B. Sc. Chemistry and Physics Program

The objectives of B.Sc Chemistry and Physics program are:

1. Providing students with a broad spectrum of the basic concepts and theories in basic sciences.
2. Enhancing the role of Physics and chemistry in life sciences and other disciplines
3. Developing scientific approaches that meet community needs considering economic, environmental, social, ethical, and safety requirements.
4. Improving the necessary knowledge and skills to solve a wide range of physical and chemical problems and apply effectively information technology relevant to physics and its applications.
5. Developing the ability of students to conduct, observe, analyze and report on experimental work.
6. Enabling students to communicate effectively in different ways.
7. Improving students' self and life-long learning skills

Courses of Chemistry and Physics Program

أكواد ورموز المقـــررات

الكـــــود	اسم المقـــرر	الكـــــود	اسم المقـــرر
ر (Math)	رياضيـــات	م (M)	ميكروبيولوجى
ف (Phys)	فيزيـــاء	جف (GPhys)	جيوفيزيـــاء
ك (Chem)	كيميـــاء	ف ح (BioPhys)	فيزياء حيويـة
ج (G)	جيولوجيـــا	ك ح (BioChem)	كيمياء حيويـة
ح (Z)	حيـــوان	ع ب (ES)	علوم بيئية
ن (B)	نبـــات	ع (Uni)	متطلبات جامعة

أولاً : متطلبات الجامعة : (8 س.م)

أ-- مقررات إجبارية : " القائمون بالتدريس "

- حقوق الإنسان ومكافحة الفساد (ع101) (2 س.م) كلية العلوم أو كلية الحقوق
- مقدمة فى علم الحاسب (ع102) (2 س.م) كلية العلوم
- مصطلحات علمية باللغة الإنجليزية (ع201) (2 س.م) كلية العلوم

ب -- مقررات إختيارية : عدد (2 س.م) فى المواد الثقافية فى أحد المقررات الأتية:

- **الثقافة البيئية (ع202) كلية العلوم**
- **تاريخ وفلسفة العلوم (ع203) كلية العلوم**
- **أخلاقيات مزاولة المهنة (ع205) كلية العلوم**
- **مهارات التواصل (ع206) كلية العلوم**
- **دراسة الجدوى (ع207) كلية العلوم أو كلية التجارة**
- **الجودة والتخطيط الإستراتيجى (ع208) كلية العلوم أو كلية التجارة**
- **الأمان المعملى (ع210) كلية العلوم**

هيكل و مكونات البرنامج :

أ- مدة البرنامج : أربع سنوات
ب –هيكل البرنامج :

نظري	**112**	**عملي**	**24**	**إجمالي**	**136**
إلزامي	**94**				
إنتقائي	**2**				
اختياري	**16**				

□ *التدريب الميداني* : يؤدى كافة طلاب الكلية بعد إجتيازهم بنجاح 72 ساعة معتمدة تدريبات تطبيقية لمدة 8 أسابيع فى شركات أو مصانع أو هيئات ذات صلة بالتخصص أو أحد المراكز أو الأقسام العلمية بالجامعة.

جـ- مستويات البرنامج (في نظام الساعات المعتمدة): 4 مستويات
المستوى الأول / السنة الأولى : يلزم اجتياز 38 وحدة موزعة كالتالي :
إلزامي 36 انتقائي 2، اختياري .....
المستوى الثاني / السنة الثانية : يلزم اجتياز 36 وحدة موزعة كالتالي :
إلزامي 32 انتقائي ..... اختياري 6
المستوى الثالث / السنة الثالثة : يلزم اجتياز 36 وحدة موزعة كالتالي :
إلزامي 31 انتقائي ..... اختياري 6
المستوى الرابع / السنة الرابعة : يلزم اجتياز 36 وحدة موزعة كالتالي :

المقررات الدراسية لبرنامج الكيمياء والفيزياء (المستوى الأول)

الفصل الدراسى	كود المقرر	إسم المقرر	متطلبات المقرر	حالة المقرر		توزيع عدد الساعات أسبوعيا				الدرجة					ملاحظات
				إجبارى	إختيارى	نظرى	عملى تطبيقى	تمرينات تطبيقية	المعتمدة	عملى	شفهى	تطبيقى/ فصلى	نظرى	المجموع	
الأول	ر111	تفـاضل وتكامل (1)	--	1	--	2	--	2	3	--	10	20	70	100	
	ف 101	خواص المادة والحرارة	--	1	--	2	2	1	3	20	10	10	60	100	
	ك101	كيمياء عامة (1)	--	1	--	2	3	--	3	20	10	10	60	100	
	ك 102	كيمياء عامة (2)	--	1	--	2	3	--	3	20	10	10	60	100	
	ح111	حيوان عام	--	1	--	2	2	--	3	20	10	10	60	100	
	ع 101	حقوق الإنسان ومكافحة الفساد	--	1	--	2	--	--	2	--	--	--	100	--	متطلبات جامعة
المجموع				6	--				17					500	
الثانى	ر112	جبر و هندسة	--	1	--	2	--	2	3	--	10	20	70	100	
	ف 102	كهربية ومغناطيسية وضوء	--	1	--	2	2	1	3	20	10	10	60	100	
	ك131	أسس الكيمياء العضوية (1)	--	1	--	2	--	--	2	--	10	20	70	100	
	ن106	فسيولوجي وميكروبيولوجى	--	1	--	2	2	--	3	20	10	10	60	100	
	ج 102	البلورات والمعادن	--	1	--	2	3	--	3	20	10	10	60	100	
	ع102	مقدمة فى علم الحاسب	--	1	--	2	--	1	2	--	10	20	70	100	متطلبات جامعة
المجموع				6					16					600	
مجموع الفصلين				12					33					1100	

المقررات الدراسية لبرنامج الكيمياء والفيزياء (المستوى الثانى)

الفصل الدراسى	كود المقرر	إسم المقرر	متطلبات المقرر	حالة المقرر		توزيع عدد الساعات أسبوعيا				الدرجة					ملاحظات
				إجبارى	إختيارى	نظرى	عملى تطبيقى	تمرين تطبيقى	المعتمدة	عملى	شفهى	تطبيقى/ فصلى	نظرى	المجموع	
الثالث	ف 201	عملى فيزياء (1)	--	1	--	--	4	--	2	60	--	40	--	100	
	ف 213	فيزياء نووية (1)	--	1	--	2	--	1	2	--	10	20	70	100	
	ك 213	التحليل الحجمي والوزني	ك102	1	--	2	3	--	3	20	10	10	60	100	
	ك 221	كيمياء العناصر الممثلة	ك 101	1	--	2	--	1	2	--	10	20	70	100	
	ك 231	كيمياء عضوية فيزيائية (1)	ك 101	1	--	2	--	1	2	--	10	20	70	100	
	ر 210	معادلات تفاضلية	ر111	1	--	2	--	1	2	--	10	20	70	100	
	ف 211	موجيات واهتزازات	--	--	1	2	--	1	2	--	10	20	70	100	اختيار مقرر واحد
	ف 215	فيزياء المرونة				2	--	1		--	10	20	70		
	ع201	مصطلحات علمية باللغة الإنجليزية		1	--	2	--	--	2	--	10	--	90	100	متطلبات جامعه
المجموع				7	1				17					800	
الرابع	ف 202	عملى فيزياء (2)	--	1	--	--	4	--	2	60	--	40	--	100	
	ف 210	فيزياء ذرية	--	1	--	2	--	1	2	--	10	20	70	100	
	ف 220	فيزياء حديثة	ف213	1	--	2	--	1	2	--	10	20	70	100	
	ف 221	ضوء فيزيائى	--	1	--	2	--	1	2	--	10	20	70	100	
	ك 230	كيمياء عضوية عملية (1)	ك 101	1	--	--	6	--	2	60	--	40	--	100	
	ك 233	أطياف المركبات العضوية (1)	ك 131	1		2	--	1	2	--	10	20	70	100	
	ك ح278	أسس الكيمياء الحيوية (2)	ك 101	1	--	2	--	--	2	--	10	20	70	100	
	ك 242	كيمياء الكم	ك 102	--	1	2	--	1	2	--	10	20	70	100	إختيار مقرر واحد
	ك 243	النظرية الحركية للغازات - قاعدة الصنف				2	--	--		--	10	20	70		
	ع 202- ع 210	مواد ثقافية (اختيار مقرر واحد)	--	--	1	2	--	--	2	--	--	--	100	--	متطلبات جامعه
المجموع				7	2				18					800	
مجموع الفصلين				14	3				35					1600	

المقررات الدراسية لبرنامج الكيمياء والفيزياء (المستوى الثالث)

الفصل الدراسى	كود المقرر	إسم المقرر	متطلبات المقرر	حالة المقرر		توزيع عدد الساعات أسبوعيا				الدرجة					ملاحظات
				إجبارى	إختيارى	نظرى	عملى تطبيقى	تمرين تطبيقى	المعتمدة	عملى	شفهى	تطبيقى/ فصلى	نظرى	المجموع	
الخامس	ف 301	عملى فيزياء (3)	--	1	--	--	6	--	2	60	--	40	--	100	
	ف 314	ميكانيكا كم (1)	--	1	--	2	--	1	2	--	10	20	70	100	
	ك 324	الكيمياء التناسقية وكيمياء العناصر الإنتقالية	ك221	1	--	2	3	--	3	20	10	20	60	100	
	ك 330	كيمياء عضوية عملية (2)	ك 230	1	--	--	6	--	2	60	--	40	--	100	
	ك331	كيمياء المركبات غير متجانسة الحلقة	ك 231	1	--	2	--	1	2	--	10	20	70	100	
	ك341	كيمياء كهربية (1)	ك102	1		2	--	1	2	--	10	20	70	100	
	ك343	كيمياء حركية	ك102	1	--	2	--	1	2	--	10	20	70	100	
	ف 311	فيزياء الجوامد (1)	ف210	--	1	2	--	1	2	--	10	20	70	100	إختيار مقرر واحد
	ف323	فيزياء نووية (2)	ف213	--		2	--	1		--	10	20	70		
	ف 317	فيزياء المعادن	--	--	1	2	--	1	2	--	10	20	70	100	
	ف 329	أطياف جزيئية	ف210	--		2	--	1		--	10	20	70		
المجموع				7	2				19					900	
السادس	ف 302	عملى فيزياء (4)	--	1	--	--	6	--	2	60	--	40	--	100	
	ف 322	فيزياء المواد غير المتبلورة	--	--	1	2	--	1	2	--	10	20	70	100	
	ف 327	فيزياء البوليمرات	--	1	--	2	--	1	2	--	10	20	70	100	
	ف 335	دوائر الكترونية والكترونيات رقمية	--	1	--	2	--	2	3	--	10	20	70	100	
	ك 315	التحليل الكهربى والطيفى	ك213	1	--	2	3	--	3	20	10	10	60	100	
	ك344	كيمياء السطوح وتطبيقاتها	ك102	1	--	2	3	--	3	20	10	10	60	100	
	ك 333	كيمياء عضوية تطبيقية	ك101	--	1	2	--	--	2	--	10	20	70	100	إختيار مقرر واحد
	ك 334	كيمياء الاصباغ والالياف				2	--	--		--	10	20	70		
المجموع				6	1				17					700	
مجموع الفصلين				13	3				36					1600	

المقررات الدراسية لبرنامج الكيمياء والفيزياء (المستوى الرابع)

الفصل الدراسى	كود المقرر	إسم المقرر	متطلبات المقرر	حاله المقرر		توزيع عدد الساعات اسبوعيا					الدرجة					ملاحظات
				إجبارى	إختيارى	نظرى	عملى تطبيقى	تمرين تطبيقى	المعتمدة	عملى	شفهى	تطبيقى/ فصلى	نظرى	المجموع		
السابع	ف 401	عملى فيزياء (5)	ف302	1	--	--	6	--	2	60	--	40	--	100		
	ف410	الليزر وتطبيقاتها	--	1	--	2	--	1	2	--	10	20	70	100		
	ف 420	فيزياء الجوامد (2)	ف 311	1	--	2		1	2		10	20	70	100		
	ف 431	فيزياء الألوان	ف221	1	--	2	--	1	2	--	10	20	70	100		
	ك 401	مشروع بحث ومقال	--	1	--	1	--	--	1	--	10	10	30	50		
	ك 431	كيمياء المنتجات الطبيعية	ك 231	1	--	2	--	--	2	--	10	20	70	100		
	ك 441	الحفز وتطبيقاتة	ك 344	1	--	2	3	--	3	20	10	10	60	100		
	ف 435	اللغة العلمية للحاسب	--	1	--	2	--	1	2	--	10	20	70	100		أختيار مقرر واحد
	ف 430	الفيزياء الرياضية لغيرالفيزيائيين (2)				2	--	1		--	10	20	70			
المجموع				6	1				16					650		
الثامن	ف 402	عملى فيزياء (6)	ف401	1	--	--	6	--	2	60	--	40	--	100		
	ف 405	مشروع بحث ومقال	--	1	--	1	--	--	1	--	10	10	30	50		
	ف 411	أشباه الموصلات	--	1	--	2	--	1	2	--	10	20	70	100		
	ف 415	فيزياء نوويه (3) وجسيمات أولية	ف 312	1	--	2	--	1	2	--	10	20	70	100		
	ك 425	كيمياء العناصر الإنتقاليه الداخليه وروابط المتراكبات (2)	ك221	1	--	2	3	--	3	20	10	10	60	100		
	ك 437	كيمياء البوليمر والبترول والبتروكيماويات	ك 231	1	--	2	--	--	2	--	10	20	70	100		
	ك 442	الكيمياء الفيزيائية للسوائل وللمحاليل - - الغرويات	ك102	1	--	2	--	--	2	--	10	20	70	100		
	ك 412	كيمياء البيئة وتطبيقات النانو (1)	ك102	--	1	2	--	--	2	--	10	20	70	100		أختيار مقرر واحد
	ك 414	مقرر خاص في الكيمياء التحليلية		--		2	--	--		--	10	20	70			
المجموع				7	1				16					750		
مجموع الفصلين				13	2				32					1400		

Courses Contents

Math.111 Fundamental Math (1) Algebra and Geometry, 2 h/W

Descriptions: Algebra: Mathematical induction and Partial fractions. Binomial theorem and its applications, Solution of cubic equations, Solution of 4th degree equations, Sets, subsets, set operations and inductively definition of sets, equivalence relations, equivalence classes, partitions and partial order, maps, composition of maps, kinds of maps and inverse functions. Geometry: 1- coordinate plane: Rectangular coordinates and polar coordinate – distance – change of axes - Straight line in plane and the common equation of two lines - Circle - The conic section: Parabola – Ellipse –Hyperbola - The general equation of the second degree in two variables

Phys 101 General Physics (1) (Thermal physics and Properties of Matter), 2h/W

This course aims at developing a clear understanding of the basic concepts in Thermal physics and Properties of Matter. The thermal physics course includes: The zeroth law of Thermodynamics. Thermal Expansion of Solids and Liquids. Heat and Thermal Energy. Heat Capacity and Specific heat-Latent heat. Thermodynamic process. Liquifiaction of gases.

The Properties of matter course includes : Units and Dimensions. Oscillatory Motion. Rotational Dynamics. Earth Satellites. Fluids. Surface Tension. Elasticity.

Chem.101, Inorganic Chemistry (Principles of Inorganic Chemistry) 2 h/W

Chemical calculations. Atomic spectra (Electromagnetic waves, Bohr's theory, principles of wave mechanics). Atomic structure. Electronic configuration of atoms. Periodic Table and the general properties of representative elements (size of atoms and ions, ionization energy, electronic affinity, electronegativity, electropositivity and polarization).Oxidation states. Types of chemical bonds (ionic, covalent, coordinate, hydrogen and metallic). Lewis structure and formal charge.Theories of bonding: valance shell electron ,pair repulsion (VSEPR),valence bond theory(VBT), molecular orbital theory (MOT) and molecular geometry.

Chem 102 Principles of Physical and Analytical Chemistry :(2h lectures + 3h practical weekly)

Physical Chemistry: (12 lecture x 1 hr) Significant figures, Measurement and unit: The gaseous state, the gas laws, real and ideal gases, the liquid state and the solid state. Thermochemistry, thermo- chemical equations, Hess's law; ΔH for various processes; bond energies, variation of ΔH with temperature; heat capacities:. Kirchoff's equation. The Solution Process, Ways of Expressing Concentration. Factors Affecting Solubility. Raoult's Law Colligative Properties - Lowering the Vapor Pressure - Boiling-Point Elevation - Freezing Point Depression – Osmosis -Determination of Molar Mass. Chemical equilibria: The equilibrium state. The Reaction Quotient – The relationship between K_c and K_p - Heterogeneous Equilibria - Le-Chatelier's Principle and Chemical Equilibrium. Equilibria in Aqueous Solutions The Arrhenius Theory of Acids and Bases, Bronsted-Lowry and Lewis theory of Acids and Bases - Auto-ionization of water and

pH - Ionization Constants of Weak Electrolytes and Polyprotic Acids - Common Ion Effect and Buffers - Hydrolysis Constants - Acid-Base Titration Curves. Solubility and Ksp relationship.
Analytical Chemistry: (12 lecture x 1 hr) Qualitative and quantitative analysis; Data Handling, Accuracy and precision; rounding off; determination of errors; indeterminate errors; standard deviation; propagation of error; significant figures and propagation of error; the confidence limit; the Q test; the correlation coefficient; detection limits and static of sampling Stoichiometric Calculations ,Review of fundamental concepts; concentrations of solutions and titer .. Acid – Base titrations, Neutralization reactions of different acids with different bases and their titration curves. Solubility and Ksp - Relationship of Ion Product to Solubility – predicting. Precipitation titrations; their types and their curves, Complexometric Titrations, Formation constants of complexes; EDTA titrations, their curves and their indicators. Oxidation–Reduction reactions and titrations Oxidation–Reduction reactions; electrochemical cells; electrode potentials; the potential of electrochemical cell; redox titrations curves; indicators and applications.

Z111 Introduction of Cytology, Histology & Genetics: (2h lectures and 2h practical/Weekly)
Cell components and ultrastructure- cell division (mitosis and meiosis)- epithelial tissues- connective tissues- vascular tissues- muscular tissues- nervous tissues- basic molecular biology- genetic engineering techniques- DNA modifying enzymes- the biology of genetic engineering.

Math112 Algebra and Geometry: (2h lecture and 2h tutorial /Weekly)

Descriptions: Algebra: Mathematical induction and Partial fractions. Binomial theorem and its applications, Solution of cubic equations, Solution of 4th degree equations, Sets, subsets, set operations and inductively definition of sets, equivalence relations, equivalence classes, partitions and partial order, maps, composition of maps, kinds of maps and inverse functions. Geometry: 1- coordinate plane: Rectangular coordinates and polar coordinate – distance – change of axes - Straight line in plane and the common equation of two lines - Circle - The conic section: Parabola – Ellipse –Hyperbola - The general equation of the second degree in two variables.

Phys 102 General Physics,(Electricity and Magnetism – Optics), (2) 2h/W
Electricity and Magnetism course includes: Electric current and ohm's law, Network theorem, Work, power and energy, Capacitance and inductance, Magnetism and electromagnetism, Electromagnetic induction.
Optics course includes: Nature of light, propagation of light, deviation of light by prisms and dispersion, image formation, perception of light and color vision, Lasers.

B106 Physiology & Microbiology: (2h lecture and 2h practical /weekly)

Plant physiology: Cytoplasm and its physical & chemical properties **-** Osmosis and permeability -
Studies on physiological interaction between: plants & soil – Enzymes - Respiration & Photosynthesis
Microbiology - Microbial diversity - Prokaryotes (Bacteria & Archaea): Cell Envelopes, Cell Walls, Cell Components, External Structures **-** Eukaryotic cell structure (fungi) **-** Isolation & cultivation of microorganisms **-** Environmental factors affecting microbial growth **-** Modes of nutrition in microorganisms **-** Control of microbial growth **-** Microbial interactions & biogeochemical cycles in the environment.

G102 Crystallography and Mineralogy: (2h lectures + 3h practical weekly)

Crystallography: Definition and crystal parts, interfacial angles and their law, crystallographic elements, crystal symmetry, crystal habit and forms, crystal aggregates, crystal systems, holohedral and hemihedral forms, hemimorphism and enantiomorphism, axial ratios-crystal parameters and Miller indices, zone, zone axes and zone symbols and law. General description of the crystal systems. Stereographic projection. Practical examination of models representing crystal forms of seven crystal systems.
Mineralogy: Definitions – Physical and chemical properties of minerals – Chemical compositions – Origin of minerals – Classification of minerals – Minerals of the Earth's crust – Mineral associations in rocks and ore deposits - Description of crystal forms; genesis, field occurrences and uses of some important minerals. Laboratory investigation of hand specimens representing the major mineral groups.

Chem 131 Principles of Organic Chemistry (1): (2h lectures/ weekly)

Structure, Reactivity, isomerism, Preparation and Reactions of Alkanes, Alkenes, Alkynes, Aromatic hydrocarbons, Alkyl Halides, Alcohols, Ethers, Aldehydes and Ketones, Carboxylic acids, Carboxylic acid derivatives, Benzene derivatives (phenols – aryl Halides, ethers, aldehydes and ketones, carboxylic acids, carboxylic acid derivatives) and Amines.

Uni.101 Computer Science (1), 2h/W
Descriptions: 1- Basic concepts- characteristics of computer- history of computer- computer generations - computer hardware - memory system in a computer - secondary storage - input output devices. 2- Software - software types- languages- law and high level languages – operating system- introduction to windows and applications- desktop - windows explorer – MS-DOS window –task bar -start menu- recycle bin- change windows settings. 3- Data communication and computer -- computer network - network topology- fundamentals of internet - internet- the history- services of internet - e-mail, ftp, telnet, www- world wide web (www). 4- The Microsoft excel- excel window- worksheet- entering data- making numeric entries- numbers and mathematical calculations.
5-Number systems (Decimal- binary- Octal- Hexadecimal - and transformations between these systems- Mathematical Operations.

Phys 210 Atomic Physics :(2h lecture and 1h tutorial/Weekly)

This course aims to introduce and explain the principles, models, and methods required to understand the behavior of atoms. The course includes: Black body radiation, Rayleigh-Jeans law, Planck's law. Photoelectric effect. Compton effect.X-rays { production of X-rays, continuous X-rays, characteristic x-rays, Moseley's law – Diffraction and absorption of x-rays}, Bohr model of H atom, energy level diagram, spectral series of H atom, H like ions. Wilson-Sommerfeld elliptical orbits {fine structure, degenerate orbits, mass relativistic effect, energy level diagram, selection rule}, Vector atom model. Normal Zeeman effect.

Phys 213 Nuclear physics (1) :(2h lecture and 1h tutorial/Weekly)

This course aims to introduce and explain the principles models and methods required for understanding the properties of the nucleus. The course includes; Structure of the nucleus: Basic properties of the nucleus Binding energy of the nucleus, Nuclear stability, Liquid-Drop model, Semi-empirical mass formula. The decay of the nucleus: The law of radioactive decay, Natural radioactivity and Alpha decay, Beta decay, Gamma decay, Interaction of Nuclear radiation with matter. Detectors. Accelerators.

Phys 211 Vibration and Waves: (2h lecture and 1h tutorial/Weekly)

This course aims at introducing a clear understanding of the basic concepts of Vibration and Waves. The course includes; Periodic motions, The Superposition of periodic motions, The free vibrations of the physical system, Forced vibrations and Resonance, Normal mode of Continuous System, Doppler effect.

Phys 215 Physics of Elasticity :(2h lecture and 1h tutorial/Weekly)

The course aims at introducing the concept of elasticity. It consists of; The Concept of the Force, plane stress, plane strain and Different Physical Properties of Material, The Mechanism of Fracture of Different Material, and Fundamental of Fracture Mechanics, Fatigue, Creep. Torsion and Twisting of the metallic beam.

Phys 220 Modern Physics :(2h lecture and 1h tutorial/Weekly)

Pre-requisite: Phys 220

This course aims at developing a clear understanding of the basic concepts of modern physics. The course includes: The special theory of relativity: Galilean transformations and their limitations, Einstein's postulates and Lorentz transformations, Length, time and simultaneously in relativity, Mass and momentum in relativity, Relativistic Mechanics, Mass and Binding Energy, Experimental verification of the relativity theory, The concepts of waves and particles: Black-body radiation, The photo-electric effect, The continuous X-ray spectrum, The photon, The Compton effect, The de-Broglie hypothesis, The diffraction of waves and particles, Introductory quantum mechanics, Bohr's principle of complementarity, Wave-packet description of material particles, Statistical interpretation of the wave function, Heisenberg uncertainty principle.Schrödinger wave equation, Particle in a one-dimensional potential well.

Phys 221 Physical Optics :(2h lecture and 1h tutorial/Weekly)

An understanding of the basic physical optics and describes the behavior and properties of light and interaction of light with matter. The course includes; the wave theory of light, Interference of two beams of light, Interference with multiple-beams, Diffraction of light, Polarization of light, Dispersion and absorption of light.

Chem 213 Volumetric and gravimetric Analysis: (2h lectures + 3h practical/ weekly)
Pre-requisite: Chem 102

Review of fundamental concepts; concentrations of solutions and titer Acid – Base titrations, Neutralization reactions of different acids with different bases and their titration curves. Solubility and Ksp - Relationship of Ion Product to Solubility – predicting. Precipitation titrations; their types and their curves. Complexometric Titrations, Formation constants of complexes; EDTA titrations, their curves and their indicators. Oxidation–Reduction reactions and titrations Oxidation–Reduction reactions; electrochemical cells; electrode potentials; the potential of electrochemical cell; redox titrations curves; indicators and applications. General principles of gravimetric analysis; preliminary treatment; precipitation step, filtration and washing of the precipitate; drying or ignition of the precipitate; thermal analysis.

Chem 221 Chemistry of representative elements: (2h lectures + 1h tutorial/ weekly)
Pre-requisite: Chem 101

General properties of the elements. Metallurgy and isolation. Chemistry of hydrogen. Chemistry of the Alkali metals. Chemistry of alkaline earth metals. Chemistry of group (IV) elements. Chemistry of group (V) elements. Chemistry of group (VI) elements. Chemistry of halogens. Chemistry of inert gases. Applications.

Chem 231 Physical Organic Chemistry (1): (2h lectures + 1h tutorial/ weekly)
Pre-requisite: Chem 101

Reactivity, Kinetics, and Mechanisms - Ionic Reactions - Nuclophilic Substitution reactions (SN^1, SN^2, SN^i) - Elimination reactions (E^1, E^2) - Electrophic aromatic substitution reactions - Nucleophilic aromatic substitution reactions – free radical reactions.

Chem 233 Spectroscopy of Organic compounds (1): (2h lectures + 1h tutorial/ weekly)
Pre-requisite: Chem 131

The Electromagnetic Spectrum - Ultraviolet spectroscopy - IR spectroscopy - Nuclear Magnetic Resonance spectroscopy - Mass Spectrometry - Applications on Structure Determination.

Chem 242 Quantum Chemistry: (2h lectures + 1h tutorial/ weekly)

Pre-requisite: Chem 102

Introduction to Quantum theory and Its Origin – wave particle duality - Properties of Wave Function - Schrödinger Equation - postulates of quantum mechanics - quantum mechanical operators and Eigen value Equations - Probability and expectation Values - Particle in a one, two and three dimensional box - Heisenberg Uncertainty Principle - Rigid rotor model - Rotational motion - Qualitative treatment of simple harmonic oscillator model - vibrational motion - Angular momentum - Schrödinger Equation of hydrogen atom and hydrogen like ions - Schrödinger equation for many-electron atoms - The Born-Oppenheimer approximation - Variational principle - Qualitative description of LCAO-MO treatment of homonuclear and heteronuclear diatomic molecules.

Chem 243 Kinetic theory of gases – Phase rule: (2h lectures + 1h tutorial/ weekly)
Pre-requisite: Chem 102

Kinetic theory of gases, ideal gas model, kinetic theory of gases, equipartition theorem. Two-parameter Equations of State, Virial Coefficients, van der Waals interactions and Molecular Potentials, Temperature as a measure of Kinetic Energy, The Maxwell-Boltzmann distribution for molecular speeds , The Mean Free Path and Collision frequencies, Diffusion, viscosity, thermal conductivity . Brownian movement and Avogadro's number-theory of non-ideal behavior- principle of corresponding states. Partition Functions, Translational Partition Functions. Electronic Partition Functions. Vibrational Partition Functions. Rotational Partition Functions. Phase rule, Application of the thermodynamic concepts to the analysis of phase equilibrium, phase transformations, -Gibbs Phase Rule and phase diagrams in one-component system. Binary phase diagrams. Binary phase diagrams and Gibbs free energy curves. Binary solutions with unlimited solubility. Relative proportion of phases (tie lines and the lever principle).. Binary eutectic systems (limited solid solubility). Solid state reactions (eutectoid, peritectoid reactions). Binary systems with intermediate phases/compounds. Gibbs phase rule. Temperature dependence of solubility. Multi-component (ternary) phase diagrams.

Chem 315 Electrochemical and Spectrochemical Analysis: (2h lectures + 3h practical/ weekly)
Pre-requisite: Chem 213

Electrochemical analysis: Introduction; potentiometry, voltametry, polarography, electrodeposition, coulometry and conductometry.
Spectrochemical Analysis: Overview of spectroscopic theory and techniques.Ultra –violet and visible spectroscopy - Atomic absorption and emission - X-ray fluorescence spectroscopy - Infrared spectroscopy - Application.

Chem 321 Chemistry of Transition Metals and Complexes: (2h lectures+1h tutorial/weekly)
Pre-requisite: Chem 221

Transition Metals: General properties of transition metals (d-block elements)- Chemistry of scandium, titanium, vanadium, chromium, manganese, iron ,cobalt, nickel, copper and zinc groups in terms of their electronic configuration, different oxidation states, physical and chemical properties of the elements and their compounds. Structure of some important compounds. Isolation of elements. Uses and applications.
Complexes: Werner theory of coordination chemistry- Classification of ligands and complexes- Nomenclature- Coordination number and stereochemistry of complexes- preparation of complexes- Isomerisms among inorganic complexes- Detection of complexes in solid and solution- Nature of metal-ligand bonding in complexes- Valence bond, Crystal field and ligand field theories. Stability of complexes- Inorganic reaction mechanism.

Chem 322 Chemistry of f-block elements and organometallic compounds: (2h lectures+1h tutorial/weekly)
Pre-requisite: Chem 221

F-block elements: General properties of lanthanides and actinides- Electronic configuration- Physical and chemical properties of lanthanides- Extraction of lanthanides- Methods of separation- Application in industry- Properties of actinides- The chemistry of some elements- Trans- uranium elements.

Chem 331 Heterocyclic compounds: (2h lectures+1h tutorial/weekly)
Pre-requisite: Chem 231

Importance and Nomenclature of heterocyclic compounds - Three membered heterocyclic rings with one heteroatom - Five membered heterocyclic rings with one heteroatom (pyrrole, furan and thiophene) - Benzoderivatives of five-membered heterocycles with one heteroatom - Five membered heterocyclic rings with two or more heteroatoms - Six membered heterocyclic rings with one heteroatom and their benzoderivatives (pyridines, quinolines and isoquinolines) - Six membered heterocyclic rings with two or more heteroatoms.

Chem 333 Applied Organic Chemistry: (2h lectures/weekly)
Pre-requisite: Chem 101

Synthetic and botanical insecticides – fungicides – herbicides – fumigants – rodenticides – nematicides – Industry of fats and fatty oils (oils, fats, waxes, soap, stearic acid, candle, oleomargarine, glycerine) – Industry of the essential oil and resins (perfumes, varnishes, printing inks, miscellaneous products from resins and essential oils).

Chem 334 Dyes and fibers Chemistry : (2h lectures/weekly)
Pre-requisite: Chem 101

Dyes: color, photoelectric theory, complement-dry light, classification of dyes according to chemical constitution - nitroso, nitro dyes, azodyes (monoazo and disazo dyes) triarylmethane dyes and related dyes - xanthenedyes, vat dyes, indigo dyes, anthraquinone dyes, introduction to reactive dyes, photographic sensitizers.
Fibers: textile fibers - fiber structure- fiber properties fiber identification - classification of fibers- cellulose **Fibers:** cotton flax, hemp jute-man - made cellulosic fibers- rayon acetate and triacetate protein fibers- wool and silk fibers – Synthetic fibers (Polyester fiber, nylon fibers, acrylic fibers, spandex fibers, polypropylene fibers) - the processing of textiles purification and preliminary singeing: desizing, scouring, bleaching and mercerizing dyeing - the kinds of forces by which dye molecules are bound to the fiber.

Chem 338 Spectroscopy of Organic compounds: (2h lectures+1h tutorial/weekly)
Pre-requisite: Chem 231

The Electromagnetic Spectrum - Ultraviolet spectroscopy - IR spectroscopy - Nuclear Magnetic Resonance spectroscopy - Mass Spectrometry - Applications on Structure Determination.

Chem 341 Electrochemistry (1): (2h lectures+1h tutorial/weekly)
Pre-requisite: Chem 101

Reversible processes; Reversible galvanic cells- EMF and its measurements- types of electrodes- relation between cell potential and free energy- types of cells (concentration cells- electrochemical cells-cells with and without transfer)" applications of EMF measurements. Irreversible processes; Types of overpotential (ohmic-concentration-activation) electrode kinetics- Tafel equation- exchange current-mechanism of hydrogen and oxygen reduction- storage cells (reversible and irreversible)- fuel cells.

Chem 342 Electrochemistry (2): (2h lectures + 3h practical/ weekly)
Pre-requisite: Chem 241

Reversible processes; Reversible galvanic cells- EMF and its measurements- types of electrodes- relation between cell potential and free energy- types of cells (concentration cells- electrochemical cells-cells with and without transfer)" applications of EMF measurements. Irreversible processes; Types of overpotential (ohmic-concentration-activation) electrode kinetics- Tafel equation- exchange current-mechanism of hydrogen and oxygen reduction- storage cells (reversible and irreversible)- fuel cells.

Chem 343 Chemical kinetics: (2h lectures+1h tutorial/weekly)
Pre-requisite: Chem 102

Elementary reaction kinetics: Definition of Elementary reactions - The molecularity of a reaction - Molecularity vs. order -The rate laws Variations of concentrations with time. The determination of the reaction order from the integration method - Fractional lifetime method - The isolation method - Comparison of these methods. The temperature dependence of reaction rates (The Arrhenius equation). Energy of activation, calculation of activation energies. Potential energy surfaces. Consecutive elementary reactions - Mechanism of chemical reactions -The rate-determining step - The steady state approximation. Kinetic of revisable reactions. Chain Reactions: Introduction - The rate laws of chain reactions: Example of a chain reaction having a complicated rate law - The formation of HBr from hydrogen and bromine. Special case: Explosions. parallel reactions .A theoretical approach to chemical kinetics: Collision theory -The reaction profile in the Collision Theory-Derivation of the rate law through the Collision theory - Activated complex theory -The reaction profile in the ACT- Derivation of the rate law through the-ACT (the thermodynamic derivation) -The activated complex theory and reactions between ions. The Lindemann Hinshelwood Mechanism - First-order gas phase kinetics Unimolecular Reactions. Influence of solvent and pressure on rates in solution - Primary salt effect in ionic reactions.

Chem 344 Surface chemistry and its applications: (2h lectures + 3h practical/ weekly)
Pre-requisite: Chem 102

Liquid interfaces, surface tension and surface free energy, measurement of surface and interfacial tension, spreading coefficient; adsorption at liquid interface, study of surfactants including applications like wetting foaming and antifoaming agents, hlb classification, solubilization, detergency, adsorption on solid interface, solid-gas and solid-liquid interfaces, complex films, electrical properties of interfaces. The terminology of surface chemistry is introduced. Liquid-gas interface and liquid-liquid interface. Measurement techniques for surface and interfacial tension are discussed. The importance of interfacial free surface science is explained through relevant examples. Wetting, detergency, micelle formation, emulsions, microemulsions, foam stability, ore flotation, and adsorption at the gas-solid and liquid-solid interfaces. Liquid interfaces: interfacial tension, adsorption at interfaces, surface active agents, adhesion and cohesion, wetting and contact angle, spreading, nucleation processes.

Chem 400 Research Project and Essay: (2h lecture weekly for one term)

Reviewing a research project in chemistry to be selected by the department, preparing a written essay on it.

Chem 433 Petroleum chemistry and petrochemicals: (2h lectures / weekly)
Pre-requisite: Chem 131

Petroleum chemistry: Composition of petroleum hydrocarbon constituents (paraffin's, aromatics, apothems) non-hydrocarbon constituents (sulphur, nitrogen, oxygen, and metallic compounds together with resinous and asphaltic materials) - specifications of petroleum and its products- classification of crude petroleum (according the chemical composition and the sulphur percentage) some physical aspects concerning petroleum fuels (diesel index, cetane number and octane number of motor and aviation fuel) - manufacturing processes and oil refinery - separation processes – distillation - absorption – adsorption - solvent extraction - conversion processes - production of motor and jet fuels –cracking – reforming - isonierisation - refining and treating processes - refining of light petroleum products - removal of H_2S, of mercaptans, sweetening - and desulphurization processes, and hydrogen treatment - refining of lubricating oils - acid treatment,

clay treatment and dewaxing - miscellaneous refining processes (water removal, and stability of gasoline) - motor aviation, jet and diesel fuels composition, volatility, combustion and stability – characterization tests of petroleum products.
Petrochemicals: Types of reactors used in petrochemical processes - Types of catalysts used in petrochemical processes - Raw materials of petrochemicals - Types of Petroleum processes (Oxidation, Nitration, Halogenation, Sulphonation, Sulphoxidation and Sulphohalogenation of hydrocarbons, Isomerization reaction, Alkylation processes) - Some petrochemical products (Detergents – Monomers – Insecticides - Synthetic fibers - Rubber and plasticizers - Paints and solvents – Explosives).

Chem 431 Natural Products Chemistry: (2h lectures / weekly)
Pre-requisite: Chem 231

Definition, classification of natural products. Biosynthetic pathways (shikimic, mevalonic, acetate) of natural products. Terpenoids (definition, isoprene rule, exceptions of special isoprene rule, isolation, classification, methods of structure elucidation, examples for different terpenes). Terpenoids (structure elucidation and synthesis of selected terpenoids). Steroids (classes, stereochemistry, structure elucidation of selected steroids, sex hormones, adrenocortical hormones). Alkaloids (introduction, classification, isolation, structure elucidation of selected alkaloids). Shikimates (C6-C1, C6-C2, C6-C3, compounds containing shikimate ring, structure elucidation of some flavonoids).

Phys 103 Electric Circuits, 2h/W
This course aims at developing a clear understanding of the basic concepts of electric circuits. The course includes: Definitions and Circuit Parameters, Sinusoidal Current and Voltage, Complex numbers, Complex Impedance and Phasor Notation, Series and Parallel Circuits, Power and Power Factor Correction, Series and Parallel Resonance, Mech Current Network Analysis, Node Voltage Network Analysis, Mutual inductance, Fourier Method of waveform analysis.

Phys 104 Electromagnetic Theory, 2h/W
This course aims at studying the Electromagnetic theory from the Electrostatic, magnetostatic and Electromagnetic relations. The course includes: Vector Analysis, Coulomb's Law and Electric Field, The Electrostatic Potential, Electrostatic Dipole, Dielectric Polarization, Poisson and Laplace Equations, Biot-Savart Law and Magnetic Field Potential, Magnetic Vector Potential and Induction, Magnetic Dipole, Poisson and Laplace Equations for Magnetic Potentials, Electromagnetic induction and Fraday's law, Maxwell's equations, Electromagnetic wave equations, electromagnetic plane wave propagation.

Chem.141, Physical Chemistry (Principle of Physical Chemistry) 2 h/W
Significant figures, Measurement and unit: The gaseous state, the gas laws, real and ideal gases, the liquid state and the solid state. Thermochemistry, thermo- chemical equations, Hess's law; ΔH for various processes; bond energies, variation of ΔH with temperature; heat capacities:. Kirchoff's equation. The Solution Process, Ways of Expressing Concentration. Factors Affecting Solubility. Raoult's Law Colligative Properties - Lowering the Vapor Pressure - Boiling-Point Elevation - Freezing Point Depression – Osmosis -Determination of Molar Mass. Chemical equilibria: The equilibrium state. The Reaction Quotient – The relationship between K_c and K_p - Heterogeneous Equilibria - Le-Chatelier's Principle and Chemical Equilibrium. Equilibria in Aqueous Solutions The Arrhenius Theory of Acids and Bases, Bronsted-Lowry and Lewis theory

of Acids and Bases - Auto-ionization of water and pH - Ionization Constants of Weak Electrolytes and Polyprotic Acids - Common Ion Effect and Buffers - Hydrolysis Constants - Acid-Base Titration Curves. Solubility and Ksp – Relationship.

Phys 201 Practical Physics

The Laboratory is designed to illustrate physical principles and to develop experimental skills; and how to emphasize a proper report writing. The course includes: Experiments dealing with the basic laws of mechanics, vibrational and circular motion, fluids, elasticity, heat, thermal properties of materials, Error analysis and the concept of computer-controlled experiments.

Math 210 Differential Equations, 2h/W

Descriptions: First order differential equations: Separable - Homogenous – Equations tends to homogenous and separable - Exact – Integration factor – Bernoulli's equations. Applications – Linear differential equations. Second order differential equations. Systems of differential equations.

Phys 202 Practical Physics

The Laboratory is designed to illustrate physical principles and to develop experimental skills; and how to emphasize a proper report writing. The course includes: Experiments dealing with the basic laws of Physical optics (As: Young Double Slit, Mickelson's Interferometer, Abbe's Refractometer, Polarization of Light, Diffraction Grating, Newton's Rings), Alternating Current and Electronic Measurements and Instrumentation.

Phys 211 Vibration and Waves , 2h/W

This course aims at introducing a clear understanding of the basic concepts of Vibration and Waves. The course includes: Periodic motions, The Superposition of periodic motions, The free vibrations of Physical system, Forced vibrations and Resonance, Normal mode of Continuous System, Doppler effect.

Phys 215 Physics of Elasticity, 2h/W

The course aims at introducing the concept of elasticity. It consists of: The Concept of the Force, plane stress, plane strain and Different Physical Properties of Material. The Mechanism of Fracture of Different Material, and Fundamental of Fracture mechanics. Torsion and Twisting of metallic beam.

Phys 220 Modern Physics, 2h/W

This course aims at developing a clear understanding of the basic concepts of modern physics. The course includes: The special theory of relativity: Galilean transformations and their limitations, Einstein's postulates and Lorentz transformations, Length, time and simultaneously in relativity, Mass and momentum in relativity, Relativistic Mechanics, Mass and Binding Energy, Experimental verification of the relativity theory, The concepts of waves and particles: Black-body radiation, The photo-electric effect, The continuous X-ray spectrum, The photon, The Compton effect, The de-Broglie hypothesis, The diffraction of waves and particles, Introductory quantum mechanics, Bohr's principle of complementarity, Wave-packet description of material particles, Statistical interpretation of the wave function, Heisenberg uncertainty principle. Schrödinger wave equation, Particle in a one-dimensional potential well.

Phys 221 Physical Optics, 2h/W

An understanding of the basic physical optics and describes the behavior and properties of light and interaction of light with matter. The course includes: the wave theory of light, Interference of two beams of light, Interference with multiple-beams, Diffraction of light, Polarization of light, Dispersion and absorption of light.

Phys 222 Atomic Physics, 2h/W

This course aims to introduce and explain the principles, models, and methods required to understand the behavior of atoms. The course includes: Black body radiation, Rayleigh-Jeans law, Planck's law. Photoelectric effect. Compton effect.X-rays { production of X-rays, continuous X-rays, characteristic x-rays, Moseley's law – Diffraction and absorption of x-rays}, Bohr model of H atom, energy level diagram, spectral series of H atom, H like ions. Wilson-Sommerfeld elliptical orbits {fine structure, degenerate orbits, mass relativistic effect, energy level diagram, selection rule}, Vector atom model. Normal Zeeman effect.

Phys 224 Electronic Measurements and Instrumentation, 2h/W

This course aims at introduces a clear understanding of the basic concepts of Electronic Measurements and Instrumentation. The course includes: Characteristics of Instruments and Measurement Systems, Units, Systems, Dimensions and Standards, Circuit Components (Resistors , Inductors and Capacitors) and their Residues, Measurement of Energy and Industrial Metering, Measurement of Phase and Frequency, High Voltage Measurements and Testing, Magnetic Measurements, Instruments for Generation and Analysis of Waveform, Transducers, Data Transmission and Telemetry, Measurement of Non-Electrical Quantities, Data-Acquisition Systems.

Z 221, Cytogenetics, 2 h/W

Cytology: Introduction: cell discovery- cell theory- relationships between cytology and other biological sciences- Protoplasmic components: plasma membrane: ultra structure- functions- methods of transfer across plasma membrane- Endoplasmic reticulum (E.R.): types- functions- relationships among E.R., plasma membrane and nuclear membrane- Ribosomes: ultra structure- functions- Golgi apparatus: ultra structure- functions- Mitochondria: ultra structure- origin.

Genetics: a summary on the general structure of the genetic material- how is gentic material been synthesized in viruses, bacteria and eukaryotes- general structure of prokaryotic and eukaryotic genes- fer chromosomic material (the genome of mitochondria and chloroplasts)- structural and numerical chromosomal changes with a detailed explanation for the associated mechanisms- a brief account on mutations as a change in genetic material.

Phys 227 Fluid Mechanics, 2h/W

The course aims at introducing the concept of fluid mechanics. It consists of: The Concept of the Stream line and turbulent flow, Bernoulli's equation, Poiseulle's law, Power dissipation. Reynolds's number, Cardiovascular system, Viscous drag forces Stock's law and centrifugation.

Bio-Phys 210 The Electricity in Bio-systems , 2h/W

This course aims at developing a clear understanding of the basic concepts in physics of electricity in bio-systems. The course includes: Membrane potentials, Nerve Impulses, Electromagnetic Blood Flow-meters, Effects of electric current in the human Body, Electrical conductivity of the cellular membrane at rest, Tissues conductivity, Medical electronics.

Phys 311 Solid State (1), 2h/W

This course aims at introducing a clear understanding of the basic concepts of physics of Solid Materials. The course includes: Crystal Structure, Crystal Diffraction and Reciprocal Lattice, Diffraction Techniques, Crystal binding, Ionic crystals, Imperfections in crystals, Diffusion.

Phys 312 Physics of Reactors and Neutrons, 2h/W

This course aims at developing a clear understanding of the basic concepts of Physics of reactors and neutrons. The course includes: Neutron and its Interaction with Matter, differential Scattering Cross-section, Nuclear Fission, The Fission Chain Reaction and Nuclear Reactors, Slowing Down of Neutrons, Neutron Moderation by Inelastic Scattering, Thermal Neutron Scattering, The scattering law.

Phys 314 Quantum Mechanics (1), 2h/W

This course aims at developing a clear understanding of the basic concepts of Quantum Mechanics. The course includes: Wave Mechanics: Schrödinger wave equation in momentum space. One-Dimensional problems: Infinite and finite potential well, Tunneling effect, Radioactive decay and penetration of potential barrier, The periodic potential, Simple harmonic oscillator, The Morse potential. Three-Dimensional Problems: Solution of Schrödinger equation in cylindrical coordinates, Solution of Schrödinger equation in spherical coordinates, Space rotator, Solution of harmonic oscillator in spherical coordinates, The Hydrogen atom. Time-Independent Perturbation Theory.

Phys 327 Polymer Physics, 2h/W

This course aims at developing a clear understanding of the basic concepts of Polymer physics. The course includes An introduction to polymers, Polymer structure, Physical states of polymers, Thermal properties of polymers, Mechanical properties of polymers, Electrical properties of polymers, Viscoelasticity of polymers, Relaxation properties of polymers, Glass-transition in polymers, Rheology of polymers.

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Phys 329 Molecular Spectroscopy, 2h/W

This course aims at developing a clear understanding of the basic concepts of Molecular Spectroscopy, The course includes: Basic Elements of Spectroscopy. Microwave Spectroscopy. Infra-Red Spectroscopy, Raman spectroscopy, Electronic Spectroscopy of Molecules, Spin Resonance Spectroscopy.

Phys 330 Mathematical Physics for non-physicist (1), 2h/W

This course aims at introduce students to some of the basic mathematical physics of partial differential Equation & Special function and further develop students skill in solving problems.The course includes: Concepts and Definitions, Mathematical Models, Fourier's Series, Method of Separation of Variables. Gamma and Beta Functions, The Hypergeometric Functions, The Legendre Functions. Bessel Functions, Laguerre Polynomials, Hermite Polynomials.

Phys 320 Computer Programming, 2h/W

This course introducing the concept of programming with Fortran Language and to give practice in the use of the language to solve scientific problems. The course includes: Elements of statements, Mathematical Functions, Arithmetic Assignment Statements, How to write the program Statements? Input and Output Statements, Application for FORTRAN 77, Transfer of control, (Arithmetic and logical IF Statement, Goto ,…), The subscripted variables and dimension, Examples of the Subscript Notation, The

dimension Statement and other information, The DO statement, Explicit uses of DO Loop and Dimension, Read Statement of one data item per line, Read Statement for more than one data item per line, Implied DO List.

Phys 410 Laser and its Applications, 2h/W

The course introduces the students to fundamentals, operation and applications of laser. The course includes: Quantum transition in an atomic system, Amplification of electromagnetic wave in an optical cavity, Population inversion (three-level and four-level energy system), Basis of laser operation, Characteristic of laser light, Some types of laser sources-Axial modes of laser, Modifying the laser output, Applications of laser (in industry, in optical information and storage, in medicine, in military).

Phys 411 Semiconductors, 2h/W

This course aims to learn about the physics and applications of Semiconductors, The course includes: The crystal structure of Semiconductors and Energy bands in Semiconductors, Properties of Semiconductors, The P – N junction, Semiconductors Devices.

Phys 432 Optical Instruments, 2h/W

This course aims to developing the basic concepts of some optical instruments and their applications for a wide variety of physical measurements. The course includes: Microinterferometry, Modern Microinterferometers, Interference microscopes, Spectrophoto-meters, Optical instruments used in medicine.

Phys 400 Project of Research and Report, 1h/W for two semesters
Chem -Phys 400 Project of Research and Report, 1h/W

The project of research and report, to develop students to use their scientific knowledge, their ability to plan and execute an extended experimental or theoretical investigation and use all their communication skills to describe their results. To provide an understanding of some techniques of research, including the presentation of results. Students should have obtained an appreciation of research methodologies gained under individual supervision; ability to design and execute a project, write a report and give a talk on it. The student chooses the project in consultation with a member of staff. The subject of the project may be experimental physics or theoretical physics. They should have produced an impressive report on their project, which they can show at career interviews and discuss its content with confidence.