various intrusions - Metamorphic zones in regional metamorphism - In pelitic sediments - In calcareous rocks - Mineral assemblages in mafic protoliths.

G665 Basement Tectonic of Egypt

Pre pan-African infrastructure in Egypt - pan-African super infrastructure in Egypt and Saudi Arab – Ophiolites - Island arc – granites –Dokhan volcanics - Hammat Molasse sedimentary rocks

G667 High Grade Metamorphism and Anatexis

Regional hypersthene zone (Granolite high grade) - Nomenclature and mineralogical features of granulites - Metamorphism of granulites and related granulites - Petrogenetic considerations – Eclogites - Anatexis, formation of migmatites, and origin of granitic magmas - Formation of migmatites - Formation of granitic magmas by anatexis

G669 Alkaline Rocks

Definition of term Alkaline rocks – History of study of the alkaline rocks - Regional discrimination & tectonic relations - Continental rift- associated Alkaline magmatism, The East –African rift system - Trends in East African Rift Magmatism - Isotopic & trace element characteristics of East African Rift Magma, Classification & mineralogy - Carbonatite occurrences - Field characteristics of Carbonatites - Carbonatite geochemistry, Kimberlites Petrogenesis of the feldspathoidal rocks and Carbonatites – Economic mineralogy of alkaline rocks

G670 Petrology of Igneous Rocks2

Origin of magmas through melting of the mantle and crust - Crystallization of magmas - Petrology of the mantle - Igneous rocks of the oceanic lithosphere - Plate tectonics and magmatism.

G672 Advanced Geochemistry

Concept of fractionation in igneous processes - Behavior of compatible and incompatible elements during melting and crystallization - Geochemical aspects of magma generation and evolution - Applied geochemistry

G674 Advanced Mineralogy

Advanced theory and practices in mineralogy - Phase equilibria in mineralogy - Detailed study of selected mineral groups - Genetic mineralogy - origin of minerals in magmatic process. Typical minerals, phase relations, PTX conditions - Genetic mineralogy - origin of minerals in metamorphic process. Typical minerals, phase relations, PTX conditions - Genetic

mineralogy - origin of minerals in hydrothermal, and sedimentary processes - Typical minerals, phase relations, PTX conditions.

G676 Igneous Petrogenesis and Plate Tectonics

Major element, trace element and radiogenic characteristics of magmas generated in different tectonic settings - Processes responsible for chemical diversity of magmas - Petrogenetic models for magmatism in terms of global tectonic processes.

G678 Petrology of Mantel

Kimberlites: Introduction to kimberlites & related rocks - Descriptive geological nomenclature and classification - The geology of Kimberley Type - Geochemistry and origin of kimberlite magm. Upper Mantle Petrology: Mantle overview and rock types - Pressure, temperature and geotherms. Ages of diamonds: Overview of mantle rocks in the mantle room – Diamonds - Diamond formation through time - Diamonds - characteristics and value - Interpretation of diamond data in exploration and evaluation. Kimberlite Indicator Minerals: Overview of kimberlitic indicator minerals (KIM), Use of indicators in exploration - Early-stage evaluation of kimberlites.



8- M.Sc. Degree in Ores & Economic Geology

G671 Minerals Deposit & Plate Tectonic

Introduction - Convergent plate boundary - Mineral deposits associated with arcs - Divergent plate boundary - Metallogeny of ocean type crust - Intra continental hotspots, anorogenic magmatism, and associated mineral deposits - Mineral deposits associated with rift - mineral deposits in relation to collision.

G673 Mineral Deposits in African Belt

Archem craton geology, metallogeny - Paleoproterozoic belts geology and metallogeny - Mesoproterozoic to early Neoproterozoic belts geology and metallogeny - Neoproterozoic-Cambrian (pan- Africa-belts) geology and metallogeny - Paleozoic – Mesozoic basins geology and metallogeny - Cenozoic cover geology and metallogeny

G675 Geochemistry Of Mineral Deposits

Theories of formation of mineral deposits - Detailed study of the geochemistry of mineral deposits, physical and chemistry of ore forming fluids.

G677 Mining Geology and Resource Estimation

Mining operations and activities - Drilling techniques and their advantages and disadvantages - Collection of lithological and structural data from drill core and drill chips - Application of mining software (Vulcan/Surpac) to mine geological data visualization and modeling - Conventional and geostatistical methods of resource estimation - Sampling, grade control and reconciliation - Quality assurance and quality control (QA/QC) for exploration and mining data.

G679 Applications of Industrial Minerals and Rocks

Abrasives - Ceramic raw - Chemical raw - Building stones – Fertilizers – Filters – Solvents – Foundry - Gem stones - Materials of glass and cement industries.

G682 Advanced Ore Petrology

Use textural relationships, mineral chemistry, and trace elements to establish the mode of formation and evolution of different rock types - Theoretical basis for understanding processes such as unmixing into immiscible fluids and melts in different systems - Textural data and phase equilibria - Separation of gasses from melts - Distribution of elements between different phases - Geothermometry, geobarometry, changes in petrophysical properties

G684 Fluid Inclusions: Techniques and Applications

Introduction-Basic principles (sample selection-sample preparation-assumption for fluid inclusion analysis-petrographic examination-Terms and abbreviation used in phase equilibria and microthermometry)-Fluid inclusion analysis techniques (microthermometry-chemical analyses)-Data handling and interpretation- Fluid inclusion applications in geology.

G686 Exploration Geochemistry

Planning – Sampling - Chemical analysis techniques and applied to exploration - Interpretation - Follow up - Basic principles of geochemical prospecting, primary dispersion, soil formation, secondary dispersion - Soil and drainage survey, biogeochemical and geobotanical surveys.

G688 Prospecting of Mineral Deposits

Introduction - Industrial types of mineral deposits - Geological criteria for ore prospecting – Geological prospecting methods and indications - Remote sensing in the search of mineral

deposits - Phases of prospecting - The geological prospecting-exploratory works on mineral deposits - Geochemical prospecting methods. Geophysical methods of prospecting for and exploration of metallic, non-metallic and coal deposits) - Case histories of prospecting and exploration - Prospecting and exploration of oil and gas deposits - Prospecting for and exploration of mineral raw materials of seas and oceans

G690 Advanced Ore Deposits

Minerals and related materials - Equilibrium and phase diagrams - Geochemical and petrological tools - Physical and chemical processes - Characterization and interpretation of processes



Ph.D. Geology Programs

1-Ph.D. Degree in Applied Geophysics

G701 Electric and Electromagnetic Prospecting

RESISTIVITY METHODS: Electrode configurations, Electric sounding & Electric profiling, field procedures, Ambiguities, Qualitative & Quantitative manual and computerized Interpretation techniques, Different Applications and case studies.

ELECTROMAGNETIC METHODS: Magnetotelluric Methods (Advantages of EM methods applications and their comparison with electrical methods, attenuation of EM field, combination of EM fields. EM methods for tilt angle measurements, AFMAG and VLF methods (theoretical bases, field procedures, data processing and interpretations), EM methods for phase and amplitude measurements, Turam method (theoretical bases, field procedures, data processing and interpretations), Airborne Method, Ground Penetrating Radar (GPR), Different Applications and case studies.

G702 Well Logging and Petrophysics-3

Measurement while drilling –Logging while drilling –Array Sonic tool- Array Induction Log - Nuclear Magnetic Resonance log. Dipmeter: Definitions- Principle- Picking up depth differences of microresistivity logs across the dipping bed plane-Computing dip angle and strike by standard nomograms or computers –Other concepts like Formation Micro Imaging by electrical conductivity and acoustic methods. Interpretation of dipmeter logs. Electrofacies and depositional environments. Preparation of facies maps. Identification of depositional environments through electrofacies

G703 Gravity and Magnetic Prospecting

Gravity and magnetic potential theory : Introduction of Vectors, vector calculus, vector differentiation and integration, Derivation of gradient, divergence and curl of vectors, Laplace differential Equations for scalar and vector potential, Poisson differential Equations for scalar and vector potentials, Green Equations in Potential theory, Applications to solve problems in gravity and magnetic fields

G704 Seismic Exploration

Standard display patterns on seismic sections, polarity conventions, information boxes. Seismic stacked, migrated, and depth sections .

Vertical and lateral resolution concepts in seismic sections:

Thin-bed effects and attenuation, Fresnel zone. Pitfalls in seismic interpretation: Multiples, diffractions and effects from third dimension, and problems due to velocity variations. Properties of seismic reflection amplitudes: Bright-spot, dim-spot, flat-spot.

Tectonic features in seismic sections: Recognition of normal, reverse, strike-slip, listric faults, and flower structures.

Sedimentary features in seismic sections: Erosion surfaces, transgressions and regressions, on-lap, top-lap, down-lap concepts. Seismic facies' and seismic sequences: parallel, convergent, divergent, sigmoid, and chaotic layering. Sea level changes. Creation of fans and basins.

G705 Shallow Geophysical Exploration and Applications

Introduction, Shallow or near surface geophysics techniques, Using Shallow Geophysics for groundwater resource mapping, groundwater character discrimination, ore deposits exploration and environmental studies .

Gravity and magnetic application to map regional aquifers and large scale basin features.

Seismic methods utilization to delineate bedrock aquifers, fractured rock systems and engineering properties of soil and bed rocks.

Electrical and electromagnet methods use to groundwater and environmental studies (porosity and permeability of rocks, mapping the depth and thickness of aquifer, Locating preferential fluid migration paths such as fractures and fault zones and mapping contamination to the groundwater such as that from saltwater intrusion).

G706 Seismic Hazard and Geophysical Site Investigations

Classification of Materials at the Soil-Rock Interface, Microearthquakes and Neotectonics, What Is a Reference Site, Seismicity and kinematic evolution, Site Amplification, Seismological and geological evaluation, Forms of ground motions, Procedures for selecting earthquake ground motions, Acquisition and evaluation of geotechnical data, Liquefaction.

G707 Advanced Sequence Stratigraphy-2

Concise review of sequence stratigraphic tools- Applications of sequence stratigraphy in: Fluvial systems - Coastal plain to shoreline-shelf systems – Deltaic systems- Estuarine systems - Deep-marine systems - Carbonate systems - Some examples of applying sequence stratigraphic tools to surface and subsurface Egyptian successions

G708 East African Rift and Geology of Nile Basin

Levant Fault System (The North Anatolian Fault (NAF), The East - Anatolian Fault (EAF) Gulf of Aqaba- Dead Sea transform fault) - Gulf of Suez and Red Sea Tectonic Evolution - Triple junction & Afar Triangle - East African rift evolution, The Great African Lakes - Gulf of Aden (Pre-rift setting- Oligocene-Miocene continental rifting) - Tectonic framework of East Sudan, Erythraea & Abyssinian Plateau

2- Ph.D. Degree in Petroleum Geology

G710 Petroleum System -3

Reservoir rocks - Structures and trap configurations - Typical and specialized logging suites - Geophysical tools integrated with geology - Correlation principles and exercise - Sequence stratigraphy primer and applications - Frontier exploration and examples - Exploration and examples from Egypt - Appraisal Methods and Examples - Reservoir mapping and volumetrics - Development and examples - Unconventional Resources

G711 Advanced Geophysical Hydrocarbon Exploration

Application of geophysical techniques to exploration of subsurface hydrocarbons, including borehole geophysical methods and the acquisition, processing and interpretation of seismic reflection data - techniques employed in the exploration for hydrocarbons - methods of reflection seismic data acquisition, processing and interpretation - description and assess the methods of borehole geophysical data acquisition and interpretation - write a technical report in the style and to the standard required by the hydrocarbon industry - The course covers the application of geophysical techniques to exploration of subsurface hydrocarbons, including borehole geophysical methods and the acquisition, processing and interpretation of seismic reflection data.

G712 Petroleum Geochemistry -2

Chemical properties of oil and natural gas - Source rock analyses. Alteration of petroleum in the reservoir rock - Application of petroleum geochemistry in the exploration of oil and natural gas - Biomarkers geochemistry I - Biomarkers geochemistry II - Fate and transport of hydrocarbons in the subsurface, applications of reservoir geochemistry - Basics of petroleum refining - Environmental aspects of petroleum production, fingerprinting.

G713 Advanced Sedimentary Basin Analysis

Modern concepts of tectonics and analysis of sedimentary basins. Application of geophysical logs and seismic stratigraphy to basin analysis, facies distribution, and structural style in a variety of basin types. Evolution of the Arabian Plate with specific examples from around the world. Applications of organic geochemistry and techniques of hydrocarbon assessment in basinal settings.

G714 Modern Applications of Remote Sensing Techniques to Geologic Problems

Current and future sensing systems - Spatial, spectral resolution and sampling – LIDAR remote sensing - Application of LIDAR techniques and DEM in geology – RADAR remote sensing principles and interferometric SAR - Remote sensing and GIS in mineral exploration - Infrared sensing methods.

3- Ph.D. Degree in Stratigraphy & Paleontology

G716 Global Stratigraphic Correlation

Correlation of the Paleozoic rocks in Egypt-This course intends in correlation the Paleozoic, Mesozoic & Cenozoic rocks with those countries at Africa, south America & Europe - Discussing the relationship between the rocks of same geologic age

G717 Micropalaeontology in the Petroleum Exploration

Calcareous microfossils – Siliceous - Origin-walled microfossils (palytomorphs) - Biostratigraphy and paleoenvironmental interpretation - Integrated stratigraphy

G718 Geological Time Scale & the World Type Geologic

Rules of the global stratotype sections & points - List of the global stratotype sections & points - Paleozoic, Mesozoic & Cenozoic - Global boundary stratotype sections & points in Egypt.

G719 Phanerozoic Mass Extinctions

The definition of the mass extinctions - mass extinctions & their geologic ages - the explanation of causes of the mass extinctions

G720 Advanced Quaternary and Environmental Geology

Concise revision of the Quaternary geology and environmental geology. Methods used to identify, map, date and correlate Quaternary deposits and interpret Quaternary history and Quaternary climate change. Utilization of geologic principles to resolve environmental issues in land use, land management and development. Methods of Acquiring, compiling, and applying geologic information for site assessment and environmental impact.

G721 Stratigraphy of Africa

The Archean between 3800-2550 MA: formation of cratons - Paleoproterozoic growth of Archean cratonic blocks - Mesoproterozoic continental break-up and growth - Neoproterozoic continental break-up and growth - The phanerozoic evolution of Africa

4- Ph.D. Degree in Sedimentary Geology

G707 Advanced Sequence Stratigraphy-2

Concise Review of sequence stratigraphic tools. Applications of sequence stratigraphy in: Fluvial systems - coastal plain to shoreline-shelf systems – deltaic systems- estuarine systems - deep-marine systems - carbonate systems. some examples of applying sequence stratigraphic tools to surface and subsurface Egyptian successions

G708 Fast African Rift and Geology of Nile Basin

Levant Fault System (The North Anatolian Fault (NAF), The East Anatolian Fault (EAF) Gulf of Aqaba- Dead Sea transform fault), Gulf of Suez and Red Sea Tectonic Evolution Triple junction & Afar Triangle, East African rift evolution, The Great African Lakes, Gulf of Aden (Pre-rift setting- Oligocene-Miocene continental rifting), Tectonic framework of East Sudan, Erythraea & Abyssinian Plateau

G713 Advanced Sedimentary Basin Analysis.

Modern concepts of tectonics and analysis of sedimentary basins. Application of geophysical logs and seismic stratigraphy to basin analysis, facies distribution, and structural style in a variety of basin types. Evolution of the Arabian Plate with examples from around the world. Applications of organic geochemistry and techniques of hydrocarbon assessment in basinal settings.

G714 Modern applications of remote sensing techniques to geologic problems

Current and future sensing systems, Spatial, spectral resolution and sampling, LIDAR remote sensing, Application of LIDAR techniques and DEM in geology, RADAR remote sensing principles and interferometric SAR, Remote sensing and GIS in mineral exploration, Infrared sensing methods

G720 Advanced Quaternary and Environmental Geology

Concise revision of the Quaternary geology and environmental geology. Methods used to identify, map, date and correlate Quaternary deposits and interpret Quaternary history and Quaternary climate change. Utilization of geologic principles to resolve environmental issues in land use, land management and development. Methods of acquiring, compiling, and applying geologic information for site assessment and environmental impact.

Stratigraphy of Africa

The Archean between 3800-2550 MA: formation of cratons, Paleoproterozoic growth of Archean cratonic blocks, Mesoproterozoic continental break-up and growth. Neoproterozoic continental break-up and growth. The Phanerozoic evolution of Africa

G723 Advanced Geochemistry of Sediments and Sedimentary Rocks

Concise revision of the basics and tools of the geochemistry of sediments and sedimentary rocks. Advanced analysis of one or more topics of the mineralogy and geochemistry of sediments and sedimentary rocks using the most recent techniques, interpretations, and data

G724 Selected Topics related to Sedimentary Geology

5- Ph.D. Degree in Structural Geology

G725 Modern Concepts in Structural Geology and Tectonics

Experimental Rock Deformation – Microtectonics - Shear sense indicators - 3-D Structural Geology

G726 Geodynamics and Neo-Tectonics

Active Tectonics - Tectonic Geomorphology - Seismo Tectonics – Geodesy - Present-Day Earth geodynamics

G727 Quantitative Geomorphology

Fluid dynamics and solid mechanics - Geomorphometry and field measurements - Drainage basins and channel networks - Landscape evolution modeling. Weathering and the interactions between climate, tectonics, erosion, and deposition

G728 Tectonic Framework of the Middle East

North Africa: Geological framework & Pan-African Orogeny - Paleozoic sedimentation history - Mesozoic rifting and extension - Alpine Uplift - Tertiary volcanism

Arabian Peninsula: Phases of the Arabian Plate tectonic history:

Pre-Cambrian - Ordovician-Silurian Glaciation / de-Glaciation - Carboniferous (Hercynian Orogeny) - Early Triassic (Zagros Rifting) - Late Cretaceous (First or Early Alpine Orogeny) - Tertiary (Second or Late Alpine Orogeny) - Neogene Separation from Africa.

G729 Tectonics of Sedimentary Basins

Methods of formation - Lithospheric stretching and triple junction - Lithospheric compression/shortening and flexure - Strike-slip deformation and pull-apart basins - Ongoing development

G730 Tectonic Setting of the Mediterranean Basins

Structure and evolution of the Mediterranean basins – Lavantine Basin - Nile Delta and northern Sinai off-shore structures

6- Ph.D. Degree in Hydrogeology

G732 Integrated Water Resources Management

Determination of sustainable yield – Water Scarcity and its impacts - Data requirement for water resources management - Water demand management - Conventional vs. non-conventional water resources - Water resources management - Surface water resources - Functions of water resources management - Groundwater resources - Artificial storage and recovery - Non-conventional water resources - Water resources in Egypt - Water resources planning

G733 Socio-Hydrology

Co-evolutionary dynamics of human-water systems – Introduction - Human-modified water cycle across time - Human and the environment - Environmental impacts - Hydrological processes - Interaction between water and human - Social processes - Comparative analysis of human and water systems - Water in different cultures and religions - Integrated water resources management - Water in ecosystem - Modeling of coupled based human-water systems - Human impacts on water systems

G734 Integrated Watershed Management

What is Restoration? – Introduction - Land use and water use - Watershed basin analysis - Socioeconomic drivers: contamination - Water availability - Ecosystem services - Watershed and climate change - Uncertainty and Complexity in Watershed Management - Conceptual Framework and Motivation for Management - Legal/Institutional Framework: Quality and Quantity - The Watershed Concept: History and Implications - The future of watershed management - The Biophysical Template: Water Availability

G735 Isotope Hydrology

Determination of the origin of water masses - An overview - Dating Old Groundwater - Environmental isotopes in hydrology - Determination of the residence time of water - Tracing the hydrologic cycle - Radiogenic Strontium and Other Miscellaneous Isotopes - Surface and groundwater studies - The Practical Side of Environmental Isotopes - Tracing the Inorganic Carbon Cycle - Study of transport and degradation of contaminants - Using Stable Isotopes in Water Quality Studies - Isotope eco-hydrology - Dating Modern Groundwater

G736 Environmental Impact Assessment

Hydrology, flooding, erosion/deposition - Introduction and brief history of the EIA - Water quality, water supply - EIA as decision making process - Air quality, climate change, energy conservation - EIA as research - Cultural Resources/Archaeology, Historic Preservation - EIA process in Egypt - Social/Demographics, Community Services - Types of Environmental documents - Noise Impact Analysis - Environmental Assessments - Visual Impact Analysis - Geology, topography, soils

7- Ph.D. Degree in Igneous & Metamorphic Rocks

G738 Micro Tectonics

Deformation - Foliation, lineations & lattice preferred orientation - Shear zones - Dilatation sites: fibrous veins, strain shadows, strain fringes and boudins - Porphyroblasts and reaction rims - Natural microgauges

G739 Modern and Ancient Volcanic Successions:

Some properties of magmas relevant to their physical behavior- Volcaniclastic deposits and their eruptions - Lava flows - Modern pyroclastic fall deposits and their eruptions - Transport and deposition of subaerial pyroclastic flows and surges - Ignimbrite and ignimbrite – forming eruptions - Subaqueous pyroclastic flows and deep- sea ash layers - Classification of modern and ancient Volcaniclastic rocks - Modern volcanoes and volcanic centers.

G740 Metamorphic Mineral Reaction & Equilibria

Polymorphic transformations - Exsolution reactions - Solid – solid net-transfer reactions - Devolatilization reactions - Continuous reactions - Ion exchange reactions - Phase diagenesis for multicomponent systems that involve several reactions - Metamorphic reactions in different rocks types - Reactions mechanism.

G741 Metamorphism and Tectonics

Introduction - Thermal considerations – A brief overview of metamorphism in orogens - Ocean –ridge metamorphism - Petrology of metamorphosed seafloor rocks - Intact slabs of ophiolite - Near- trench metamorphic associations

G742 The Evolving Continents

Archean high-grade regions - Archean (Archeangreenstone belts) - Crustal evolution in the Archaean - Early to mid-Proterozoic basic – ultrabasic intrusions - Mid- late Proterozoic basins, dike, Glaciations and life forms - Continental evolution in the Proterozoic - Caledonian – Appalachian fold belt - Hercynian fold belt - The evolving continents.

G743 Isotope Geology

Introduction - Radiogenic isotopes and their applications – Geochronology - Stable isotopes and their applications

8- Ph.D. Degree in Ores & Economic Geology

G745 Hydrothermal Alteration:

Water and hydrothermal fluids on Earth- Hydrothermal processes and whole rock alteration - Tectonic setting geodynamics and time-dependent evolution of hydrothermal mineral systems - Intrusion-related hydrothermal mineral systems - Porphyry systems, fossil and active hydrothermal systems - Skarn systems - Submarine hydrothermal mineral systems, orogenic amagmatic and indefinite-originated hydrothermal mineral systems - Hydrothermal systems and the Biosphere - Hydrothermal processes associated with meteorite impact - Uranium hydrothermal mineral systems - Geological issues formed by hydrothermal alteration - Industrial raw materials due to hydrothermal alteration, and their usage, hydrothermal alteration samples from Egypt

G746 Isotope Geochemistry for Economic Geologists

Mechanisms of radioactive disintegration; mass spectrometry; different radiogenic and stable isotope systems (e.g., Rb-Sr, Sm-Nd, Re-Os, Lu-Hf, Sm-Nd and U-Pb and Pb-Pb; S and C isotopes); examples of the use of isotopes in the research of ore deposits. calculate the ages of rocks using given isotope measurements of different isotopic systems and based on isotopic ratios, can make inferences on - origin of different rocks types including ore deposits.

G747 Applications of Industrial Minerals and Rocks -2

Separation of ores into concentrates - Mineral chemistry & its implications - Study of some minerals and rocks

G748 Fluids in Earth Crust

Introduction: history – the development of ideas about crustal fluid compositions and their effects on rocks - Crustal fluid : the basins - The solvent perspective : where do fluids occur? – Geological setting of crustal fluid

G749 Mineral Hazards to Human Health

Position effects of minerals on human health: environmental mineralogy, minerals as conditioners, clay, mud and health, special sands, mineral – medicinal water - Negative effects of minerals on human health: quality of soil, water and oil and toxicity, diseases influenced by minerals.

G750 Advanced Mineral Exploration

Mineralogy, economics and models- reconnaissance exploration.

Geophysical methods: airborne, magnetic, gravity, seismic, ground radar.....etc.- exploration geochemistry – data storage , integration and GIS

Botany and Microbiology Programs

1- Professional Diploma in Applied Microbiology

B501 Virology and Immunology

Infection process in details - Strategies of virus maintenance in communities - Virus replication strategy - Resistance to viral infection - Determination of physical and Chemical characteristics of viruses - Polyclonal and monoclonal antibodies against viruses.

B502 Applied Phycology

Commercial uses of algae. Fundamental research development of techniques and practical applications in algal and cyanobacterial biotechnology, genetic engineering, tissues culture, collections commercially useful, micro-algae and their products, mari culture algalization and soil fertility pollution, fouling monitoring toxicity tests, toxic compounds, antibiotics and other biologically active compounds.

B503 Yeasts systematics

Introduction – Isolation and maintenance of yeasts – Criteria employed in yeast taxonomy: A. Morphological characteristics (Vegetative reproduction – Vegetative cells). B. Cultural characteristics (Growth on liquid medium – Growth on solid media). C. Sexual characteristics (Ascus and ascospore formation – Infertility of ascomycetous yeasts – Aeciospores and sporadic). D. Physiological characteristics (Utilization of carbon compounds – Utilization of nitrogen compounds – Growth in vitamin-free medium – Growth on high osmotic pressure - Growth at elevated temperature – Acid production of extract lunar compounds – Fat splitting- Pigment formation – Ester production – Cyclohexamide resistance – Hydrolysis of urea – Diazonium Blue B Test (DBB) - Gelatin liquification). E. New trends (Kits and automated programs – Molecular techniques applied in yeast identification). F. Study representative genera of common and wide latitude yeasts.

B504 Microbiological Analyses

The spatial distribution of microorganisms, Ideal sampling quantities, Sampling plans, isolate and enumerate microorganisms in samples, aerobic plate count, aciduric flat sour sore formers, Detection and determination of anaerobic spore former, Detection of coliform, faecal coliforms and E coli in samples, Direct microscopic count, Fermentation test, Detection and confirmation of salmonella species in samples, Detection and confirmation of Shigella in samples, Detection and confirmation of Staphylococcus aureus in samples, Detection and confirmation of sulfide Spoilage sporeformers species in samples, Bacteriological examination of water, Culture media, Biochemical tests.

B505 Medical Microbiology

Medical Bacteriology- A systematic bacteriology, ways of infection, diagnosis and treatments of the studying pathological bacteria groups.

Medical Mycology - Topics of this course cover the fundamentals of fungi causing infections to humans. Each micro-organism is studied from the following topics: Morphology and characters, virulence factors "surface antigen, toxins and enzymes", pathogenesis.

B506 Selected Topic in Microbiology

The course title and description are submitted by the department committee.

B507 Biofuels and Renewable Energy

Introduction to Biofuels, Bio-oil-Biodiesel-Biohydrogen, solid biofuels, liquid biofuels (bioalcohols, such as bioethanol, and oils, such as biodiesel), and gaseous biofuels (biogas, landfill gas and synthetic gas). Fermentation of the sugar components of plant materials. Solar energy. Biomass.Green renewable energy.

B508 Microbial Bioremediation

The definition of bioremediation and the organisms involved are covered. The ability of microbes to degrade or transform pollutants (organic and inorganic) is discussed; especially the limitations of bioremediation and use of inoculants. Fundamental knowledge on microbial-based bioremediation will be applied in the form of case studies which will enhance and add to the lectures e.g. full-scale treatment of industrial effluents.

B509 Aquatic Hyphomycetes

Introduction; isolation and identification; nutrition and sporulation; role in food webs; adaptation; attachment and germination of conidia, factors affecting the occurrence of aquatic hyphomycetes; species composition and water chemistry; aquatic hyphomycetes occurring on wood and role of woody debris in life cycle; anamorph–teleomorph relationships, interaction with invertebrates; ecological and biological role of aquatic hyphomycetes. Water pollution and aquatic hyphomycetes.

B510 Food Microbiology

Food as substrate for microbes – Factors influencing microbial growth in foods – The role of microorganisms in food processing and preservation – Relation of microorganisms (bacteria, fungi viruses and bacteriophages) to food spoilage, foodborne illness and general food quality – Role of microorganisms in healthpromotion – Types of microorganisms in foods, meat, poultry, seafoods, fruits, vegetables and frozen foods.

B511 Environmental Microbiology

This course covers fundamental aspects of microbial physiology and ecology. Specific areas of focus include energetics and yield, enzyme and growth kinetics, cell structure and physiology, metabolic and genetic regulation, microbial/environmental interactions, and biogeochemical cycles. The goal of this course is to provide a basic understanding and appreciation of microbial processes which may be applicable to environmental biotechnology.

B512 Applied Bacteriology

Composition and ultrastructure of bacterial cell; Peptidoglycan synthesis and antibiotic effects; Protein synthesis and antibiotic effects; DNA replication and antibiotic effects; Quorum sensing and mechanisms of bacterial pathogenicity; Regulation of gene expression and control metabolic activity; Plant growth promoting bacteria; Anaerobic fermentation; Anaerobic respiration.

B513 Microbial Toxins

Soil environment, Taking soil samples, Methods for isolation of micro-organisms from different substrates, Micro-organisms in the plant rhizosphere, Formulae of selected culture media, Bacterial toxins (Protein Toxins), Phycotoxins (Cyanobacterial toxins), Mycotoxins (Fungal toxins), Classification and history of microbial toxins. Factors affecting microbial toxins production.

B514 Biosafety and Biocontrol

Importance of biotechnology, application of biotechnology, bioethics, product safety, release of genetically modified organisms; public perception of biotechnology and biotechnological products. Biosafety regulation. Biosafety precautions.

MD515 Medical Biochemistry

Introduction to metabolism; methods for studying biochemical abnormalities; Body fluids, electrolytes, acid-base balance; Proteins; Enzymes including clinical enzymology; Membranes; Energy metabolism; Molecular mechanisms of movement; Molecular basis of inheritance; Nucleotide metabolism; Digestion and absorption; Mode of action of hormones; Carbohydrate metabolism; Lipid metabolism; Protein metabolism; Amino acid metabolism; Vitamins; Mineral metabolism; Metabolic integration; Biochemistry of Diabetes mellitus, Atherosclerosis, Fatty liver, and obesity; Liver function tests; Kidney function tests; Thyroid function tests; Adrenal function tests; Pancreatic function tests; Gastric function tests; Biochemical changes in pregnancy and lactation; Cancer Biochemistry.

Z650 Selected Topics in Parasitology



M.Sc. Botany and Microbiology Programs

1- M.Sc. Degree in Plant Physiology

B601 Molecular Physiology

Understanding the nature of membrane transport processes at the cellular, molecular, biophysical and physiologic levels. Students will learn about the different classes of molecular machines that mediate membrane transport and their mechanisms of action. Emphasis will be placed upon the relationship between the molecular structures of transport proteins and their individual functions. The interactions among transport proteins in determining the physiologic behaviors of cells and tissues will also be stressed. Molecular motors will be introduced and their mechanical relationship to membrane transport proteins will be explored. Signal transduction molecules Molecular mechanisms of plant metal tolerance and homeostasis.

B602 Physiology and Plant Biochemistry

Introduction - Photosynthesis – History and environment – Photosynthetic apparatus – Light - reactions- Dark reactions - Respiration - Nitrogen metabolism- Fat metabolism - Signal transduction- Programmed cell death- Coarse activity.

B603 Mineral Nutrition

Introduction - Absorption of minerals by root system- Active and passive absorption of minerals - Availability of different minerals in the soil - translocation of minerals across different plant tissues and organs - Function and assimilation of macro- and micro-elements - Factors affecting the absorption and translocation of minerals.

B604 Plant Hormones

Introduction - History and environment of growth regulators - Biosynthesis of plant growth - hormones - Physiology and Biochemistry of plant growth regulators – Type of plant growth hormones, Modes of hormone action, Photoperiodism, phototropism, Vernalization and abscission, Fruit ripening and parthenocarpy, Hormones and stress physiology.

B605 Plant Water Relations

B606 Selected Topics related to Plant Physiology

The course title and description are submitted by the department committee.

B607 Environmental Pollution

B608 Physiology of Salt Tolerance

The course will start with an overview and discussion of the key elements in economic growth of any country, population dynamics, current trends and future needs of improved plant production in actual context (sustainable agriculture). Types of saline soil, salt stress, how to measure salinity, adverse effects of salt stress on plants, plant adaptations to salt stress, strategies for crop improvement against salt stress will be introduced.

B609 plant Biotechnology

Introduction - Plant genome structure and regulation - Protein synthesis and translocation -Vector and restriction enzymes- Methods for plant transformation -Analyses of the transgenic plants – Protein over expression systems - Gene silencing and RNAI - Hazards , risk assessment and public acceptance for the genetic modified organisms.

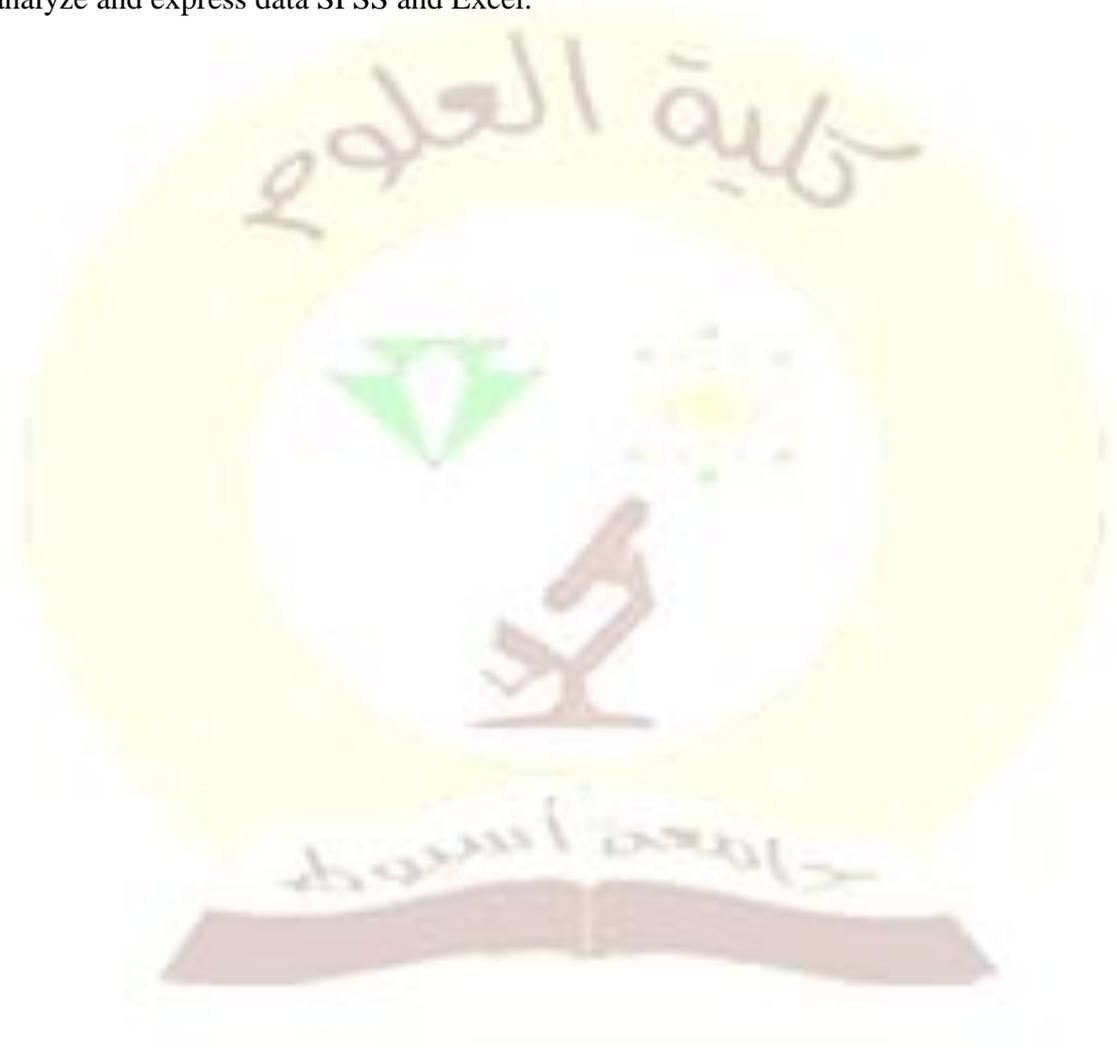
B610 Enzymology

Introduction - Structure and classification - Enzyme Kinetics Regulation - application in agriculture and medicine. Types of enzymes and their nomenclature- Inhibitors of enzymatic activity- Factors affecting enzymatic activity- Methods for measuring enzymatic activity.

B627 Soil Microbiology

M640 Biostatistics

Fundamentals of statistics - Sampling techniques - Estimation theory - Tests of hypotheses - Curve fitting and regression analysis - Basic statistical tests: goodness of fit test - ANOVA, t-test - Chi-square test - Mann-Whitney test - Multivariate analysis - Using computer software to analyze and express data SPSS and Excel.



2- M.Sc. Degree in Plant Ecology

B603 Mineral nutrition

B605 Plant Water Relations

Physio-chemical properties of water based on the phase rule. Chemical potential of water in relation to solutions. Soil physio-chemical properties affecting chemical potential of soil water. Absorption of water and the role of plant roots. Anatomy of root and stem affecting water movement in plants. Role of leaves in plant water relations and metabolism. Continuum theory in plant water relations. Role of micro-climate in affecting transpiration water loss. Resistances affecting water flow in the soil. Plant atmosphere continuum. Water balance in plants and its reflection on metabolism.

B607 Environmental Pollution

Water Pollution: Types of water pollution - Sources of water pollution - Biodegradation - Effects of water pollution upon plants- Biological waste treatment.

Air pollution: Causes of atmospheric pollution - Harmful effects of air pollution - Toxic metals - Plant response to air pollution - Reducing pollution.

Soil pollution: Sources of soil pollution - Common hazardous wastes- Contamination release and transport from the sources- Phytoremediation.

Radioactive Pollution: Radiation - Sources of radioactive waste- Radioactive waste management.

B611 Ecology of Halophytes

Distribution and synecology of halophytes - Classification of halophytes - Sources of salinity - Ion transport and mineral nutrition - Regulation of salt content of salt content of shoots - Water relations - Salt resistance- Salt secreting halophytes.

B612 Environmental Soil Chemistry

Important concepts in studying soil chemistry - Oxidation and reduction in soil systems – Inorganic-solid phase of soil system - Soil organic matter-weathering and soil development- Cation exchange in soils - Anion and molecular retention in soils - Soil PH and acid soils - Salt- affected- soils- Contaminated soils.

B613 Ecology of Mediterranean Region

The Mediterranean Climate from a Biological view point - Subdivision of the Mediterranean climate - The Bioclimatic Area of a Species or of a plant community- Mediterranean type of vegetation of the world- Physiography and soil of Mediterranean lands- The origin of Mediterranean biota- Main physiognomic types and geographic distribution of shrub system related to Mediterranean climates-Floristic composition and phytosociological structure of sclerophyllousmatoral around the Mediterranean- California chaparral.

B614 Phytogeography and Natural Ecosystems

How the living world is organized?– The Biosphere- Biomes and ecosystems –Components of the ecosystem including man– How do ecosystems work?– Food chains and food webs– Flow of energy and matter in the ecosystem– Entropy– Biomass and ecological pyramids- Nutrient cycles– Ecosystem balance and imbalance–Ecosystemstability, definition and causes– Correcting imbalance in ecosystems: Succession – Human impact on ecosystems, effects and assessment – Restoration ecology- Re-establishing the balance.

B615 Biology of Seeds Dispersal and Germination

Introduction - Guidelines for laboratory studies on germination ecology - Causes of within species variations in seed dormancy and germination characteristics - Germination of desert plant seeds - Germination of halophytic seeds - Metabolic changes during seed germination - Germination ecology of seeds in the persistent seed bank.

B616 Selected Topics related to Plant Ecology

The course title and description are submitted by the department committee.

B618 Microenvironment of Plants

Introduction- Soil as the medium for growth - Movement of water in the soil toward roots - The plant in the water-potential gradient between soil and atmosphere (SPAC) - Water relations of plant communities - Evapotranspiration from a stand - Rhizosphere and Electrochemical gradient - Definition of Climatology, Microclimatology and Meteorology - Relations with Biota - Microclimate and plants: the principal effects - Elements of the microclimate and their direct effects on plant life - Principal factors affecting plant water relations; quantitative relations (thermodynamics and energies)- Specific role of microclimate in water use efficiency of plants - Desert microclimate; extremes and their reflections on desert vegetation - Wind and leaf boundary layer - Light and canopy.

B620 Phytosociology and Functional groups

Historical aims and concept of plant community – Plant grouping and populations – Evolutionary processes structuring communities – Evolution and succession of vegetation – Community analysis – Community classification and ordination – Value of functional groups (FG) - FG and fragmentation – FG and competition – FG and precipitation - Examples to some communities in Egyptian deserts.

M640 Biostatistics

3- M.Sc. Degree in Taxonomy of Flowering Plants and Flora of Egypt

B613 Ecology of Mediterranean Region

B614 Phytogeography and Natural Ecosystems

B617 Principles of Plant Taxonomy

Introduction - Flower structure - Inflorescences - Fruits - Systems of classification - Study of representative families of angiosperms

B619 Cytotaxonomy

The course contains: Introduction -Historical review – Embryology - Embryo formation – Parthenogenesis – Agamospermy - Types of ovule axes - Chromosomes in Angiosperms: (structure, types, numbers, behavior) - Influence of environment - Karyotypes and polyploidy and their taxonomic applications - Chromosomes diversity within species (population, ecotypes, landraces, cultivars with case a study in each) - Breeding, hybridization and introgression - Characterization of hybrids and polyploidy by molecular tools.

B621 Comparative Plant Morphology

Introduction - Evidence from inflorescences, Fruits and seeds - Evidence from Paleontology - Evidence from anatomy -Evidence from embryology.

B622 Advanced Palynology

Definition and importance of palynology- Historical review- Methods of pollen slide preparation and staining- Development of pollen sacs- Sporogenesis- Microsporogenesis- Pollen Composition- Pollen Morphology: (Pollen nucleus number- Pollen storage product - Pollen units -Polarity and symmetry - Pollen size - Pollen shape - Aperture characters) Exine structure and sculpture- Pollen morphology in Gymnosperms - Spores in pteridophyta -The production and dispersal of pollen grains – Pollination - Significance of cross pollination - Means of pollination - Pollen morphology and the taxonomy of Angiosperms (Identifications of Plants - Classification of Plants)- Pollen morphology and the theory of continental drift - Pollen analysis - Isolation of pollens - Identification of fossil pollen - Pollen diagram -Pollen germination and its viability -Factors affecting on pollen germination -Applications and scope of palynological studies -The matrix containing pollen and spores (Pollen preparations - Fossil material -Sandy and clayey sample).

B623 Taxonomy of Aquatic Plants

The course contains: Introduction - Historical review – Main characters of Aquatic plants - Classification of Aquatic plants - Adaptation of Aquatic plants - Anatomy and physiology of Aquatic plants - Reproduction of Aquatic plants - Economic value of Aquatic plants - Examples of Aquatic plants in the Egyptian flora.

B624 Chemotaxonomy

Introduction - Historical review - Chemotaxonomic investigation - Evidence from phenolics and betalains - Evidence from alkaloids - Evidence from carbohydrates - Characters of taxonomic molecules - Classification of molecules – Micromolecules – Macromolecules – Allozymes – Semantides – Serology – Electrophoresis.

B625 Botanical Gardens and Herbaria

This course deals with the sources of plant identification (botanical gardens and herbaria)- Types of botanical gardens, Role and functions of botanical gardens- Botanical gardens

network- Historical development- Importance of making good herbarium specimens- collecting plant material of preparation of herbarium specimens- and pressing- drying and mounting of plant specimens- Floras and checklists- A survey of plant in an area can be made by listing all species of which have been collected in the area.

B626 Selected Topics related to Plant Taxonomy

The course title and description are submitted by the department committee.

B628 Medicinal Plants

Introduction - Plants and phytomedicine - Pharmacopoeia wild medicinal plants in Egypt - Wild plants used in folk medicine.

B630 Fossil Plants

The course contains: Introduction – Preservation of fossil plants – Extraction techniques – Terrestrial and marine palynomorphs – Biostratigraphy and palaeoecology of fossil plants – Applied palynology.



4- M.Sc. Degree in Microbiology

B627 Soil Microbiology

A-Microbial ecology: The soil environment – Taking soil samples – Methods for the isolation of Micro-organisms from different substrates –Micro-organisms in the plant rhizosphere – Formulae of selected culture media. B-The Carbon Cycle: Organic matter decomposition – Microbiology of cellulose and hemicelluloses – Lignin decomposition – Microbiology of other polysaccharides (e.g. starch, pectic substances, inulin and chitin).

B629 Microbial Secondary Metabolites

Basic understanding of secondary metabolites based on the structural elucidation, biosynthesis of key secondary metabolites and biological activity of representative compounds. Microbial Metabolites Derived from Glucose, Acetyl CoA Pathway, Acetone-malonate-pathway, Shikimic acid pathway or aromatic amino acids, Aliphatic Amino acids, Intermediates of TCA cycle, Several Metabolic Pathways.

Chemotaxonomy of different microbial groups depend up on the 2ry metabolites - Regulations of the microbial 1ry and 2ry metabolisms - Yeast and Aspergillusterreus 1ry and 2ry Metabolism - Catabolism and anabolism of the structural & functional molecules - Yeast and Aspergillusterreus Metabolites Derived from Glucose, Acetyl CoA Pathway, Acetone-malonate-pathway, Shikimic acid pathway or aromatic amino acids, Aliphatic Amino acids, Intermediates of TCA cycle, Several Metabolic pathways - Regulations of the Yeast and Aspergillusterreus 1ry and 2ry metabolisms.

B631 Microbial Enzymes

Introduction - Sources & location of enzymes - Screening of microbes for selection of enzyme producers - Production of microbial enzymes on laboratory & industrial scales - Isolation & purification of microbial enzymes - Detection of enzymes - Application of microbial enzymes (Different application forms –Amylytic, Proteolysis, Cellulolytic, Ligninolytic, Biolytic, and other enzyme groups).

B632 Aquatic Microbiology

Nature of aquatic environment; Microbiology of water supply; Microbial flora of surface and ground waters, aquatic bacteria, aquatic fungi, distribution of bacteria and fungi in waters, influence of physical and chemical factors on aquatic microorganisms, influence of biological factors on aquatic microorganisms, Classify microorganisms based on environmental factors prevailing in their habitats (fresh waters, seawaters and ground waters; Bacteria and fungi as food for other organisms, Waste-water and sewage microbiology, Microorganisms inhabiting plants and animals, the role of microorganisms in the cycling of elements in waters, microorganisms and sedimentation, role of microorganisms in the origin of mineral resources, microorganisms and water pollution, economic significance of aquatic microorganisms.

B633 Advanced Virology

Infection process in details - Strategies of virus maintenance in communities – Virus replication strategy – Resistance to viral infection – Determination of physical and Chemical characteristics of viruses – Polyclonal and monoclonal antibodies against viruses.

B634 Microbial Biotechnology

Production of bioactive pharmaceutical compounds (antibiotics – anticancer agents) – Production of enzymes, vitamins, polysaccharides, alcohols, pigments, lipids, etc.) - Role of

microbes in Food biotechnology- Manufactured of mycopesticides - biodegradative activities of microbes – Agriculture and industrial waste treatment.

B635 Advanced Bacteriology

The course contains: Composition and ultrastructure of bacterial cell - Polysaccharide biosynthesis and the assembly of cell surface structures (Glycogen, Murein and Teichoic acid synthesis- protein, Lipopolysaccharide (LPS) and Phospholipid translocation) - effect of antibiotics on cell wall formation, DNA replication and protein synthesis - Export of cell surface structural components (Protein transport- Protein translocation across the outer membrane in Gram-negative bacteria).

B636 Selected Topics related to Microbiology

The course title and description are submitted by the department committee.

B637 Advanced Mycology

Techniques of isolation and identification of various genera and species- Specific diagnostic mycological techniques-Molecular techniques for identification of fungi. Establishment of phylogenetic tree based on DNA sequencing- Current trends in mycology - Description of various representative fungal groups - Disease(s) caused in human and animals- Mechanisms of infection. Specific antifungal agents.

B638 Host Parasite Relationship

Introduction - Causes of plant diseases – Symptoms - Identification of plant diseases - Pathogenesis (survival of pathogens – dispersal of pathogenesis) - Infections (phenomenon of infections – effect of infections on physiology of the host and on the growth of the host – defense mechanisms in plants and post-infection structural defense).

B639 Advanced Algae

Definition of Algae - Habit – Habitat - Phytoplankton (Buoyancy of phytoplankton - Concentration In Lab. & Field - Standing crop – Diversity)-Factors affecting population (Nutrients - Light – Temperature – pH – Turbidity – Grazing) – Economic importance of algae (Pollution - Heavy metals – Sewage – Processing of sewage Purification - Role of algae played in oxidation ponds - COD, BOD - Types and determination – Eutrophication – Algae and hydrogen production – Algae effect on and affected by pollution – Symbiosis, parasitism and saprophytes by algae).

B640 Industrial Microbiology

Scope of Industrial Microbiology (soil and Agricultural Microbiology, Medical Microbiology, Microbial Physiology, Cytology and Morphology, Virology, Genetics, Marine Microbiology, Food and Dairy Microbiology and Immunology) -Characteristics of Ideal Fermentor or bioreactor: Selection of active microbial strains- Microbes involved in food, detergent and therapeutic industries – Enrichment culture technique- Production of biofuels.

B642 Physiology of Bacteria

Introduction to bacterial physiology and metabolism - Composition and structure of prokaryotic cells - Membrane transport - Nutrient uptake and protein excretion – Glycolysis - Tricarboxylic acid (TCA) cycle - Electron transport and oxidative phosphorylation - Biosynthesis and microbial growth - Heterotrophic metabolism on substrates other than glucose - Anaerobic fermentation - Anaerobic respiration – Chemolithotrophy - Photosynthesis - Metabolic regulation - Energy, environment and microbial survival. Practical for Advanced Bacterial Physiology Diploma Students.

B644 Microbial Pollution

Microbial pollution of air, water, soil seeds, foods, cheese , fruits (Bacteria , fungi, Algae)- Natural mycotoxins in infected foods and feeds – Factors responsible for ecosystem pollution by microorganism – Diseases caused to human health – Strategies for prevention and control the microbial pollution – Ideal methods for food Storage – Pesticide and their relation to microorganisms (Effect of pesticides on fungi – Microbial hydrolysis of pesticides) – Microbiological control of insects – Fertilizers - Heavy metals and their relation to microorganisms (their effect on fungi – Treatment of pollution by bacteria and fungi) – petroleum pollution and its hydrolysis by microorganism – Dangerous effect of algae to filters and concretes).



Ph.D. Botany and Microbiology Programs

1- Ph.D. Degree in Plant Physiology

B701 Growth Regulators

Introduction - Physiology and biochemistry - Plant growth hormones - Photoperiodism - Vernalization and abscission.

B702 Plant Metabolism Regulation

Some Aspects of Calcium-Dependent Regulation in Plant Metabolism, The 14-3-3 proteins: cellular regulators of plant metabolism, Hydrogen peroxide is produced predominantly in plant cells during photosynthesis and photorespiration, and to a lesser extent, in respiration processes. It is the most stable of the so-called reactive oxygen species and Sucrose plays a central role in plant growth and development.

B703 Bioinformatics

Introduction to bioinformatics. Bioinformatics and molecular biology techniques. Major Research areas of bioinformatics (Sequence analysis, Genome annotation, Computational evolutionary biology, Measuring biodiversity, Analysis of gene expression.(Bioinformatics software tools, formats & web-services (BLAST, FASTA format, Bioinformatics web-services (NCBI, Entrez, Gene Bank). Alignments and Phylogenetic Trees. Global and local alignments, Pairwise alignment, Multiple Sequence Alignment (MSA)), Structural Alignment, Phylogenetic analysis).

B704 Plant Signals

Introduction to Plant Responses to Environmental Stimuli, types of signals Plants Receive Signals (Plants can respond to darkness or light by etiolating or de-etiolating (greening), respectively), Transduction Process and Second Messengers, Regulating Enzyme Activity, Transcription Factors and That Regulate De-etiolation and Etiolting. The biochemical and molecular mechanisms of signal transduction in plants. Receptors and photoreceptors in plants and their role in signal perception and transduction. The central role of protein degradation in the regulation of signal transduction in plants. The central regulatory role of protein phosphorylation and dephosphorylating in signal transduction. Calcium and calcium-binding proteins as second messengers in signal transduction. The role of large and small G-proteins in signal transduction in plants. Transcription factors (trans elements) and response elements (cis elements) in promoters of genes acting downstream the signaling pathways. Defense-related proteins in higher plants.

B705 Secondary Metabolites

Secondary plant metabolites, types, biosynthetic pathways, role of 2ry compounds in growth and developments of plants, biological functions of 2ry compounds, Isoprenoid compounds, Nitrogen containing secondary plant products, Plant phenolics and their relatives. Biosynthesis of key secondary metabolites and biological activity of representative compounds.

B706 Environmental Stresses

stress and strain terminology; the nature of stress injury and resistance; water stress, dehydration and drought injury; drought avoidance; drought tolerance; the measurement of drought resistance; excess water or flooding stress; radiation stress - visible and UV radiation;

ionizing radiations; salt and iron stresses; other stresses and comparative stress responses. Tolerance of temperature extremes, salt, pathogens and other plants.

B707 Mechanisms Associated With Environmental Stress Tolerance in Plants

History of the study of plant tolerance Tolerance-Resistance Trade, Mechanisms of Tolerance, Ontogenetic shift Effects of Resource Levels on Tolerance Growth rate model (GRM) Compensatory continuum hypothesis (CCH) Limiting resource model (LRM) Species Interactions.

B708 Plant Tissue Culture

Introduction, History, Safety, Media composition and culture environment – Hormones, Types of tissue cultures – Mutagenesis – Regeneration Transformation (Agarobacterium, Bioblastic) – Micropropagation – Commercial applications – Ethics of transformation and GM) – Coarse activity.growth measurements of cell suspension cultures factors influencing cell growth in continuous cultures, experimental design and statistical analysis of cell cultures, automation in cell culture management, in vitro propagation techniques, somatic embryogenesis and production of synthetic seeds, secondary metabolite production.

B709 Genetic and Molecular Biology

This course will emphasize on the molecular mechanisms of DNA replication, repair, transcription, protein synthesis, and gene regulation in different organisms. The techniques and experiments used to discern these mechanisms, often referring to the original scientific literature. In addition, an in-depth look at some rapidly evolving fields, including chromatin structure and function, RNA polymerase dynamics, and regulation of gene expression by different types of RNAs.

B710 Selected Topics related to Plant Physiology

The course title and description are submitted by the department committee.

2- Ph.D. Degree in Plant Ecology

B711 Phytotechnology

Introduction - Contaminated soil and bioremediation - Biotechnology selection - Factors affecting the use of bioremediation - Advantages and disadvantages of phytoremediation - Metal phytoremediation Strategies involved in phytoremediation (1- Phytoextraction (concentration; accumulation; hyperaccumulation); Phytovolatilization Phytostabilization; Phytofiltration; Phytodegradation (or detoxification); Biosorption - Biotechnology and transformation - Organic pollutants and mechanisms of action (xenobiotics; organophosphates; chlorinated aromatics; other problematic compounds); (phytodegradation; rhizodegradation; phytovolatilization) – oxygenation, Increasing biodegradation, Nano-phytoremediation as a new technology.

B712 Ecology of Xerophytes

Introduction - Desert ecosystem - Classification of xerophytes - Types of xerohabitats - Nature of drought and heat stresses in xeric habitats - Adaptional features of xerophytes - Osmoregulation and osmotic adjustment in xerophytes.

B713 Vegetation Analysis

This course describes the classification and ordination of vegetation using systematically collected data from the field. In order to obtain an effective analysis of the vegetation and related environmental factors, both classification and ordination techniques must be employed using specific computer program for vegetation analysis – classification Each floristic matrix will be subjected to classification by Two Way Indicator Species Analysis (TWINSPAN) – Ordination: The basic goal of ordination is to summarize the community patterns, and to compare these with the environmental information. (1) Indirect gradient analysis. The indirect gradient analysis must be employed using Detrended Corresponding Analysis (DCA). (2) Direct (constrained) gradient analysis Canonical Correspondence Analysis (CCA) is a multivariate analysis technique developed to relate community composition to known variation in the environment.

B714 Ecology of Aquatic Plants

Types of hydrophytes. Flow, substrate and plant distribution. Flow, substrate, and how they affect individual plants. Depth and plant distribution. Light. Nutrients. Productivity. Vegetation of streams. Vegetation of channels. Uses and benefits of hydrophytes,

B715 Botanical Maps

The course contains Introduction – Study the factors affecting on the distribution of wild plants – Distribution of wild plants – Using Geographic Information System (GIS) and Remote sensing (RS) to design the botanical maps - Using Global Position System (GPS) to certify the distribution of wild plants. Major types of concept mapping techniques including spider ,hierarchy ,flowchart ,systems and network concept maps .Specialized types of concept maps, including IMHC maps, mind maps ,logic trees, decision trees, fishbone diagrams, pictorial maps, multi-dimensional/3-D maps ,and Mandela maps.

B716 Physiological Plant Ecology

The environment of plants- Radiation and temperature - Carbon utilization and dry matter production – The utilization and cycling of mineral elements - Water relations.

B717 Evolutionary Ecology

Introduction - Darwin and "The theory of evolution by natural selection- Science before the theory of evolution - Geologists, Uniformitarianism and Paleontology - Concepts of Naturalists - Mechanisms of selection - Difference between Genealogy and Evolutionary Ecology - Molecules and origin of life - Atmosphere before life - Biological elements - Early atmosphere and the beginnings of life - Problematic in which molecule came first - Models and concepts about the origin of life - Role of organisms in the changes of early Earth's atmosphere - (Geomicrobiology) - Evolution of relationships between different organisms - Evolution of relationships between organisms and abiotic – components - Identification of species and concepts of taxonomy - Biological filters and evolution - Evolution, development and regulation or mechanisms.

B718 Selected Topics related to Plant Ecology

The course title and description are submitted by the department committee.



3- Ph.D. Degree in Taxonomy of Flowering Plants and Flora of Egypt

B715 Botanical maps

B719 Molecular Systematic

Introduction - Contribution of PCR- based methods in plant systematic and Evolutionary biology - The origin and evolution of plastids - Chloroplast DNA and the study of plant evolution - Role of mitochondrial DNA in Plant systematic - Role of ribosomal RNA as phylogenetic tool in Plant systematic.

B720 Flora of Egypt in Relation to Neighboring regions

Historical notes – Egypt as a part of the floral regions of the world – Phytogeographical regions and domains that influence the Flora of Egypt - Flora of the Nile region and Oasis – Flora of the deserts and semi-deserts – Flora of red sea coast – Flora of Sinai Peninsula and Gable Elba.

B721 Paleobotany

Introduction and plant structure – Phylogenetic - Fossils and preservation Early land plants – Lycophytes - Sphenopsids and ferns - Origin of seed plants – Medullosa and Cycads -Ginkgo, cordites and conifers - Glossopteris through entophytes - Interpreting ancient climate - Biogeography.

B722 Numerical taxonomy

Introduction to the numerical approach to taxonomy - Aims and principles of numerical taxonomy – Selection of taxonomic characters – Applications of numerical taxonomy for biological disciplines – Advantages and problems with numerical taxonomy.

B723 Plant Nomenclature

Introduction: History of classification - Systems of classification (Artificial, Natural, Phylogenetic, modern) - History of Nomenclature (different codes) - Rules of Nomenclature: Principles - Ranks of taxa , and the terms denoting them - Names of taxa (Definitions, Typification, Kinds of types, Priority, limitation of the principle of priority) - Nomenclature of taxa according to their rank (Names of taxa above the rank of family, names of families and subfamilies, names of genera, names of species, names of plants in cultivation) - Publication: Effective and valid publication - Conditions and dates of valid publication of names - Citation of authors names and of literature for purpose of precision - Retention , choice , and rejection of names and epithets.

B724 Modern trends in Plant Identification

History of classification: (1- Preliterature, 2- Ancient Literature, 3- Medieval or dark ages 4- Renaissance, 5- Theory of Evolution, 6-Taxonomy Revolt.). Morphology. Vegetative morphology. Floral morphology and anatomy. Palynology. Embryology. Seed and fruit morphology. Karyomorphology. Anatomy. Chemotaxonomy and serology. Paleobotany. Phylogeny. Molecular biology. Diversity and adaptation. Ecotaxonomy. Cladistic analysis. Host-parasite relationships with relation to plant taxonomy.

B725 Selected Topics related to Plant Taxonomy

The course title and description are submitted by the department committee.

4- Ph.D. Degree in Microbiology

B726 Actinomycetes

Taxonomic outline of phylum actinobacteria - isolation and screening of actinomycetes - distribution of actinomycetes in nature - discovery and production of new antibiotics - growth, product formation and fermentation technology - actinomycetes enzymes and growth promoting substances - actinomycetes in agriculture and forestry - actinomycetes as biodeteriogens and pollutants of the environment - actinomycetes in biodegradation of agricultural and urban wastes - actinomycetes in Biotechnology and as causative agents of plant and animal diseases.

B727 Algal Toxins

Cyanobacteria and Dinoflagellates: definition- description; harmful algal blooms, Incidence and distribution of blooms, Factors contributing to bloom formation; Cyanobacterial and Dinoflagellates toxins, Types of toxins; chemical structure- mechanism of action- symptoms and treatments of toxicoses in human; Factors contributing to toxin production, Toxin persistence and degradation, Removal of cyanobacterial and Dinoflagellates toxins.

B728 Ecophysiology of Aquatic Fungi

Introduction; aquatic ecosystems; Origin, evolution, Biogeography, biodiversity and adaptation degree of aquatic fungi. Fungal loop and the Food Web in a aquatic System; Factors and adaptive mechanisms that affect the presence of aquatic fungi in fresh and marine water environment; Interaction and association of aquatic fungi with other water-inhabiting organisms. Ecological and biological role of aquatic fungi; Aquatic fungi in terms of physiological capability and biogeochemical role; Aquatic fungi inhabiting wood; Aquatic fungi related to aquaculture.

B729 Bacterial Biotechnology

Introduction to biotechnology – genetic recombination in bacteria- genetic approaches for improving bacterial strains – selective isolation of mutants – kinetics of bacterial cell growth – role of biotechnology in production of antibiotics, vitamins, enzymes and food additives - production of insulin, interferon and growth hormones in bacterial cells using genetically microbial biocatalysts – bacterial bioremediation and bio fertilizers.

B730 Biochemistry and Physiology of the Plant Pathogenic Viruses

An advanced course in biochemistry, biochemical methods, and reading of the primary literature, featuring systematic coverage of the biochemistry of the central dogma, including DNA (replication, repair, recombination),

RNA (regulation and mechanism of transcription, processing, turnover), and proteins structure, synthesis, modification, degradation, mechanisms of action, function). Plant viral disease, symptoms, pathogenicity and virulence, pathogenesis, tolerance, compatibility and incompatibility, hypersensitive reaction and biotrophs.

B731 Bioremediation of Environmental Pollutants

The definition of bioremediation and the organisms involved are covered. The ability of microbes to degrade or transform pollutants (organic and inorganic) is discussed; especially the limitations of bioremediation and use of inoculants. Fundamental knowledge on microbial-based bioremediation will be applied in the form of case studies which will enhance and add to the lectures e.g. full-scale treatment of industrial effluents.

B732 Biosensors and Their Biological Functions

General principles: A historical perspective of biosensors technology; bioassay and bioindicators, Signal transduction; Physico-chemical and biological transducers; Sensor types and technologies. Definitions and Concepts: Terminology and working vocabulary; Main technical definitions: calibration, selectivity, sensitivity; reproducibility, detection limits, response time; Problems and trade-offs. Physico-chemical transducers: Electrochemical transducers (Amperometric, potentiometric, conductimetric); Semiconductor transducers; Optical transducers; Thermal transducers; Piezoelectric and acoustic-wave transducers; Limitations & problems to be addressed; An Overview of Performance and Applications. Types of Biosensors: Optical biosensors, Surface Plasmon resonance (SPR) biosensor, Bioluminescence, Fluorescence, Colorimetric, Absorption, Turbidity. - Electrochemical biosensors: Amperometric, Potentiometry, Voltammetry, Impedimetric, Conductivity, Microbial fuel cell. - Thermal and other biosensors: Thermal Biosensors, Nucleic Acid-based Biosensors, Nanobiosensors - Microbial biosensors: BOD biosensor, Nitrite Biosensor, Ammonia Biosensor. Dissolved oxygen biosensor, Phenol biosensor, Cyanide biosensor, and other microbial biosensor. Microtox biosensor, Photobacterium biosensors, heavy metal microbial based biosensor. Biosensors application. Biosensors for Environmental Applications: Environmental monitoring, Toxicity assessment. Biosensors for clinical application: Glucose biosensor, Urea determination biosensor, Drug development and detection. Biosensors for Food quality control. Biosensors for agricultural uses. Immobilization: Enzyme immobilization Peptide immobilization; Antibody immobilization; Oligonucleotides and Nucleic Acid immobilization; Cell immobilization. Affinity-based Biosensors: Catalytic biosensors: electrodes and enzyme competition electrodes; Affinity-based biosensors; Inhibition-based biosensors; Cell-based biosensors; Biochips and biosensor arrays. Biosensor Engineering: Methods for biosensors fabrication, microcontact printing, Engineering concepts for mass production. Biosensor limitation and problems.

B733 Cyanobacteria

Classification of cyanobacteria: Ecology of Cyanobacteria, Role of cyanobacteria in ecosystem ; Morphology, Cell wall and gliding, cell structure; Growth and metabolism; Nitrogen fixation, Symbiosis, Cyanobacteria and the quality of drinking water, Utilization of cyanobacteria as food, Cyanophages, Cyanotoxins.

B734 Freshwater Algae

Introduction to freshwater algae, Algae as primary producers, Freshwater environments, Planktonic and benthic algae, Taxonomic variation- the major groups of algae, Biochemistry and cell structure.

B735 Fungal Biotechnology

Biotechnological potential of entomo-pathogenic fungi and ergot alkaloids, applications of *Trichoderma* in disease control, and the development of mycoherbicides. Fungal control of nematodes, control of plant disease by arbuscularmycorrhizal fungi - Production of edible fungi, fermented foods, and high-value products like mycoprotein -Production of enzymes, vitamins, polysaccharides, polyhydric alcohols, pigments, lipids, and glycolipids, immune enhancers, immune suppressors, antibiotics, anticancer agents. Cholesterol lowering agents.

B736 Fungal Enzymes

Fungal Invertases – Amylases – Lipases - Proteases – Pectinase - Cellulases, Hemicelluloses - Lignolytic Enzymes – Thermostable fungal enzymes.

B737 Medical Mycology

Laboratory Diagnosis- Histopathologic Diagnosis of Mycoses- Antifungal Agents - Principles of Antifungal Therapy - Superficial Mycoses- Dermatophytoses – Keratomycosis - Infections Caused by Malassezia Species - Subcutaneous and Deep Mycoses – Aspergillosis – Blastomycosis - Candidiasis – Chromoblastomycosis – Coccidioidomycosis – Cryptococcosis– EntomophthoramycosisHistoplasmosis – Mucormycosis– Mycetoma Paracoccidioidomycosis – Phaeohyphomycosis - Pseudallescheriasis – Sporotrichosis - Basidiomycosis- Geotrichosis, Hyalohyphomycosis- Penicilliosis – Pythiosis - Infections due to Trichosporonand other yeast-like fungi.

B738 Industrial Mycology

Types of fermenters (Small Laboratory fermentors - Pilot plant fermentors - Large industrial fermentors) – Role of pH, temperature, agitation, and aeration- Foam control- Selection of active fungal strains- Enhancers and inhibitors of fungal growth – Production of ethanol, glycerol, citric acid.

B739 Lichens

Introduction – A fungus (Mycobiont) – Photo, or phycobionts (A green alga, or a cyanobacterium) – The morphological and anatomical structures (Foliose, Fruticose, Squamulose and Crustose) – The partnership - Growth and development - Reproduction (Reproduction of the mycobiont and phycobiont) - The classification - Ecology of lichens - Lichen conservation - Biology of lichens - Economic relevance.

B740 Marine and Fresh Water Bacteria

General diversity, habitat preferences, and ecological significance of freshwater and marine bacteria - taxonomic, biochemical, and molecular characterization of freshwater bacteria - genetic interactions - metabolic activities - bacterial populations and productivity - bacterial communities in the lotic environment - bacterial interactions with phytoplankton.

B741 Marine Phytoplankton

Introduction to marine algae, Classification, Marine Chlorophyta, Marine Cyanophyta, Marine diatoms; cell structure; cytology- morphological diversity- Ecology.

B742 Microbial Biotransformations

Introduction – Reactions, processes and microorganisms used for Biotransformation: Oxidations (hydroxylation of saturated positions,epoxidation, oxidation of alcohols and ketones, dehydrogenation of C-C bonds,oxidation of nitrogen and sulfur group, Baeyer-Villiger oxidation, partial oxidative degradation & other) – Reductions (reductions of mono – and diketo substrates, reduction of aldehydes and carboxylic acids, reduction of double bonds, reduction of heteroatoms & other) – Hydrolytic Reactions (hydrolysis of esters, ethers and glycosides, hydrolysis of C=C and C=N bonds & hydrolysis of epoxides) – Condensations and Additions (Formation of esters, lactones and amide bonds, Glycosidations, Addition of ammonia to C=C bonds &varios other coupling reactions) – other biotrasformations.

B743 Microbial Genetics

Operons and Transcriptional Regulation in Bacteria (Negative Transcription Regulation in Prokaryotes, Operons and Prokaryotic Gene Regulation, Simultaneous Gene Transcription and Translation in Bacteria. Microbial Genomes (Genome Packaging in Prokaryotes: the Circular Chromosome of *E. coli*, Simple Viral and Bacterial Genomes. Microbial Virulence (Genetics of the Influenza Virus, Genetic Origins of Microbial Virulence, Antibiotic Resistance, Mutation Rates and MRSA). Principles and concepts of modern microbial genetics. Study of the genotype of microbial species and also the expression system in the form of phenotypes.

B744 Mycorrhizae

Introduction – Taxonomy - Morphology of mycorrhizal symbiosis, Infection process - Function of arbuscularmycorrhizal fungi (AM) - Plant regulation of fungal development - Uses of PCR in identification of AM, Application of AM in Agriculture.

B745 Mycotoxins

Classification of Mycotoxins – Classification of *Penicillium* according to mycotoxin – Classification of *Aspergillus* - Classification of *Fusarium* - Classification of *Alternaria* and other genera - Mycotoxins in various media and environments – Mycotoxicoses of *Aspergillus* toxins - *Penicillium* toxins – *Fusarium* toxins – *Alternaria* & other genera – Analysis of fungal toxins using Elisa – Advanced biosynthesis of mycotoxins specific to *Aspergillus*, *Penicillium*, *Fusarium* group.

B746 Nitrogen Fixing Prokaryotes

Introduction to the nitrogen cycle in nature - biological forms of N₂ fixation (Classification of nitrogen fixation) - Symbiotic nitrogen fixation - Process of nodulation - Different forms of nodules - Metabolism of N₂ fixation - Assessment technique for N₂ Fixation - Influence of environment.

B747 Seaweeds

Introduction to seaweeds, Phaeophyceae, Rhodophyceae, chlorophyceae; classification; cell structure; chloroplasts; life cycles; Commercial utilization of seaweeds.

B748 Seed-Borne Fungi

Introduction- Seed Infection Mechanisms - Systemic Infection of the Seed- Seed contamination or infestation- Infection of the embryo- Non-embryo infection- Episperm contamination- Prevention of Seedborne Diseases- seed deterioration by fungi - Examples of seed borne diseases.

B749 Serological Techniques and Plant Viruses

Introduction- principles of immunology- antigens- antibodies- serological techniques polyclonal and monoclonal antibodies production- application of serology in medical treatments, industry, microbial labs and food examinations. Histological and cytological effects of plant virus, Serological reactions and their interpretation, Explain the advanced serological and molecular techniques for viral detection.

B750 Viroids

What are viroids; taxonomy (Family Pospiviroidae and Family Avsunviroidae); Circular RNA; RNA world hypothesis; Viroids and RNA silencing.

B751 Plant Viruses and the environment

Host-virus relationship - Transmission of viruses - Virus-cell interaction -Viral Pathogenesis - Relationship between plant viruses and invertebrates a. Vectors groups in the invertebrates - Nematodes (Nematod -Vector genera , Virus transmitted ,Mechanism of transmission, Aphides) - Life cycle and feeding habits- Vector groups of Aphids -Type of Aphid- virus relationship- Non-persistent transmission -Semi-persistent transmission - Circulative transmission -The Most important viral disease - plant viral disease -Human viral disease - Animal viral disease. Presence of viruses in different habitats- factors affecting distribution of viruses- ways of virus transmission in nature.

B752 Selected Topics related to Microbiology

The course title and description are submitted by the department committee.



Zoology Programs

1- M.Sc. Degree in Zoology

Z601 Cell Biology

Cell growth and proliferation, cell cycle, cell death, cell signaling, transcription and translation regulations.

Z602 Histology

The fine structure of tissues, digestive system excretory system, and skin.

Z603 Molecular Biology

Cell-based assays, genome structure and function, gene expression, protein expression, gene cloning, and gene transfection.

Z604 Histochemistry

Enzymes and histochemical reagents, immunocytochemistry, fluorescence microscopy, and light microscopy.

Z605 Practical Cell Biology

Cell and tissue culture, synchronous cell cultures, RNA analysis, protein analysis, proliferation and toxicity analysis.

ZM606 Biostatistics

Examination of statistical methods, statistical analysis, programs for biostatistics, analysis, prism, SPSS and Excel.

Z607 Cellular Traffic and Endocytosis

Cell receptors, Trans membrane receptors, membrane biology, and endocytosis.

Z608 Stem Cells

Types of stem cell, origins of stem cells, uses of stem cells, stem cells and future studies, stem cells and therapeutic potentials.

Z609 Tumor Biology

Types of tumors, mechanisms of tumor promotion and progression, Benign VS malignant tumors invasion, and cancer metastasis.

Z610 Special Course

This course is left to the Department as a kind of flexibility of the syllabus.

Z611 Signal Transduction

Cell surface receptors, cytoplasmic signal transduction, nuclear receptors, transcription factors, and cell cycle regulation.

Z612 Selected Topics related to Cell Biology

Selected topics related to Cell biology.

Z613 Histochemistry and Microtechniques

Special requirements for histochemical methods, requirements of chemical nature, requirements of morphological nature, the chemistry of fixation, proteins and amino acids, Fluorescent antibody methods, the histochemistry of some important simple proteins, Nucleic acids and nucleoproteins, Carbohydrates and mucosubstances, applied mucosubstances, lipids, lipoproteins and proteolipids Microscopy: general principles microscopes light Microscope ,phase contrast Microscope ultraviolet Microscope, polarizing Microscope, fluorescent Microscope, electron Microscope. General types of biological mounts: whole mounts, smears, squashes. The basic steps in preparing histological sections (paraffin technique)

Z614 Physiology

The course deals with understanding of how various organ system of the body perform their functions and how these functions are integrated. The course covers the major physiological

organ systems including cardiovascular, respiratory, renal, gastrointestinal, and endocrine as well as basic concepts of cellular physiology.

Z615 Special Course

This course is left to the Department as a kind of flexibility of the syllabus.

Z616 Basic Toxicology

A survey of interaction of environmental pollutants with living systems; general principles underlying the effects of toxic substances on biological systems; the mechanism of toxic action, biotransformation of xenobiotics; strategies for management of toxic chemicals.

Z617 Immunology (1)

An overview on the immune system, the differences between innate and acquired immunity, types of antigens, allergens, antibodies and antigen-antibody interaction, types of cytokines and their receptors. An overview on the autoimmunity. immunological basis of tumors. Basics of immuno histochemistry to discriminate between normal and pathological cells and tissues.

Z618 Aquatic Pollution (1)

Introduction. Aquatic Toxicology. Organic Pollution. Eutrophication. Acidification. Heavy metals and organochlorines.

Z619 Pathology (1)

Terminologies, etiology and pathogenesis of disease, cell injury types - congenital, Acquired (Hypoxic injury, chemical injury, physical injury, immunological injury), cell death & necrosis apoptosis, definition, causes, features and types of necrosis, pathological calcifications, inflammation, vascular response, cellular response, chemical mediators, chronic inflammation, granulomatous inflammation, repair mechanisms, healing by primary intention, healing by secondary intention, factors influencing healing process, complications immunological mechanisms in disease, hypersensitivity & autoimmunity, general aspects of neoplasia, differences between benign and malignant neoplasms, The neoplastic cell, metastasis, carcinogenesis, tumor biology, oncogene and antioncogenes.

Z620 Biochemistry

Chemistry of biological molecules: proteins, lipids, carbohydrates, nucleic acids, etc. Mechanisms of enzyme catalysis. Metabolic pathways, integrated metabolic systems, and molecular physiology.

Z621 Genetic and Molecular Biology

The course covers the molecular nature of genes, gene function, the inheritance of genes, and the genetic basis of traits. Topics include Mendelian inheritance, mutation, linkage and recombination, gene regulation and interactions. Mechanism of DNA replication, recombination, transcription, and protein synthesis are emphasized. Advanced topics including gene expression during cell differentiation, retroviral infection, and regulation of cell proliferation.

Z622 Endocrinology

A comprehensive study to the chemical and physiological principle of hormonal regulation in animals. Molecular mechanisms by which hormones elicit specific responses and regulate gene expression and hormone-receptor interaction. Study of different endocrine glands and its hormones secretion.

Z623 Invertebrate Structure and Function

The foundations of animal life including living systems, organization and life, movement, aspects of metabolism, and information & control.

Z624 Special Course

This course is left to the Department as a kind of flexibility of the syllabus.

Z625 Animal Ecology

Introduction to individual organism, population, community and ecosystem. Organism and its environment including abiotic factors, moisture, temperature, light and periodicity,

ironing, radiation, wind, nutrients and animal life. Population and its properties, life history, patterns, population growth, intraspecific regulation, competition regulation, competition, perdition, parasites, mutualism and commensalism. Community and ecosystem: succession, production in ecosystem and food chains.

Z626 Selected Topics related to Histology and Histochemistry

Z627 Principles of Systematic Zoology

The science of taxonomy. The species category. The species taxon. Intrapopulation variation and the comparison of population samples. Speciation and taxonomic decisions. Theory and practice of Biological classification. Taxonomic characters.

Z629 Ecophysiology (1)

Introduction. The organism and its environment. Desert animals, physiological problems of heat and water. Animal reproduction mechanisms in relation to environment.

Z630 Practical Invertebrates

How to make a culture of different invertebrate groups in lab.

Z631 Special Course

This course is left to the Department as a kind of flexibility of the syllabus.

Z632 Biology of Mollusca

Survey of Mollusca. Field studies, Origin, and Evolution. Morphology and anatomy of a mollusk. Embryonic development. Harmful and Medical mollusks. Molluscs and Pollution. Economic importance of mollusks.

Z633 Parasitic Protozoa

Morphology - Structure and developmental stages, basic life cycle, diagnosis and control - Taxonomy

Z634 Immunology of Invertebrates

Concepts of modern immunology and their importance in biology. Topics include humoral and cellular immune responses, antibody structure and biosynthesis, antigen-antibody interactions, cellular immunology, immunological tolerance, autoimmunity, and tumor immunology.

Z635 Histo-Pathology

Disturbances in cell metabolism - Intra cellular degeneration - Extra cellular degeneration - Pathological calcification - Pathological Pigmentation - Necrosis and Apoptosis - Gangrene. Disturbances in circulation – Congestion – Hemorrhage – Edema – Thrombosis - Infarction - Shock- Inflammatory and repair - Components of inflammatory response. Inflammatory cells classification of inflammation- Healing. Disturbances in growth.

Z636 Soil Ecology

Introduction to the complex world of soils including information on how they are formed, characterized, and populated by a wide array of organisms. An overview of soil types is presented, followed by the study of soil habitats and their properties. Soil animal populations. Diversity and functioning of soil communities. Nutrient recycling. The soil food web, man and the soil.

Z637 Parasites of Fishes

Protozoan parasites - a-myxozoa - b-Blood parasites - c-some other ecto and endo parasitic protozoa - 2-Helminthic parasites - a-Monogenea - b-Trematoda - c-cestoda - d-Nematoda - e-Acanthocephala.

Z638 Invertebrate Relationships

Introduction to animal phylogeny sources of evidence in invertebrate phylogeny
Phylogeny of major groups.

Z639 Fresh Water Ecology

Introduction. The structure of aquatic ecosystems. Chemistry of natural waters. Organisms in Lakes, streams, and Estuaries. Zooplankton and zoobenthos.

Z640 Selected Topics related to Invertebrates

This course is left to the Department as a kind of flexibility of the syllabus.

Z641 Special Course

This course is left to the Department as a kind of flexibility of the syllabus.

Z642 Parasitic Helminthes

Morphology - Anatomy and developmental stages, basic life cycle, diagnosis control – Taxonomy

Z643 Comparative Physiology

The significance of all physiological mechanisms in the ecological theaters will be viewed with evolutionary perspective.

Emphasis in the interrelationships between animals and their environment, relation between form and function, similarities and differences among vertebrates and invertebrates in achieving homeostasis focusing on the excretory, reproductive, muscular, nervous, respiratory and digestive system.

Z644 Intermediate Hosts and Biological Vectors

Vectors transmitted parasites including insects, terrestrial snails (land snails), terrestrial Oligochitae parasites and vectors interactions.

- Control strategies of vectors.

Z645 Physiological Biochemistry

The course shows how the physiological actions of selected organs can be explained by their particular biochemical processes. The course provides information on the following topics: biomarkers of cell organelles, enzymes, and enzyme mediated control of metabolic pathways and bioenergetics, models of control of metabolic pathways, biochemistry of intercellular communication, signaling molecules and target tissue response to signals, metabolism of xenobiotics, cytokines, oxidative stress and diseases.

Z646 Immunology

Concepts of modern immunology and their importance in biology - Topics include humoral and cellular immune responses, antibody structure and biosynthesis, antigen-antibody interactions, cellular immunology, immunological tolerance, autoimmunity, and tumor immunology.

Z647 Nutrition and Metabolism

This course will integrate the biochemical and physiologic aspects of metabolic processes, with a focus on nutritional impact. Lectures will center on the function and regulation of major metabolic processes involving anabolic and catabolic hormones. Also, the course discusses the relationships between diet and disease and nutritional mechanisms of disease prevention. Nutritional Disorders, starvation, obesity, malnutrition, pathogenesis of deficiency diseases with special reference to disorders of vitamins & mineral.

Z 648 Practical and Research Project in Parasitology

Z649 Immunohistochemistry

This course explains various immunohistochemical (IHC) techniques used in the laboratory. The course will also focus on the following points: Identify appropriate quality control (QC) used while performing IHC procedures. Describe slide preparation procedures used in IHC procedures. Define epitope unmasking and retrieval procedures that may be used in performing IHC procedures. Identify and solve problems that can occur when performing IHC procedures. Determine the principles underlying the fixation of proteins in tissues. The strategies for detecting the presence of specific antigens in cells. Practical and research project in Parasitology related to the registered topic.

Z650 Selected Topics related to Parasitology

This course is left to the Department as a kind of flexibility of the syllabus.

Z651 Pharmacology

This course introduces the study of the properties, effects, and therapeutic value of the primary agents in the major drug categories. Topics include introduction to drug usage, drug dosage forms, determining factors of dosages, routes of drug administration, drug actions and body responses, nutritional products, blood modifiers, hormones, diuretics, cardiovascular agents, respiratory drugs, and gastrointestinal agents.

Z652 Selected Topics in Physiology

This course is left to the Department as a kind of flexibility of the syllabus.

Z653 Comparative Reproduction

The course provides an overview of mammalian reproductive biological processes with an emphasis on the diversity of reproductive mechanisms that have evolved in placental, marsupial, and monotreme mammals. The lecture topics include sex determination and sex differentiation, development of the gonads, gonadal ducts and external genitalia. The cell and molecular biology of sperm-egg interactions at the time of fertilization are then given, followed by the processes involved in egg activation and differentiation of the early embryo. Macromorphological and cellular changes associated with implantation, placentation and lactation in various groups of mammals are then covered.

Z654 Lab and Research Project in Physiology

Z655 Limnology

Introduction to limnology, physical limnology of lakes, chemical limnology of lakes. Biological /Ecological limnology of lakes, Wetlands. Physical and chemical stream ecology. Biological stream Ecology. Pond and Small lake management and Applied limnology /lake Restoration.

Z656 Cell Physiology

Basic concepts of cellular organization, function, regulation. Emphasis on molecular/biochemical approach to fundamentals of bioenergetics; plasma membrane functions such as transport, secretion, and signal transduction; organelle function and biogenesis; cell growth.

Z657 Fish Ecology

Introduction to the biology and ecology of freshwater and marine fishes. Topics include taxonomy, physiology, biogeography, competition, predation, fishing, and conservation. Lab exercises and field trips emphasize familiarity with local fishes and their ecological interactions.

Z658 Pathology (2)

Water, electrolyte and Acid-Base homeostasis, Renal functions, disorders and urinalysis. Liver functions, disorders including enzymology, Lipid metabolism and cardiac biomarkers. Endocrinology disorders (Diabetes, thyroid and calcium homeostasis). Erythropoiesis, anemia and polycythemia, Leucopoiesis and disorders of white blood cells. Homeostasis and Bleeding disorders, Blood transfusion medicine. Clinical microbiology and proper test selection and interpretation. Autoimmune diseases, hypersensitivity and immunodeficiency. Immunological diagnosis of liver diseases and tumor markers, Laboratory statistical applications and performance criteria of laboratory tests.

Z659 Fish Physiology

Fish physiology is the study of the physiological systems of fish. Topics emphasized include sensory systems, feeding circulatory, nervous and endocrine, digestion, osmoregulation, movement, reproduction and development.

Z660 Biotechnology

This course is designed to introduce the student to the concepts of biotechnology as they relate to working in the biotechnology industry. The student should be provided proper handling of laboratory chemicals, operate common analytical instruments, describe the theory

and applications of various analytical instruments including types of electrophoresis, spectrophotometry, chromatography, and centrifugation, practice laboratory safety, basic laboratory math and statistics, buffer preparation, and introduction to relevant biotech databases available on the Web.

Z661 Special Course

This course is left to the Department as a kind of flexibility of the syllabus.

Z662 Environmental Physiology

Physiological adaptations that allow animal life to survive in diverse environments. The course will look at the strengths and weakness of the comparative approach and its relationship to phylogeny. Topics that may be addressed include osmoregulatory physiology and water balance, thermoregulation, metabolic rates, exercise, acid-base regulation and cardiovascular physiology.

Z663 Electron Microscopic Technique

Principles of electron microscopes, comparison of light microscope and electron microscope, structure of transmission electron microscope, structure of scanning electron microscope, specimen preparation for scanning electron microscope.

Z665 Comparative Anatomy of Nervous system (Cranial nerves and sensory organs)

This course is designed to give a broad overview of the structure of nervous organs of vertebrates, recognize the developmental phases of the cranial nerves and sensory organs in vertebrates, and explain the structural functional adaptation of these nervous organs. A critical comparative anatomy of nervous systems of the vertebrates and evolutionary relationships and morphological adaptations of fish, amphibians, reptiles, birds and mammals will be emphasized.

Z666 Aquaculture

Introduction, ponds and fish suitable for cultivation, Techniques and methods of fish cultivation, control and increase of production in fish cultivation, cultivation of aquatic animals other than fish, Biotechnology in aquaculture.

Z667 Molecular Taxonomy and Vertebrate Fauna

The course covers a broad knowledge on the concept of evolution, general classification of vertebrates, characteristics and life history of representative types from each group. The course will also give important knowledge on the new molecular taxonomy methods for vertebrate fauna.

Z668 Fish Population Dynamics

History, population size, virtual population analysis, minimum viable population, maximum sustainable yield, recruitment, overfishing, metapopulation cycle, trophic cascades, basic models, predator-prey equations.

Z669 Experimentation and Data Analysis

This course is intended for postgraduate students who plan, design and analyze the results from experiments with animals. Statistical analysis as well as non-statistical design questions will be covered. The course will cover the following topics: basic concepts in probability and statistics; Single and two factor analysis of variance; basic principles of animal experimental design I; basic principles of animal experimental design II; analysis of covariance; data transformations and non-parametric methods; and multivariate analysis of variance.

Z670 Cryo preservation

Introduction, mechanisms of freezing damage, cryopreservation of animal cells, mechanisms of cryoprotectant action.

Z671 Development of Vertebrate Body

A comparative study of the biochemical and cellular mechanisms associated with the morphological development of vertebrates. Embryological development of the frog, chick and human will be emphasized.

Z672 Fish Biodiversity

This course will study the diversity, evolution, relationships and identification of the fishes, the most diverse of all vertebrate groups and the dominant group of vertebrates in aquatic habitats. This course will provide concrete lab skills and will help prepare you for careers in fisheries science, ichthyology, oceanography or vertebrate biology.

Z673 Advanced Histology and Histochemistry

A comparative study of the biochemical and cellular mechanisms associated with the morphological development of vertebrates. Embryological development of the frog, chick and human will be emphasized.

Z674 Fisheries Managements

Historical back ground and process of fisheries management, fish sampling and gear bias, statistics for fisheries management, Abundance estimation, Estimating mortality rates, Age and growth, populations dynamics, stock assessment, great lakes fisheries.

Z676 Fish Taxonomy

This course will provide students with an introduction to the biology and taxonomy of fishes . During lecture sessions, students will be introduced to the taxonomy, major groups, general morphology, physiology, and natural history of fishes. During lab sessions, students will gain "hands- on" , practical knowledge of material learned in lecture. Specifically, students will become familiar with fish morphology and anatomy will learn fish taxonomy and fish identification and will be exposed to local aquatic habitats and their associated fish fauna.

Z677 Special Course

Z678 Selected Topics Related to Fish Biology

This course is left to the Department as a kind of flexibility of the syllabus.

Z680 Biology of Regeneration

This course will cove different topics including conserved developmental pathways that are necessary for regeneration, and the relevance of these findings for regenerative medicine will be discussed.

Z682 Isolating Mechanism and Speciation

The course provides knowledge about speciation which occurs when two populations of a species are no longer capable of breeding successfully. If natural selection acts differently on the two reproductively isolated populations they will evolve in different ways. The characteristics of the two populations will gradually diverge and the allele frequencies in both populations will change. If the populations cannot successfully interbreed, they have evolved into separate species. The course will also cover different topics including Hybrid sterility which is a special instance of reproductive isolation. Reproductive isolation between species is the barriers to mating do not just have to be due to incompatibility between genomes. These isolating mechanisms which serve to limit gene flow between species are categorized in terms of pre- or post-mating mechanisms.

Z684 Developmental Biology and Electron Microscopy

It covers major topics on the developmental biology of vertebrate embryos (e.g. formation of the germ line, gastrulation, segmentation, nervous system development, limb patterning, organogenesis). The course makes extensive use of the current primary literature and emphasizes experimental approaches including embryology, genetics, and molecular genetics.

Z686 Special Course

Z688 Selected Topics Related to Comparative Anatomy and Embryology

This course is left to the Department as a kind of flexibility of the syllabus.

Z689 Comparative and Developmental Immunology

Comparative Immunology is designed to give a broad overview of the immune defense mechanisms of major domesticated vertebrate species, and to compare common and unique defense strategies they have developed for resistance against microbial and viral infections.

Topics include an overview of the innate and acquired immune system, evolution of the immune system and immunoregulation among different animal species. This course also is designed to acquaint students with fundamental cellular processes involved in the generation of an immune response and provide students with detailed knowledge of the cells and organs of the immune system, their organization and diversity, and their specialized functions at different anatomical locations in different animal species. This course will help students to study the ultrastructures of the immune system organs using electron microscope pictures.

Z690 Molecular Immunology

The course is designed to acquaint students with structure and functional relationships of immune cell receptors. Students will acquire knowledge of structural properties of immune receptors and how these are important in receptor functions such as antigen interaction and signal transduction. This course focus on the molecular and cellular basis of the adaptive immune response, which is mediated by lymphocytes and learn how these cells are generated and how they communicate, differentiate and function to eliminate invading antigens. Other areas of this course are focusing on regulation of the immune system in the normal steady state and its lack of regulation during several experimental animal disorders.

Z691 Advanced Immunohistochemistry

Immunohistochemistry course is designed to provide students with the knowledge and skills to manipulate complex multiple immunohistochemistry staining techniques to fit applications within research areas. Also, this course will help students to understand how immunohistochemistry can be linked to other techniques to enhance the research topics and to use different techniques for best demonstration and diagnosis in experimental animal models.

Z692 Tumor Immunology

This course will give the students the opportunity to enhance their own knowledge of tumor immunology and using experimental animal models with tumors. Special focus will lie on immunological processes accompanying tumor development as well as opportunities to use the immune system to fight cancer in experimental animal. The course also covers in-depth topics on molecular mechanisms underlying immune-tumor cross-talk. The main topics include tumor metastasis in experimental animals, immune surveillance of cancer and tumor escape mechanisms using experimental tumors using animal models.

Z693 Molecular Hematology

The course focuses on the physiology and pathology of blood and its use as diagnostic tools for experimental animal diseases. This course will also provide advanced knowledge and information on the abnormal signaling transduction of B cell receptor and T cell receptor that lead to hematological malignancy such as chronic lymphocytic leukemia and diffuse large B cell lymphoma. Topics also include pathways that transduce important survival and proliferation signals in the malignant B and T cells. Studying other signaling pathways that lead to other hematological disorders such as TGF-beta signaling and JAK-STAT pathways.

Z694 Pathophysiology

Pathophysiology course focuses on the functional and metabolic alterations and mechanisms underlying the development of organs dysfunction. It enables the students to understand how and why disorders develop in animal models. This course is designed to provide students with an in depth study of the abnormal physiology associated with organs dysfunction. The frame work is designed to present the general concepts of disorders which are common in many diseases using experimental animal models.

Z695 Lab and Research Project in Immunology

This course covers wide range of practical topics including an overview of animal handling, blood collection and biochemical preparations, paraffin sections and immunostaining, Western blot analysis, flow cytometry, biology of cytokines and their receptors, antioxidant and free radical analysis.

Z696 Principals of Animal Cell and Tissue Culture

This course introduces students to basic principles and techniques in animal cell culture. It more specifically outlines the importance of animal cell culture to the field of biotechnology and Immunology. The course provides weekly practical session on the animal cell isolation from mice and culture of these cells. It will also give practical skills on the culture and manipulation of different cell line and cryopreservation.

Z697 Host-Pathogen Interactions

This course explores host-pathogen interactions from bacterial, fungal, parasite, viral and animal host perspectives in a lecture series, examining virulence factors, host defenses and immune responses. The material on the course will enable students to develop and refine their understanding of the roles of host and pathogen in infectious diseases using different animal models.



Ph.D. Zoology Programs

Z701 Advanced Cell Biology

Cell abnormalities, receptor-ligand interaction, protein-protein interactions, DNA- protein binding.

Z702 Advanced Histology

Different changes of tissues, Identification of necrosis, apoptosis and how to detect them.

Z703 Advanced Molecular Biology

DNA biology, RNA biology, micro RNA synthesis and regulation, gene cloning, gene and protein regulation, transcription factors.

Z704 Advanced Signal Transduction

Cell surface receptors, cytoplasmic signal transduction, nuclear receptors, transcription factors, cell cycle regulation.

Z705 Advanced Cellular Traffic and Endocytosis

Training on how to use the statistical methods to perform the statistical analysis of any given data, mechanism of Autophagy.

Z706 Advanced Stem Cells

Definition of stem cell – types- origin characteristics, and uses.

Z707 Advanced Tumor Biology

Gene expression analysis, protein expression analysis, mi RNA expression analysis, gene cloning, cell culture, cell based assays, promoter analysis.

Z708 Molecular and Cellular Immunology

Concepts of modern immunology and their importance in biology. Topics include humoral and cellular immune responses, antibody structure and biosynthesis, antigen-antibody interactions, cellular immunology, immunological tolerance, autoimmunity, and tumor immunology.

MZ708 Mathematical and Statistical Packages

How to use different mathematical and statistical programs to analyze biological data.

Z709 Selected Topics related to Cell Biology

This course is left to the Department as a kind of flexibility of the syllabus

Z710 Histochemistry

Immunocytochemistry - substrate film techniques - Enzymes and histochemical reagents - Autoradiography and its applications - Fluorescence microscopy.

Z711 Biochemical Toxicology

Molecular biological aspects of toxicology - reactive metabolites and toxicity - Biochemical toxicology of nervous system – hepatotoxicity - pulmonary toxicity - renal toxicity - cardiovascular toxicity.

Z712 Immunology (2)

Advanced topics in immunology - Topics include antigen processing and presentation - B-cell differentiation - T-cell structure - function and activation - MHC molecule - cytokine release and effects self and non-self-recognition - and immunopathology of HIV.

Z713 Aquatic Pollution (2)

Introduction, thermal pollution – Radioactivity – Oil - Biological assessment of water quality in the field - Intrusive microorganisms and Bioassays - Management of water resources.

Z714 Genetic Engineering

Recombinant DNA - Restriction enzymes and basic cloning - DAN sequencing and PCR - Prokaryotic and Eukaryotic gene expression - molecular diagnosis - therapeutic agents, vaccines - microbial insecticides - animal genetic engineering – regulation - ethics and patenting of biotechnology.

Z715 Microbiology

A survey to provide a general understanding of fungi - bacteria and viruses - Bacterial structure – growth – ecology - pathogenic mechanisms - and viral life cycle.

Z716 Selected Topics related to Histology and Histochemistry

This course is left to the Department as a kind of flexibility of the syllabus.

Z717 Invertebrate Hematology

Aspects of the evolution and development of body cavities, circulatory systems and blood cells organisms without special circulatory systems:

Annelids and related phyla; Comparative aspects of the structure and function of invertebrate and vertebrate leucocytes.

Z718 Nanobiology

Nanoscale analysis of biological specimens - CryoEM characterization of virus structures and infection - Nanosensors and nanoarrays - AFM based diagnosis of cancer - Single cell analysis of signaling events using microfluidic devices - Signal transduction networks and systems biology - Vault nanoparticles and their use as carriers of DNA, RNA, proteins and small molecules.

Z720 Soil Biology

An overview of soil types is presented, followed by the study of soil habitats and their properties. Soil animal biology. Diversity and functioning of soil communities. Nutrient recycling. The soil food web, man and the soil

Z721 Invertebrate Biodiversity and Conservation

What is biodiversity?; measuring biodiversity; patterns of biodiversity in space; effects of habitat disturbance and destruction; what is conservation?; sustainable exploitation of natural resources; selection and design of protected areas; conserving species In Situ; conserving species Ex Situ. Investigating mechanisms maintaining biodiversity in natural and managed ecosystems.

Z722 Aquatic Ecotoxicology and Terrestrial Ecotoxicology

Ecotoxicology deals with the dispersal and transformation of xenobiotics in environment and their deleterious effects on fauna .in addition to the damage on the individual organism , ecotoxicology comprises the effects of chemicals on higher levels of biological organization , I.e. population and communities - The course in ecotoxicology focus on the uptake and biotransformation of xenobiotics in living organisms and their harmful effects from molecule to population.

Z723 Advanced Biology of Hirudinea

Anatomy, Physiology, taxonomy, Behavior.

Z724 Biology of Crustacea

General characters and taxonomy of crustacean, embryology of crustacean, larval morphology and diversity, comparative morphology of crustacean, growth, reproduction and sex determination, hormones and neurosecretion, photoreception, chemoreception, thermoreception and mechanoreception, the population and communities of crustacean, and economic importance of crustacea.

Z725 Invertebrate Taxonomy

The new trends and principles in the taxonomy of invertebrates.

Z726 Ecophysiology (2)

Adaptations of animals facilitating their survival in natural environments where physiological stress is induced by prevailing physical conditions temperature; water availability; and oxygen availability ;and oxygen availability often restrict their abilities to exploit specific environments Biochemical; cellular; and organismal responses to these factors will be studied. A major theme will include the range of adaptive responses that can be implemented in order to overcome a specific limitation in the environment.

Z727 Special Course

This course is left to the Department as a kind of flexibility of the syllabus.

Z728 Selected Topics Related to Invertebrates

This course is left to the Department as a kind of flexibility of the syllabus

Z729 Advanced Parasitology

Myxozoa –Apicomplexa- Helminthes.

Z730 Ultrastructure of Histopathology

Ultrastructure of cells and organelles- Electron microscopy of different parasites. Abnormalities of cellular structures.

Z731 Special Course

This course is left to the Department as a kind of flexibility of the syllabus

Z732 Selected Topics related to Parasitology

This course is left to the Department as a kind of flexibility of the syllabus

Z733 Hematology

Homeostasis - blood coagulation and fibrinolysis - acquired haemostatic defects - red blood cells and gasses transport, anemia - leukocytes and immunity - blood grouping and Rh – preparation - storage and transfusion of blood and blood products.

Z734 Ecotoxicology

Ecotoxicology deals with the dispersal and transformation of xenobiotics in the environment and their deleterious effects on fauna .in addition to the damage on the individual organism ecotoxicology comprises the effects of chemicals on higher levels of biological organization i.e. population and communities.The course in ecotoxicology focus on the uptake and biotransformation of xenobiotics in living organisms and their harmful effects from molecule to population.

Z735 Seminars and Research Project related to Parasitology

This course is left to the Department as a kind of flexibility of the syllabus

Z736 Neurophysiology

Topics to be covered include neuron morphology, electrical properties, resting potential of neurons; the structure and function of voltage-gated and neurotransmitter-gated ion channels; generation and propagation of action potentials; the physiology of fast synaptic communication. Physiological basis of sensory systems, language, learning and memory. Biochemical, molecular, physiological, and behavioral changes associated with normal aging versus changes associated with pathologic conditions such as Alzheimer's and Parkinson Disease.

Z737 Immuno-Regulation and Cell Signaling

This course introduces regulatory pathways and molecular themes employed in signal transduction and their modulation by pharmacological agents. The molecular basis of diverse diseases and existing therapies for them engage the various pathways that will be covered in the course. This course covers the basic biology of normal and cancer cells at the cellular and molecular levels with special emphasis on aberrant signal transduction pathways in cancer cells. The course involves lectures and discussion of original research/review articles.

Z738 Molecular Genetics

Principles of genetics, including the structure of RNA and - DNA, molecular replication, transcriptions, translation - Protein synthesis. Basic introduction to PCR technology and to the analysis of genetic diversity using both lecturer-directed and student-directed learning.

Z739 Special Course

Z740 Cell Cycle Control and Cancer

This course will present an overview of the cancer development process at the cellular and molecular level, including regulatory networks involved in growth control and tissue organization and an introduction to animal, cell and molecular techniques for studying progression, treatment and prevention of cancer.

Z742 Applied Immunology

This course provides advanced training in designing, implementing and evaluating Immunological techniques that measure immune responses. The course also covers the following topics: Basic immunology, organ and bone marrow transplantation, congenital and acquired immunodeficiency, immunopathogenesis of infectious diseases (including HIV, HCV, and influenza virus infections), vaccinology, cancer immunology and immunotherapy.

Z743 Dysfunction of Some Organs

The course deals with pathophysiological mechanisms and interpretation of organ dysfunctions. For example disorders of some organs such as liver, kidney, brain, heart, gonads and bone marrow. Also, the course focus on the understanding of the value of laboratory tests in diagnosis and management of dysfunctions.

Z744 Molecular Endocrinology

The course provide advanced knowledge on hormone receptors and the mechanisms of hormone action on target cells, molecular mechanisms by which hormones elicit specific responses and regulate gene expression and hormone-receptor interaction. Brain hormones and their precursors, insulin and its receptor, gene-associated peptides, new glycoprotein hormones, growth factors, steroids, the superfamily of steroid and thyroid receptors, pheromones, oncogenes, and immune-endocrinology

Z745 Reproduction and Infertility Problems

Different protocols for reproduction, different measurements for reproduction effecting, types of infertility problems, different causes of infertility (Hereditary and Acquired), diagnosis and treatment of infertility, control of infertility, and methods to improve reproductive performance

Z746 Advanced Molecular Hematology

The course focuses on the physiology and pathology of blood and its use as a diagnostic and therapeutic tool. Also to highlight to hematopoiesis, erythrocytes, granulocytes, lymphocytes, normal hemostasis, red cell immunohematology, blood cell antigen an antibodies, general aspects of hematologic malignancy and bone marrow implantation. Cellular Hematology, Immunohematology and Homeostasis. Molecular Science and Diagnostics., Discussion of the physiology and pathology of blood cells and bone marrow ; reviews physiology of blood hemopoisis; discuss hematologic results as relate to normal, anemic, and leukemia conditions. To study disorders of red cells such as: hemolytic anemia, hereditary disorder of hemoglobin structure and synthesis and other disorders of red cells. Study of aplastic anemia and its causes. Acute leukemia and hematologic malignancy.

Z747 Seminar and Research Project related to Physiology

Z748 Selected Topics Related to Physiology

This course is left to the Department as a kind of flexibility of the syllabus

Z749 Fish Biogeography

This course will examine patterns of distribution and abundance of fishes and plants and the physiological and ecological process that produce these patterns .topics include human

mediated effects on distribution and abundance, historical causes of these patterns at both geological and ecological time scales.

Z750 Aquatic Ecosystem

An aquatic ecosystem is an ecosystem in a body of water. Communities of organisms that are dependent on each other and on their environment live in aquatic ecosystems. The two main types of aquatic ecosystems are marine ecosystems and freshwater ecosystems.

Z756 fish hatchery management purpose, Production steps (Brood stock, spawning, Fertilization, larvae, settlement of shellfish), Hatchery design, issues (Genetic, fish farms).

Z751 Fish Hatchery Managements

Fish hatchery management purpose, Production steps (Brood stock, spawning, Fertilization, larvae, settlement of shellfish), Hatchery design, issues (Genetic, fish farms).

Z752 Aquatic Toxicology

This course provides participants with a strong foundation of aquatic toxicology and how these concepts are applied to managing pollutants in aquatic environments. The course covers terminology. Common test designs, and endpoints such as lethality and endocrine disruption. Important legacy and emerging pollutants of concern such as heavy metals, organic pesticides, PAHS, PCBDEs, pharmaceuticals, personal care products, and nanoparticles will also be presented. Fate and transport as it relates to bioavailability and pollutant partitioning in aquatic environments will be discussed. Water Quality criteria from the clean water Act with an emphasis on, and examples of site specific criteria for metals using hardness correction, water effects ratio (WER) and the biotic ligand model (BLM) are included.

Z753 Fish Embryology

What is a fish larva?-Development and ontogenetic state –An overview of teleostean phylogeny- Embryology, hatching, growth and metamorphosis –Food, feeding, predation – Physical process –Mortality, cohort dynamics and recruitment theory- Condition, growth, energetic –Culture, stocking, restoration –Egg and larval surveys, applications.

Z754 Bioinformatics

In order to facilitate the approach to bioinformatics, the course focuses on problems from the fields of biology, biochemistry, molecular biology and structural biology. Which can be addressed by applying bioinformatics methods. The current available DNA and protein sequence databases and sequence analysis methods will be described. Prediction methods will be presented which let one gain insight into the three-dimensional structure and function of a protein starting from its DNA sequence.

Z755 Nanotechnology

Nanotechnology represents one of the fastest growing fields in science and technology. Applications of nanotechnology range widely from advanced electronics to energy storage and conversion to biomedical uses including drug delivery and imaging. In this course we will explore the history of the field, the tools used to characterize these unique materials, and discuss the implications for future development on science and society. Focus will be given to the production of these materials, including in-class hands-on synthesis of gold nanoparticles and characterization by electron microscopy and other methods. Specific attention will be given to the environmental and ethics considerations for nanomaterials in consumer products.

Z756 Fish Reproduction

In particular relation to the reproductive biology of fish, this option offers the following taught modules:

Sex determination and differentiation in fish –neuroendocrinology- oogenesis- spermatogenesis- genetic selection-cryopreservation and genome regeneration.

Z757 Fish Food and Feeding Biology

Introduction, feed composition and analysis, Experimental design in feeding Experiments, Gustation and feeding behavior, Environmental factors and feed intake, feeding Rhythms, feeding anticipatory activity, Effects of feeding time on feed intake and growth, Effects of nutritional factors and feed characteristics on feed intake, Regulation of food intake by transplantation immunity in Arthropods: Is immunorecognition merely wound healing.- Evolution of histoincompatibility –the refnce reaction –Encapsulation in arthropods –cellular immune responses and their genetic aspect in drosophila –hemolymph clotting in insect -The prophenoloxidase activating system: the biochemistry of its activation and role in arthropod cellular immunity , with special reference to crustaceans.

Z758 Selected Topics related to Fish Biology

This course is left to the Department as a kind of flexibility of the syllabus.

Z759 Experimental Embryology

The mechanisms controlling the individual development of animals by means of experiments. Types of methods as marking, removal, transplantation, and isolation of body parts and organs. The action of various external factors on embryonic development. By removing, inactivating, or transplanting cell nuclei, experimental embryologists investigate the interaction of the nucleus and cytoplasm during gametogenesis and embryonic development, as well as the stages and factors of differential activation of genes in the course of development.

Z760 Functional Anatomy of Vertebrates

Comparative investigations of functional morphology across major vertebrate lineages. Evolutionary history and patterns of development. Integumentary, skeletal and muscular systems. Sensory systems and neural and endocrine integrations. Biomechanical and physiological performance of biological structures, from cells to organ systems, and on the origins and diversification of form-function complexes among vertebrates. Lab exercises include dissections, observation of prepared specimens and other material, and modeling/simulation of biomechanical systems.

Z761 Vertebrate Physiology

Principles of physiology and physiological processes. Integration of physiological systems. Osmoregulation and ionic balance in a challenging environment.

Z763 Advanced Developmental Biology

It covers major topics on the developmental biology of vertebrate embryos (e.g. formation of the germ line, gastrulation, segmentation, nervous system development, limb patterning, organogenesis). The course makes extensive use of the current primary literature and emphasizes experimental approaches including embryology, genetics, and molecular genetics.

Z764 Practical and Research Project

Practical and research project related to the registered topic.

Z765 Selected Topics related to Comparative Anatomy and Embryology

This course is left to the Department as a kind of flexibility of the syllabus

Z766 Special Course

ZP708 Biomechanics

Laws of mechanics and their application on vertebrate body using different examples inhabiting different environment. Introduction to Newton's Laws of Mechanics, and multiple applications of those laws to vertebrate motions. Mechanical Analysis of Human Performance.

MD767 Immunotherapy

This course provides comprehensive coverage of the latest developments in immunotherapy including the use of microbial products in immunomodulation and vaccination, small molecules and biologics, as well as cellular immunotherapy. The course aims to allow the

students to understand the research process, from the fundamental discoveries at the forefront of immunological research, to the application of novel interventional immune-based therapies.

Z767 Immunopathology

The course aims to provide an understanding of immunological processes associated with the ability to distinguish self from non-self antigens, as well as abnormal immune responses including autoimmunity. The course also aims to provide an understanding of the pathogenic processes associated with infectious agents infecting animals. Further, this course provides students in depth understanding of current molecular and conventional investigative tools involved in the analysis of complex infectious and immunological diseases using experimental animal models such as type I diabetic mouse model and diabetes-associated immunopathology of diabetic mice lymphoid organs.

Z768 Seminar and Research Project in Immunology

This course is left to the Department as a kind of flexibility of the syllabus

MZ769 Bioinformatics

This course provides an introduction to both theoretical and practical aspects of DNA and protein sequence analysis including the searching of DNA, protein and nucleic acid databases using homology-based and pattern-based search algorithms, as well as sequence comparisons and alignments and evolutionary analysis. Students will develop skills in interfacing with and retrieving information from sequence and genome databases. Topics include collection of sequences, sequence alignment, prediction of RNA secondary structure, phylogenetic relationships, gene prediction and protein structure prediction. Analysis of images will also be covered.

Entomology Programs

E601 Insect Comparative Anatomy

Integument in insects. Digestive system in various insect orders. Respiratory organs in insects from different habitats. Locomotory organs in insects. Nervous system in insect orders and some immature stages. Excretory system in insects from different habitats. Reproductive system in insects.

E602 Insect Physiology and Behavior

This course is a detailed study of the physiology and biochemistry of insect organ systems - Topics include: circulation – digestion – respiration – excretion - hormonal regulation – pheromones – metabolism – growth - reproduction and nerve and muscle physiology - Types of communication - Physical communication (sound – light - tactile) - Chemical communication (semiochemicals – allelochemicals - pheromones) - Sensory modalities used in insect communication - Insect pheromones - Types of pheromones - Nature and characteristics of pheromones - Processing of olfactory information - Factors affecting pheromone communication systems.

E603 Insect Taxonomy and Ecology

Fundamentals of insect classification - Types of keys - Recognition of insect orders - Identification of adult insects to family level - Identification of immature insect stages to family level, using different types of keys - Life histories of selected pest and beneficial species - Community development, structure and organization - Communities & distributions. Population dynamics - Coevolution of prey and predator - Predator and prey populations - Diversity and stability - Structure of tropic community - Energy Flow - Social systems.

E604 Insect Control

Basic tenets of integrated pest management emphasizing ecological principles; integration of chemical, biological, cultural and physical tactics into an overall strategy for the agroecosystem; chemical pesticides, cultural practices, host resistance, biological control, sterility principle, economics of pest control and pest/host relationships.

E 605 Selected Topics

EM606 Biostatistics

Fundamentals of statistics - Sampling techniques - Estimation theory - Tests of hypotheses - Curve fitting and regression analysis - Basic statistical tests: goodness of fit test - ANOVA, t-test - Chi-square test - Mann-Whitney test - Multivariate analysis - Using computer software to analyze and express data SPSS and Excel.

E607 Medical Entomology

Arthropods as vectors of diseases (Mechanical and Biological transmission) - Biology and medical importance of culicine mosquitoes - Biology and medical importance of blackflies - Flies and myiasis - Ectoparasitic insects.

E608 Histology and Histochemistry

Basic types of animal tissues. Histological structure of insect integument, alimentary canal, excretory system, gonads and genital system, brain and nerves, and fat body. Special requirements and precautions for histochemistry. Classification and demonstration of carbohydrates, lipids, proteins, and nucleic acids. Using autoradiographic techniques and immunohistochemical methods to follow up cell activities. Demonstration of mucopolysaccharides and other compounds.

E609 Insect Toxicology

Classification and properties of major types of insecticides; chemistry, metabolism and mode of action; selectivity, use hazards, residues and resistance; environmental problems: biological magnification, persistence and effects on non-target organisms. How to measure toxicity. The routes of death. Pesticides that disturb energy production. Pesticides inhibiting enzymes in nucleic acid synthesis. *Bacillus thuringiensis* and its toxins. Inhibitors of chitin

synthesis. Inhibitors of cholinesterase. Interference with signal transduction in nerves. Translocation and degradation of pesticides.

E610 Molecular Biology

Types of nucleic acids. Gene structure and function in prokaryotes and eukaryotes. Mechanism of DNA replication. Gene expression. Fundamentals of recombinant DNA technology. Advanced topics of molecular biology, including gene expression during cell differentiation, retroviral infection, and regulation of cell proliferation. Mutation and repair mechanisms.

E611 Microtechnique

How to obtain (histological specimens) from an insect? The steps of preparation of histological slides & the name of each step Fixation: definition, purpose, classification of fixatives, & types of fixatives, washing, dehydration, clearing, infiltration, Sectioning, staining. The histochemistry of some important simple proteins, Nucleic acids and nucleoproteins, Carbohydrates and mucosubstances, Applied mucosubstances, Lipids, lipoproteins and proteolipids. Types of light microscopes, and how to use electron microscope?

E612 Practical Entomology

Methods of insect rearing, including techniques of keeping, types of diets and rearing conditions. Basic practice, including designing of experiments, collecting results, and analyzing data. Selection of appropriate statistical tests. Presenting data, both graphically and as written texts. Pass Expressing the data for scientific audience. Training on dissemination of results.

E613 Social Insects

Sociality as a means for life in insects and other animal taxa. The evolution of insect societies. Degrees of social interactions between insects. Structure of colony in eusocial insect species. Caste formation and selection pressures. Nest-mate recognition and its significance. The honeybee language. Kin selection.

E614 Chemical Ecology

Definition of chemical ecology, chemical interactions between organisms (semiochemicals, pheromone, allelochemicals) Host plant selection, Tritrophic interaction, Parasitoids and predators, chemical defense in animals, social insects, plant-plant interaction, plant-microorganism interaction.

E615 Insect Immunity

Behavioral defense in insects. Chemical defense. Structure of insect blood. Cellular immune responses: phagocytosis, nodulation, encapsulation. Molecular events controlling cellular immune response (recognition and mediation). Humoral immune response in insects.

E616 Selected Topics

Ph.D. Entomology Program

E701 Advanced Insect Physiology (1)

Behavior and physiology. Ecology and physiology. Physiology and development. Physiology and systematics. Immune responses of insects to parasitoids, entomopathogenic fungi, and bacteria. Insect defense against viruses. Bidirectional connection between the immune system and nervous system in insects. Neurobiology of insects.

E702 Advanced Insect Behavior

Types of communication. Physical communication (sound, light, tactile). Chemical communication (semiochemicals, allelochemicals, pheromones). Sensory modalities used in insect communication. Insect pheromones. Types of pheromones. Nature and characteristics of pheromones. Processing of olfactory information. Factors affecting pheromone communication systems.

E703 Insect Endocrinology

The general principles of endocrinology. The system-based endocrinology. The endocrine system and its hormonal products, including the hormone producing cells, synthesis and modification of the hormones, release and transport of the hormones, hormone receptors and the mechanisms of hormone action, the effects of hormones on target cells, and the effects of hormones on physiological processes. The relationship between hormones, nervous system and anatomical function and structure.

E704 Insect Sensory Physiology

Morphology of sense organs in insects. Simple eyes, compound eyes, and ocelli. Tactile organs. Olfactory and taste organs. Auditory organs. Proprioceptors. Processing of information acquired through the different sensory modalities. Adaptation of sense organs to insect habitats.

E705 Forensic Entomology

Explores the science, methodology and technology employed to gather, preserve and present information about insects and other arthropods in such a manner that this information can be used in courts of law as evidence and testimony to help resolve issues of a criminal or civil nature.

E706 Advanced Histology and Histochemistry

Advanced techniques for monitoring the histological structure of insect integument, alimentary canal, excretory system, gonads and genital system, brain and nerves, and fat body. Applied methods for histochemistry.

E707 Advanced Insect Control

A brief history of pest control, Ecological concepts, pest management tactics, culture control, chemical control, genetic manipulation of crops, Genetic manipulation of pest population, Biotechnology, Theory and practices relating to the role and use of natural enemies in arthropod and plant population regulation; review and analysis of projects in biological control; biology and behavior of entomophagous arthropods. Biological control of insects, plant diseases and weeds.

E708 Biochemistry

Chemistry of biological molecules: proteins, lipids, carbohydrates, nucleic acids, etc. Mechanisms of enzyme catalysis. Metabolic pathways, integrated metabolic systems, and molecular physiology.

E709 Selected Topics

E711 Insect Behavior 2

Types of communication. Physical communication (sound, light, tactile). Chemical communication (semiochemicals, allelochemicals, pheromones). Sensory modalities used in insect communication. Insect pheromones. Types of pheromones. Nature and characteristics

of pheromones. Processing of olfactory information. Factors affecting pheromone communication systems.

E714 Genetic Engineering

Recombinant DNA, Restriction enzymes and basic cloning, DNA sequencing and PCR, Prokaryotic and Eukaryotic gene expression, molecular diagnosis, therapeutic agents, vaccines, microbial insecticides, animal genetic engineering, regulation, ethics and patenting.

E716 Molecular Biology 2

DNA-binding motifs in gene regulatory proteins. The influence of chromatin structure and gene location on gene expression. Mechanisms of transcriptional activation. Transcriptosome – profiling gene expression at the mRNA level. Gene control and micro RNAs. A view of genome function obtained by profiling gene expression at the protein level (the proteome). Global changes in protein expression and the systematic study of protein interactions in cell physiology. biotechnology.

E718 Insect Molecular Systematics

Fundamentals of insect evolution. Approaches to insect phylogenetics and classification. Insights from molecular genetics into phylogeny and classification. Species boundaries and hybridization and phylogenetic relationships. PCR and DNA amplification. Sequencing of nucleic acids and amino acids. DNA hybridization. DNA polymorphism. Intraspecific and interspecific differentiation and phylogeny reconstruction. The molecular clock. Speciation and macroevolution (Anagenesis and cladogenesis). Genetic differentiation during speciation.

E719 Cell Biology

Intracellular compartments. Co-translational translocation of proteins. Golgi apparatus and lysosomes. Protein folding, protein aggregation and protein degradation. Mechanisms of cell signaling. Microtubules. Intermediate filaments. Actin filaments. Cell contraction and locomotion. Cell cycle and programmed cell death (apoptosis). Signals that trigger cell death, growth and proliferation. Extracellular matrix (ECM), Cell-cell junctions, Cell-ECM junctions.

E720 Advanced Insect Physiology (2)

The course introduces the exoskeleton as an evolutionary influence on the various physiological processes. Regulatory processes including neural and endocrinal details. The course includes detailed discussions on: insect growth hormones and the control of molting; respiration; the hemolymph and immune systems; digestive and excretory systems; control of water balance; energy sources and metabolic hormones; muscle function and flight; reproductive maturation and vitellogenesis; chemical communication systems, the control of sex-pheromone biosynthesis and olfactory sensory reception; endogenous cycles and synchrony of biological processes. The course culminates in a discussion of the physiological adaptations of insects to the external environment.

E721 Selected Topics

E724 Advanced Insect Behavior

Types of communication. Physical communication (sound, light, tactile). Chemical communication (semiochemicals, allelochemicals, pheromones). Sensory modalities used in insect communication. Insect pheromones. Types of pheromones. Nature and characteristics of pheromones. Processing of olfactory information. Factors affecting pheromone communication systems.

E725 Economic Entomology

Major types of economically important insects. Medically important insects: pathogen vectors, ectoparasites, and insects producing drugs. Insect pests: plant pests, stored product pests, household pests. Beneficial insects: pollinators, biological control agents, honey production, silk production and production of commercial commodities.

E728 Aquatic Insects

Types of aquatic habitats: marine, brackish, inland, and fresh. Water inhabiting insects: swimmers, skaters, and striders. Insect immature stages that live in water. Basic morphological and anatomical modification as adaptation to water life. The importance of aquatic insects in food web.

E729 Advanced Chemical Ecology

Overview of chemical ecology: design and significance of bioassays, chemical techniques in studying ecological interactions, Infochemicals: semiochemicals, pheromones, allomones, kairomones, Chemical interactions among plants: allelopathy, higher plant parasites, chemical communication, Chemical recognition: chemosensory and neurophysiological basis, behavioral mechanisms, Herbivory and the chemical defenses of plants, Coevolution of herbivores and plant allelochemicals.

E730 Apiculture and Bee Keeping

Fundamentals of the biology of honeybee. Division of labor in the hive of honeybee. Initiation of a honeybee colony. Factors affecting the potentials of honeybee colony. Diseases of bees and protective measures. Swarming and reproduction of bee hives. Vegetation structure and the performance of bees. Large scale production and packaging of honey and other bee-produced materials, e.g. propolis and royal jelly.

E731 Acarology

Position of acarina among arthropods. Ontogeny, diversity and lifestyles of ticks and mites. Taxonomy of ticks and mites. Economic importance of acarina: ectoparasitic ticks and mites, acarine pathogen vectors, and plant pests. The role of mites in ecosystem. Soil mites: isolation, identification, classification and examination).

E733 Selected topics