قسم الفيزياء بكلية العلوم بالزلفي

كتيب الماجستير في الفيزياء

كلمة رئيس قسم الفيزياء

بصفتي رئيسًا لقسم الفيزياء ، أود أن أرحب بكم في اختياركم برنامج ماجستير الفيزياء. يفخر القسم بتقديم تعليم ممتاز وداعم و بيئة تدريسية متكاملة تمامًا مع أبحاثنا: في محاضراتك، ومختبراتك والعمل في المشروع، حيث سيتاح لك الفرصة للتفاعل مع الباحثين الرائدين في العالم والعمل في طليعة مجموعة واسعة من مجالات الفيزياء، الذين يعالجون بعضًا من أكبر التحديات المعاصرة في العلوم والتكنولوجيا .

ويدرك القسم التنوع بين جميع الطلاب وبرامج الفيزياء التي حصلوا عليها وندرك أن هذا التنوع يحسن جودة عملنا من خلال السماح للطلاب بجلب مجموعة من المهارات ووجهات النظر التي تهدف إلى تعزيز إنجازاتهم الجماعية. لذلك نتوقع أن جميع الطلاب وأعضاء هيئة التدريس سوف يعملون معا بشكل منتج ومهني في جو من الاحترام المتبادل . وعند وجود اي ملاحظة فان أعضاء هيئة التدريس بالقسم على أتم استعداد للتفاعل معك لذلك فلا تتردد في التحدث معهم وسوف يبذلون قصارى جهدهم للمساعدة .

أتمنى أن تستمتع بوقتك معنا في قسم الفيزياء وأتمنى لك ذلك النجاح في دراستك الحالية والمستقبلية .

أطيب الأماني

رئيس قسم الفيزياء

مقــدمة:

إن ما يشهده قطاع التعليم في المملكة العربية السعودية في الوقت الحالي من تغييرات وتطورات استجابة للمستحدثات العالمية كشيوع نظم الجودة والاعتماد الأكاديمي والتنافسية والتقدم العلمي والتقني وتغير متطلبات سوق العمل القائمة على التميز والانفراد المهارى لدى الخريجين جعل من استحداث أو تطوير البرامج الأكاديمية أمرا مستمرا كي تتمكن من مسايرتها لتقديم القيمة العلمية والإضافة النوعية التي يضيفها البرنامج للمجتمع وسوق العمل والبيئة المحيطة، وهذا يتطلب توفر عدد من العناصر عند استحداث أو تطوير البرامج كالخطة الدراسية المطابقة للمعايير الوطنية والعالمية وتوفر الكادر التدريسي المؤهل من ذوي الاختصاصات الدقيقة الضرورية ودراسة سوق العمل وتوفير مصادر تعليمية وتعلمية مختلفة يساهم إسهاما كبيرا في بناء برنامج أكاديمي له القدرة على تحقيق الأهداف المرجوة منه.

وكأي برنامج أكاديمي يطمح إلى التحسن ومعرفة انعكاسه على العملية التعليمية لا بد من وضع استراتيجية واضحة للتقييم الذاتي من خلال معايير الجودة الخاصة بجميع عناصر البرنامج من تدريس واختبارات وخطة دراسية وتوصيف مقررات وإدارة تعليمية إلى غير ذلك كتقييم شامل ومستمر يهدف إلى استخدام التغذية الراجعة للتطوير والتحسين، ولا بد من القائمين على البرنامج أن تكون عندهم رؤية واضحة، واستراتيجية تطوير مستقبلية تتعامل مع المتغيرات والأحداث وتتفاعل معها لأجل التغيير والتعديل البناء بما يخدم محور العملية الأكاديمية ويحسن مخرجاته.

وللتعرف علي برنامج الماجستير في الفيزياء فسنعطي تقدم للكلية التي ستشهد تدريس البرنامج في جنباتها فقد صدرت الموافقة بإنشاء كلية للعلوم بالزلفي بتاريخ 5 شعبان 1426 هـ، وقد بدأت الدراسة في كلية العلوم في العام الجامعي 1427 / 1428 هـ ، وتحتوي الكلية على أقسام (رياضيات ، فيزياء ، علوم الحاسب ، أحياء ،كيمياء) وقد حصلت الكلية على الاعتماد الاكاديمي من الهيئة الالمانية **ASIIN** من عام 2015م حتى عام 2020م. يوجد بالكلية ما يزيد عن **623** طالب و**355** طالبة و100 عضو هيئة تدريس ومجهزة بأحدث الأجهزة بالقاعات والسبورات الذكية ومكاتب علي أحدث مستوي وأيضا بها مكتبة ذاخرة بالكتب التخصصية بالإضافة إلي شبكة انترنت قوية تخدم الطلاب ومنسوبي الكلية ووحدة أنشطة رياضية ونوادي علوم متخصصة للأقسام المختلفة ومسجد ومطعم.

توصيف برنامج ماجستير الفيزياء

شروط القبول بالبرنامج

- أن يكون المتقدم سعودياً، أو متحصل على منحة رسمية للدراسات العليا إذا كان من غير السعوديين.
- أن يكون المتقدم حاصلاً على الشهادة الجامعية من جامعة سعودية أو من جامعة أخرى معترف بها.
- أن يكون المتقدم حاصلاً على بكالوريوس العلوم في الفيزياء.
- أن يكون حسن السيرة والسلوك ولائقاً طبياً.
- أن يقدم توصيتين علميتين من أساتذة سبق لهم تدريسه.
- موافقة جهة العمل على الدراسة إذا كان موظفاً.
- حصول الطالب على تقدير "جيد جداً" على الأقل في المرحلة الجامعية.
- الحصول على درجة 70 كحد أدنى في اختبار القدرات العامة للجامعيين.
- أن يكون المتقدم متحصل في اختبار IELTSعلى درجة أعلى من 3.5 أو ما يعادلها في الاختبارات المعتمدة الأخرى.
- لا يتم قبول الحاصلين على الدرجة الجامعة بنظام الانتساب.

الأوزان النسبية لمعايير القبول

الترتيب التفاضلي للمتقدمين على البرنامج يتم بالاعتماد على المعايير التالية:
1- المعدل التراكمي للمتقدم من أصل 5 (رمز M) والوزن 50 درجة ويحسب كالتالي:

إذا كان المعدل التراكمي يساوي 2.5 فيتحصل المترشح على 0 درجة. اذا كان المعدل التراكمي يساوي 5 فيتحصل المترشح على 50درجة. تتزايد الدرجة خطيا مع المعدل التراكمي، أي أن a=20x(M-2.5)

2- الدرجة المتحصل عليها في اختبار القدرات العامة للجامعيين (رمز T) والوزن 30 درجة ويحسب كالتالي:

- الدرجة المتحصل عليها في هذا المعيار تساوي ثلث الدرجة المتحصل عليها في اختبار القدرات العامة للجامعيين وبحد أقصى 30 درجة، أي أن b=min (T/3;30)

- الدرجة المتحصل عليها في اختبار اللغة الإنجليزية (رمز E) يتم اعتماد اختبار STEP وتحويل النتائج المتحصل عليها في اختبار آخر (TOEFL, IELSTS) والوزن 20 درجة ويحسب كالتالي:

إذا كانت الدرجة المتحصل عليها في اختبار STEP تساوي 50 فيتحصل المترشح على 10 درجات ويتحصل على 20 درجة إذا كانت الدرجة المتحصل عليها في اختبار STEP تساوي 100، أي أن c=0.2xE

ويتم حساب مجموع النقاط (score) بالطريقة التالية: Score = a+b+c

وبنهاية البرنامج بنجاح يتم منح المتقدم درجة ماجستير العلوم في الفيزياء (**Master of Science in Physics**) ويوجد مسارين للبرنامج هما **الإشعاع وحماية البيئة** (**Radiation and Environmental Protection**) **وعلم المواد وتطبيقاتها** (**Material Science and Applications**). **ويهدف البرنامج الى الاتي:**

- إعداد كوادر وطنية متميزة علمياً وبحثياً تساهم في خدمة وتنمية المجتمع المحلي والإقليمي.
- تكوين باحثين أكفاء في مجال الفيزياء وتطبيقاتها.
- العمل على توطين تكوين طلاب الدراسات العليا وتدريبهم على إجراء بحوث في مجالات حيوية.
- إعداد مختصين يمكنهم إسداء خدمات للمستشفيات (التصوير الطبي، الأشعة السينية،..). أو في مجال الطاقة النووية والطاقة المتجددة او المواد الحديثة واستخداماتها (طاقة شمسية، طب،....).
- توفير فرص تعليم محلية لحملة الشهادات العليا لمواصلة دراستهم في مجال تطبيقي بقسم الفيزياء الذي يمتلك العديد من التجهيزات الحديثة والموارد البشرية.
- ترسيخ ثقافة البحث العلمي التطبيقي والنشر العلمي بطريقة متواصلة ومتنامية في مجلات علمية مصنفة عالميا.

الحاجة المتوقعة لسوق العمل لخريجي هذا القسم

- **التدريس بالجامعة حيث أن عدد أعضاء هيئة التدريس السعوديين بالقسم يقتضي تعزيزه.**
- **توجد اتفاقية تعاون في طور الإبرام مع مدينة الملك عبد الله للطاقة الذرية والمتجددة.**
- **العمل بالمستشفيات والعيادات الصحية في أقسام التصوير الطبي والأشعة والرنين المغناطيسي.**
- **العمل في مكاتب الدراسات والاستشارات في ميدان الطاقة وهندسة المواد والبيئة.**
- **وبحسب وزارة الخدمة المدنية توجد بعض الوظائف على سبيل المثال وظائف باحثي وأخصائي المواصفات والمقاييس والمعايرة وأيضا في وظائف رؤساء المحطات الفرعية للرصد الجوي والبيئي (المرتبة 8).**

المخرجات المتوقع اكتساب الخريجين لها بعد إتمام هذا البرنامج

- **القدرة علي التعامل مع الأجهزة المختلفة والتي تتعامل مع ظواهر فيزيائية عديدة تلزم في مجال العمل.**
- **التعامل الجيد مع النماذج الرياضية والتي تتيح التعامل الجيد مع نماذج الأرصاد الجوية علي سبيل المثال.**
- **يكتسب الخريج مهارات في التعامل مع نظريات الفيزياء والتي تؤهله للعمل بمهارة في مجال التدريس والبحث**

نواتج التعلم المتوقعة من البرنامج وفق المركز الوطني للتقويم والاعتماد الأكاديمي

أ- المعارف

1 التعرف على مفهوم الفيزياء على مستوى متقدم في مجالات دراستهم الفيزيائية لحل المشكلات المعقدة.

2 المعرفة الأساسية والنهج متعدد التخصصات في الفيزياء.

3 إتقان المعرفة الأساسية في الفيزياء.

4 تحديد العوامل الرئيسية وتطبيق المبادئ والافتراضات المناسبة في صياغة مشاكل الفيزياء.

ب- المهارات:

1 إجراء التجارب والحصول على البيانات وتحليل البيانات واستخلاص النتائج والاستنتاجات.

2 الشرح لجمهور عام ، سواء الخبراء الآخرين في هذا المجال أو للأشخاص خارج المجال ، مفاهيم ونتائج الفيزياء.

3 القدرة على استخدام الأساليب التحليلية أو الحسابية لحل مشاكل الفيزياء

4 تطبيق نظريات ومفاهيم العلاقات الفيزيائية المتعلقة بالبحث العالمي في السياقات المحلية والدولية.

ت– الكفاءة:

1 العمل بفعالية في مجموعات وكذلك بشكل فردي

2 استخدم الأدوات المناسبة ومحو الأمية الإعلامية المطلوبة لاكتساب وتقييم وتحليل البيانات والمعلومات من مصادر متنوعة امتلاك مهارات إدارة الوقت.

3 تطبيق مهارات البرمجة العلمية المناسبة

4 امتلاك مهارات إدارة الوقت.

5 الانتباه للمسؤوليات المهنية والأخلاقية.

رابعا: الخطة الدراسية للبرنامج: – توزيع المقررات على المستويات

المستوى الأول								
رقم المقرر	رمز المقرر	اسم المقرر	نوع المقرر	توزيع الوحدات الدراسية				رقم ورمز المتطلب السابق (المرافق)	اسم المتطلب السابق (المرافق)
				نظري	عملي	تدريب (تمارين)	معتمد		
611	PHYS	Computational Physics	إجباري	3			3		
612	PHYS	Advanced Quantum Mechanics	إجباري	3			3		
613	PHYS	Electrodynamics	إجباري	3			3		
المجموع				9			9		

المستوى الثاني (الإشعاع وحماية البيئة)									
رقم المقرر	رمز المقرر	اسم المقرر	نوع المقرر	توزيع الوحدات الدراسية				رقم ورمز المتطلب السابق (المرافق)	اسم المتطلب السابق (المرافق)
				نظري	عملي	تدريب (تمارين)	معتمد		
621	PHYS	Advanced Nuclear Physics	إجباري	3			3	PHYS 612 PHYS 613	Advanced Quantum Mechanics Electrodynamics
622	PHYS	Radiation Physics and Dosimeter	إجباري	2	2		3	PHYS 612 PHYS 613	Advanced Quantum Mechanics Electrodynamics
623	PHYS	Statistical Physics	إجباري	2			2	PHYS 612 PHYS 613	Advanced Quantum Mechanics Electrodynamics
المجموع				7	**2**		8		

المستوى الثاني (علم المواد وتطبيقاتها)								
رقم المقرر	رمز المقرر	اسم المقرر	نوع المقرر	توزيع الوحدات الدراسية الإشعاع وحماية البيئة				رقم ورمز المتطلب السابق (المرافق)	اسم المتطلب السابق (المرافق)
				نظري	عملي	تدريب (تمارين)	معتمد		
624	PHYS	Physics and Technology of Semiconductors	إجباري	3			3	PHYS 612 Advanced Quantum Mechanics PHYS 613 Electrodynamics	
625	PHYS	Characterization of Advanced Materials	إجباري	2	2		3	PHYS 612 Advanced Quantum Mechanics PHYS 613 Electrodynamics	
623	PHYS	Statistical Physics	إجباري	2			2	PHYS 612 Advanced Quantum Mechanics PHYS 613 Electrodynamics	
المجموع				7	2		8		

المستوى الثالث									
رقم المقرر	رمز المقرر	اسم المقرر	نوع المقرر	توزيع الوحدات الدراسية				رقم ورمز المتطلب السابق (المرافق)	اسم المتطلب السابق (المرافق)
				نظري	عملي	تدريب (تمارين)	معتمد		
630	PHYS	Research Methodology	إجباري	2			2		
63x1	PHYS	Elective course	إجباري	3			3		
63x2	PHYS	Elective course	إجباري	3			3		
المجموع				8			8		

المستوى الرابع									
رقم المقرر	رمز المقرر	اسم المقرر	نوع المقرر	توزيع الوحدات الدراسية				رقم ورمز المتطلب السابق (المرافق)	اسم المتطلب السابق (المرافق)
				نظري	عملي	تدريب (تمارين)	معتمد		
640	PHYS	Dissertation	Academic	6			6	PHYS 630	Research Methodology
المجموع				6			6		

المقررات الاختيارية (ضمن الساعات المعتمدة للبرنامج) مسار الإشعاع وحماية البيئة									
اسم المتطلب السابق (المرافق)	رقم ورمز المتطلب السابق (المرافق)	توزيع الوحدات الدراسية				نوع المقرر	اسم المقرر	رمز المقرر	رقم المقرر
		معتمد	تدريب (تمارين)	عملي	نظري				
Advanced Nuclear Physics Radiation Physics and Dosimeter	PHYS 621 PHYS 622	3			3	Academic	Application of Ionizing Radiation Physics	PHYS	631
Advanced Nuclear Physics Radiation Physics and Dosimeter	PHYS 621 PHYS 622	3			3	Academic	Radiation Detection and Measurements	PHYS	632
Advanced Nuclear Physics Radiation Physics and Dosimeter	PHYS 621 PHYS 622	3			3	Academic	Detector Instrumentation	PHYS	633
Advanced Nuclear Physics Radiation Physics and Dosimeter	PHYS 621 PHYS 622	3			3	Academic	Radiation Protection	PHYS	634
		6			6			المجموع	

المقررات الاختيارية (ضمن الساعات المعتمدة للبرنامج) مسار علم المواد وتطبيقاتها									
اسم المتطلب السابق (المرافق)	رقم ورمز المتطلب السابق (المرافق)	توزيع الوحدات الدراسية				نوع المقرر	اسم المقرر	رمز المقرر	رقم المقرر
		معتمد	تدريب (تمارين)	عملي	نظري				
Computational Physics	PHYS 611	3			3	Academic	Heat Transfer in Microelectronic Devices	PHYS	635
Physics and Technology of Semiconductors	PHYS 624	3			3	Academic	Solar Cells	PHYS	636
Characterization of Advanced Materials	PHYS 625	3			3	Academic	Non-crystalline materials	PHYS	637
Physics and Technology of Semiconductors	PHYS 624	3			3	Academic	Nanostructures engineering	PHYS	638
Characterization of Advanced Materials	PHYS 625	3			3	Academic	Optical Properties of nanostructures	PHYS	639
		6			6			المجموع	

أعضاء هيئة التدريس بالقسم

يضم قسم الفيزياء نخبة من أعضاء هيئة التدريس القائمين علي تدريس البرنامج

مسلسل	الاسم	التخصص	الرتبة الأكاديمية
1	ا.د.ثامر شليح الحربي	فيزياء نووية	أستاذ
2	ا.د. حافظ عمار بلمبروك	فيزياء المواد نقل حراري ميكانيك الموائع	أستاذ
3	ا.د. ياسر بكر صديق	فيزياء الجوامد التجريبية	أستاذ
4	د. حسن سعد حنفي	فيزياء ذرية	أستاذ مشارك
5	د. إبراهيم شعراني	فيزياء نظرية	أستاذ مشارك
6	د. محمود محمد أحمد	فيزياء الليزر وتطبيقاتها	أستاذ مساعد
7	د. موحد شاكر خان	فيزياء نووية	أستاذ مساعد
8	د. منى بن هندة	فيزياء البوليمر- فيزياء المادة اللينة	أستاذ مساعد
9	د.الهام الظفيري	فيزياء نظرية	أستاذ مساعد

المعامل البحثية بالقسم

1- معمل فيزياء المواد

2- معمل الفيزياء النووية والاشعاعية

3- معمل الميكروسكوب الالكتروني

طرق التقييم:

Proportion of Total Assessment	Week Due	Assessment task (e.g. essay, test, group project, examination, presentation, etc.)
20%	9	Midterm
20%	All semester	Assignments
20%	All semester	participation, presentation, attendance etc.
40%	At the end	Final exam

Phys611: Computational Physics

Course Objectives and Learning Outcomes

1. Course Description

Introduce the basic concepts of numerical analysis and computation using Matlab
Programming using Matlab
Numerical Solution of Ordinary Differential equations and Partial Differential equations
Applications to many physical problems

2. Course Main Objective

Introduce the basic concepts of numerical analysis and computation using Matlab
Programming using Matlab.
Numerical Solution of Ordinary Differential equations and Partial Differential equations
Applications to many physical problems

Course Learning Outcomes

CLOs		Aligned-PLOs
1	**Knowledge:**	
1.1	Introduce the basic concepts of numerical analysis and computation using Matlab	
1.2		
1.3		
1...		
2	**Skills :**	
2.1		
2.2	Applications to many physical problems	
2.3		
2...		
3	**Competence:**	
3.1		
3.2	Programming using Matlab	
3.3		
3...		

Course Content

No	List of Topics	Contact Hours
1	Introduction to Matlab, Complex numbers, Elementary math functions	6
2	Vectors, main operations on vectors, vector functions, Vectors, main operations on vectors, vector functions,	6

3	Matrices, matrix functions, matrix operations, inverse matrix, Linear equations, Eigen values, Eigen vectors, Application to quantum mechanics, Conditional statements, loops (for loop, while loop),	6
4	Functions and subroutines, Input and output arguments, Graphs (2D and 3D plots), polar plots, applications (wave functions, radiation pattern, distribution density,…)	9
5	Numerical integration, applications (mean value, …), Ordinary differential equations (first order equation, second order equation, Euler method, Implicit method, Predictor-Corrector methods, Runge-Kutta methods)	9
…	Partial differential equations (Finite difference method, Poisson equation, Schrödinger equation,	6
	Review	3
Total		45

Phys612: Advanced Quantum Mechanics

Course Objectives and Learning Outcomes

1. Course Description

The course covers the basic principles of Quantum formalism for closed systems, two-slit experiment. Schrödinger equation with spin (Pauli and Dirac equations) - Stern-Gerlach experiment. Quantum statistics, Theory of Angular Momentum and addition of two angular momentums-Approximation Methods, - Time-dependent Hamiltonian, quantum protocol and control; Time-dependent perturbation theory (Dyson method);, - Approximations (semi-classical analysis, WKBJ-method, Born-Oppenheimer approximation)., Open systems, dissipative evolutions, decoherence, Caldeira-Leggett model. Weak coupling (Fermi-Golden rule), Lindblad equation, - Quantum nature: superposition, entanglement, tunneling, nonlocality; Quantum optics. Jaynes-Cummings model, Rabi oscillations, coherent states, squeezing, manipulations of individual atoms;, -Depending on available time and taking into account the possible overlap with other course

2. Course Main Objective

- This course expands the knowledge of physics, providing deeper and fundamental insights into the research field you choose to focus on. In addition, there is a strong focus on providing you with the important practical skills you need to successfully perform experiments. Use perturbation theory (time independent or time dependent to resolve approximately Schrödinger equation: the Stark effect, Hyper fined split, harmonic oscillator and Zeeman effect.
- Demonstrate an understanding of angular momentum and addition of two momentums in quantum mechanics; Use different approximations methods , Undetstand many-particle Theory, Second Quantization theory and scattering theory: bosons and fermions

Course Learning Outcomes

	CLOs	Aligned-PLOs
1	**Knowledge:**	
1.1	The students should be **familiar with** Quantum formalism for closed systems, two-slit experiment. Schrödinger equation with spin (Pauli and Dirac equations) - Stern-Gerlach experiment. Quantum statistics, Theory of Angular Momentum and addition of two angular momentums	a2
1.2	**Know** Approximation Methods, - Time-dependent Hamiltonian, quantum protocol and control	a2
1.3	**Recognize** - Time-dependent perturbation theory (Dyson method);, - Approximations (semi-classical analysis, WKBJ-method, Born-Oppenheimer approximation).,	a2
1.4	**Explain** Open systems, dissipative evolutions, decoherence, Caldeira-Leggett model. Weak coupling (Fermi-Golden rule), Lindblad equation, - Quantum nature: superposition, entanglement, tunneling, nonlocality	a2
2	**Skills :**	
2.1	**Capable of calculating** Jaynes-Cummings model, Rabi oscillations, coherent states, squeezing, manipulations of individual atoms;, -Depending on available time and taking into account the possible overlap with other courses	b2

CLOs		Aligned-PLOs
2.2	**Analysis and calculation** path-integrals (example: Ahoronov-Bohm effect);, - From Einstein-Podolsky-Rosen experiments to Bell inequalities and the Kochen-Specker No-Go Theorems;	b2
2.3	**Solve various problems related to** Schroedinger's cat and possible solutions of the measurement problem	b2
3	**Competence:**	
3.1	Work in a group and learn time management.	c1
3.2	Learn how to search for information through library and internet.	c1
3.3	Present a short report in a written form and orally using appropriate scientific language	c1

Course Content

No	List of Topics	Contact Hours
1	Quantum formalism for closed systems, two-slit experiment. Schrödinger equation with spin (Pauli and Dirac equations) - Stern-Gerlach experiment. Quantum statistics, Theory of Angular Momentum and addition of two angular momentums	6
2	-Approximation Methods, - Time-dependent Hamiltonian, quantum protocol and control;,	6
3	- Time-dependent perturbation theory (Dyson method);, - Approximations (semi-classical analysis, WKBJ-method, Born-Oppenheimer approximation).,	6
4	- Open systems, dissipative evolutions, decoherence, Caldeira-Leggett model. Weak coupling (Fermi-Golden rule), Lindblad equation, - Quantum nature: superposition, entanglement, tunneling, nonlocality;	9
5	- Quantum optics. Jaynes-Cummings model, Rabi oscillations, coherent states, squeezing, manipulations of individual atoms;, -Depending on available time and taking into account the possible overlap with other courses	9
6	- Introduction to path-integrals (example: Ahoronov-Bohm effect);, - From Einstein-Podolsky-Rosen experiments to Bell inequalities and the Kochen-Specker No-Go Theorems;	6
7	- Schroedinger's cat and possible solutions of the measurement problem., Review	3
Total		45

Phys613: Electrodynamics

Course Objectives and Learning Outcomes

1. Course Description

Classical electrodynamics is important from both the fundamental and applied viewpoints. This course aims to provide students with an introduction to the principles and behaviours of dynamical electric and magnetic systems, and a theoretical foundation in classical field theory. The course will cover the classical electromagnetism in microscopic and macroscopic forms; electromagnetic fields of and forces between charged particles. Applications to electrostatic, magnetostatic, electrodynamic, and radiation problems.

2. Course Main Objective

• Use a range of mathematical techniques for solving challenging problems in electrodynamics.
• Create and interpret visual representations of electromagnetic fields and potentials.
• Gain physical insight from mathematical expressions of energy, momentum and charge conservation.
• Apply boundary conditions to solve reflection and transmission problems involving dielectric and conducting materials.
• Express scalar and vector potentials in different gauges, and use them to compute timedependent electromagnetic fields

Modern technology to understand Physics and physical phenomena is very important e.g. 1. Experimental or Theoretical Modeling 2. Equipment and Computer Interfacing to Collect and Process Data 3. Computer Simulations and Graphics 4. Research/Reference/Presentation, Reporting, and Displaying Information 5. Use of digital libraries like Saudi digital library (SDL)

Course Learning Outcomes

	CLOs	Aligned-PLOs
1	**Knowledge:**	
1.1	Understand origin of Maxwell's equations in magnetic and dielectric media.	K1
1.2	Understand transport of energy and Poynting vector	K2
1.3	Understand transport of momentum, Maxwell stress tensor and radiation pressure	K3
1.4	Write down Maxwell's equations in linear, isotropic, homogeneous media	K4
1.5	Write down electromagnetic field tensor in covariant notation	K5
1...		
2	**Skills :**	
2.1	Derive continuity conditions on electromagnetic fields at boundaries	S1
2.2	Derive electromagnetic wave solutions and propagation in dielectric and other media	S2
2.3	Derive electromagnetic wave solutions and propagation in dielectric and other media	S3

CLOs		Aligned-PLOs
2.4	Obtain scalar and vector potential equations in presence of sources,. Understand gauge invariance of Maxwell's equations	S4
2.5	decoupling of scalar and vector potential equations in Lorentz gauge and corresponding solutions	S5
2.6	Obtain Lorentz transformations for electric and magnetic fields and apply to simple cases	S6
2.7	Derive Lienard-Wiechert potentials for a moving point charge.	S7
3	**Competence:**	
3.1	Work effectively in groups as well as individuals.	C1
3.2	Use information technology and modern computer tools to locate and retrieve scientific information relevant to Electrodynamics	C2
3.3	Present a short report in a written form and orally using appropriate scientific language.	C3
3...		

Course Content

No	List of Topics	Contact Hours
1	Electrodynamics :Electromotive force ,Electromagnetic induction ,Maxwell's equations ,Maxwell's equations in matter ,Boundary conditions ,Conservation Laws : Charge and energy ,the continuity equations ,Poynting's theorem , Maxwell's stress tensor ,conservation of momentum	6
2	Potentials and Fields :Scalar and vector potentilas ,Gauge transformations , Coulomb Gauge and Lorentz Gauge ,Lienard -Wiechert Potentials ,The Fields of a Moving Point Charge., Radiation :Dipole Radiation ,Electric Dipole Radiation , Magnetic Dipole Radiation ,Power radiated by a point charge ,The mechanism responsible for radiation reaction,	6
3	Electrodynmaics and relativity :The Special Theory of Relativity ,The Lorentz Transfonnations ,Relativistic Energy and momentum ,Relativistic Kinematics , Magnetism as a Relativistic Phenomena ,How the Fields transorms , Electrodynanlics in Tensor Notation ,Relativistic Potentials, ,	6
Total		

Phys621: Advanced Nuclear Physics

Course Objectives and Learning Outcomes

1. Course Description

The following topics will be covered: Nuclear reactions: general description, Cross Sections, Qualitative features of nuclear reactions, Partial wave analysis, Classical and semi-classical descriptions of scattering, Direct reactions, Distorted-wave Born approximation, Inelastic scattering, Stripping and pick-up reactions, Knock-out reactions, Simple theory of a resonant cross-section, Resonances with charged particles.

2. Course Main Objective

The course gives an overview of the physical models which have been developed to account for the various aspects of nuclear reaction phenomena.

1. Annual review of the course using recent textbooks and references.
2. Electronic materials are updated frequently to support the lecture course.
3. Increase use of discussion workgroups.

Course Learning Outcomes

	CLOs	Aligned-PLOs
1	**Knowledge:**	
1.1	Understand processes and phenomena in nuclear reactions.	Fundamental knowledge and interdisciplinary approach in physics;
1.2	Recognize classical and semi-classical descriptions of scattering.	
1.3	Describe transport of energy and Poynting vector.	identifying the key factors and applying appropriate principles and assumptions in the formulation of physics problems;
1...		
2	**Skills :**	
2.1	Analyze production and decay reactions for fundamental particles, applying conservation principles to determine the type of reaction taking place and the possible outcomes	Apply the theories and concepts of physics relations relating to the global research in local and international contexts;
2.2	Apply conservation laws to nuclear reactions and transform quantities between laboratory and centre-of-mass frames.	
2.3	choose the most appropriate and effective theoretical models, mathematical and numerical techniques, software packages and algorithms to solve non-standard problems in nuclear reactions.	Explain to a general audience, both other experts in the field and to people outside the field, physics concepts and results

CLOs		Aligned-PLOs
2...	Compare and constrast different reaction mechanisms in relation to cross-sections, excitation functions, and angular distributions	
3	**Competence:**	
3.1	Work effectively in groups as well as individuals.	Work effectively in groups as well as individually
3.2	Present a short report in a written form and orally using appropriate scientific language.	
3.3	Use information technology and modern computer tools to locate and retrieve scientific information relevant to electrodynamics	Use the appropriate tools and requisite media literacy to acquire, assess, and analyze data and information from diverse sources
3...		

Course Content

No	List of Topics	Contact Hours
1	**Reaction mechanisms**: Types of nuclear reactions, Conserved Quantities in Nuclear Reactions, Reaction Kinematics, Nuclear Reactions Under Parity Conservation, Isospin in Nuclear Reactions, Exchange Symmetry in Nuclear Reactions of Identical Particles. Time-Reversal Invariance	6
2	**Cross Sections**: Rutherford Scattering, Rutherford Scattering Cross Section, Consequences of the Rutherford Experiments, Quantum-Mechanical Derivation of Rutherford's Formula, Deviations from the Rutherford Formula, Nuclear Radii from Deviations from Rutherford Scattering, Coulomb Scattering from an Extended Charge Distribution, Electron Scattering, Neutron Skins and Halo Nuclei.	6
3	**Qualitative features of nuclear reactions**: Compound nucleus formation and direct reactions, Compound resonances, Reaction times, Energy spectra, Branching ratios, Coulomb effects, Giant resonances and strength functions, Cross-section fluctuations, Some characteristics of heavy-ion reactions.	6
4	**Elementary Scattering Theory:** Form of the wave function, laboratory and centre-of-mass systems, the scattered waves, Differential cross-sections, coupled equations form of the Schrodinger equation, The Born and the distorted-wave Born approximations.	6
5	**Partial waves:** Significance of partial waves, Partial wave expansions, Scattering matrix and phase shifts, Phase shifts for potential scattering, Partial wave expression for scattering amplitudes, Partial wave expressions for cross-sections.	6
6	**Classical and semi-classical descriptions of scattering:** Classical elastic scattering of particles, Semi-classical treatments: The WKB approximation, The eikonal approximation	6

7	**Models of Nuclear Reactions:** (Direct reactions): Plane-wave Born approximation, Distorted-wave Born approximation, Inelastic scattering, Stripping and pick-up reactions, Knock-out reactions, (Compound-Nucleus (CN) Reactions): Simple theory of a resonant cross-section, Resonances with charged particles	9
Total		45

Phys622: Radiation Physics and Dosimetry

Course Objectives and Learning Outcomes

1. Course Description

Basic principles of radiation physics: radioactivity, the physics of ionizing radiation, radioactivity, x-ray production, interactions of radiation, radiation dosimetry, radiation exposure, dose deposition, radiation shielding, and radiation detectors. imaging equipment, radiation therapy equipment and The course will include lectures and demonstrations of clinical equipment applications. Provide a basic understanding of ionizing radiation. Course topics will include radiation detection, Course will also cover basic mathematical and physics concepts necessary in the understanding of the above topics.

2. Course Main Objective

- The course will cover basic mathematical and physics concepts necessary in understanding the following aims : Basic principles of radiation physics: radioactivity, the physics of ionizing radiation,
- Radioactivity, x-ray atteuation, quality, and production,
- Interactions of different kinds of radiation with matters, quality factors,
- Radiation dosimetry, radiation exposure, dose deposition,
- Radiation shielding, and radiation detectors.

Course Learning Outcomes

	CLOs	Aligned-PLOs
1	**Knowledge:**	
1.1	Describe basic principles of radiation physics: radioactivity, the physics of ionizing radiation.	k1, k2
1.2	Describe x-ray production, interactions of radiation, radiation dosimetry, radiation exposure, dose deposition, radiation shielding, and radiation detectors.	
2	**Skills :**	
2.1	Apply the gained mathematical and experimental knowledge in any physical phenomena to understand its behavior.	s2
2.2	Solve the numerical problems with confidence.	
3	**Competence:**	
3.1	Work effectively in groups as well as individuals.	c1
3.2	Present a short report in a written form and orally using appropriate scientific language.	
3.3	Use information technology and modern computer tools to locate and retrieve scientific information relevant to radiation physics and dosimetry.	

Course Content

No	List of Topics	Contact Hours
1	Atomic and nuclear structure; Structure of Matter; Sources of radiation, Classification of radiation; quantities and units for radiation.	6
2	Radioactivity and radioactive decays, measurements of radioactivity and standards.	6
3	Interaction of radiation with matter, Photons: interaction and attenuation, attenuation coefficients; Interactions of neutrons; directly ionizing radiation; charged particle equilibrium (Particulate Radiation).	9
4	Radiation dosimetry, Radiation Detection; Cavity theory and ionization chambers.	6
5	In vivo dosimetry, Radiation dosimetry; Radiation Shielding, Medical physics equipment.	6
6	X-rays: Properties and Interactions; Quality of x-rays; production.	6
7	Introduction to radiation detectors, Radiation Detection, Exposure and Dose; Equipment demonstration.	6
Total		45

Phys623: Statistical Physics

Course Objectives and Learning Outcomes

1. Course Description

Statistical physics is witnessing a revolution: understanding the dynamics of a very large number of interactive degrees of freedom, which has been from the beginning the main aim of statistical physics, has become now a central problem in many fields such as physics, biology, computer science, just to cite a few. Now more than ever, statistical physics is both for its methods and its applications a very powerful discipline with a very broad range of theoretical methods and ramifications in many branches of science.

The aim of this series of lectures is facing the students with this very rich state of the art: on one hand by teaching fundamental notions and methods of statistical physics and at the same time by presenting its modern applications in physics and beyond.

2. Course Main Objective

Modern technology to understand Physics and physical phenomena is very important e.g.

1. Experimental or Theoretical Modeling
2. Equipment and Computer Interfacing to Collect and Process Data
3. Computer Simulations and Graphics
4. Research/Reference/Presentation, Reporting, and Displaying Information
5. Use of digital libraries like Saudi digital library (SDL)

Course Learning Outcomes

CLOs		Aligned-PLOs
1	**Knowledge:**	
1.1	Define and discuss the basic concepts and physics of statistical mechanics.	Fundamental knowledge and interdisciplinary approach in physics;
1.2	Review of the principles of statistical mechanics: microcanonical ensemble, canonical ensemble, grand canonical ensemble. Maximum entropy principle.	
2	**Skills :**	
2.1	apply statistical physics to predict the mechanical and dynamical properties and to explain phase behavior of physical systems.	Apply the theories and concepts of physics relations relating to the global research in local and international contexts;
2.2	use simple physical models to illustrate the fundamental ideas of thermodynamics and statistical mechanics.	
3	**Competence:**	
3.1	Work effectively in groups as well as individuals.	Work effectively in groups as well as individually
3.2	Present a short report in a written form and orally using appropriate scientific language.	
3.3	Use information technology and modern computer tools to locate and retrieve scientific information relevant to electrodynamics	Use the appropriate tools and requisite media literacy to acquire, assess, and analyze data and information from diverse sources
3...		

Course Content

No	List of Topics	Contact Hours
1	Review of equilibrium thermodynamics: first law and equilibrium, second law, thermal equilibrium and temperature, phase transitions.	3
2	Review of the principles of statistical mechanics: microcanonical ensemble, canonical ensemble, grand canonical ensemble. Maximum entropy principle.	3
3	Phase transitions: Ising model, lattice gas, broken symmetry and range of correlations, Ising model in one dimension, mean field theory, Landau theory of phase transitions, critical exponents, scaling, renormalization group theory, Ising model in two dimensions.	4
4	Statistical mechanics of non-equilibrium systems: systems close to equilibrium, Onsager's regression hypothesis and time correlation functions, fluctuation-dissipation theorem, response function, Brownian motion, Langevin Equation, Fokker-Planck equation, master equation and detailed balance, systems far from equilibrium, the concepts of work and heat revisited, the fluctuation theorems.	5
Total		

Phys624: Physics and Technology of Semiconductors

Course Objectives and Learning Outcomes

1. Course Description

The course introduces the important physics underlying semiconductor materials and devices. Discusses methods for phenomena and behavior of semiconductors and introduces the key technological important mechanism that count in optimization of devices.

2. Course Main Objective

- Provide the student with a detailed understanding of the principles and operation of semiconductor devices
- Enable the student to understand the methods by which semiconductors may be produced and characterised
- Illustrate how groundbreaking physics has led to advanced technologies

Course Learning Outcomes

	CLOs	Aligned-PLOs
1	**Knowledge:**	
1.1	Back ground and development of fundamental knowledge in Physics	Fundamental knowledge and interdisciplinary approach in Physics.
1.2	Fundamental knowledge and mathematical approach in Physics	
1.3	To understand the Physics conceptus at an advanced level for solving complex problems.	
1.4	Identifying the key factors and applying appropriate principles and assumptions in the formulation of Physics problems	
2	**Skills :**	
2.1	Perform data analysis and draw results and conclusions	Apply and explain the theory and experimental data to concepts of Physics.
2.2	Apply the Physics theories and draw relations with research on related topics	
2.3	Ability to use analytical and/or computational methods to solve physics problems;	
2...	Explain to a general audience and experts in the field with concepts and results	
3	**Competence:**	
3.1	Applying appropriate scientific programming skills;	Use the appropriate tools and acquire requisite information from diverse sources
3.2	Use the appropriate tools and requisite media literacy to acquire, assess, and analyze data and information from diverse sources	
3.3	Having good time management skills.	Work effectively in groups as well as individually
3.4.	Work effectivily in group	

Course Content

No	List of Topics	Contact Hours
1	INTRODUCTION TO SEMICONDUCTOR : Classification of Semiconductor	3

2	SEMICONDUCTOR BONDING: Empirical Evidence of Semiconductor bonding, Hybridization of Group IV Elements	3
3	ENERGY BANDS: One Electron Model, Bloch Theorem, Reduced zone Scheme for representing energy bands,	3
4	Empty Lattice Band Structure, Effect of Filling the Empty Lattice,	3
5	Qualitative Band Shapes of the Diamond Lattice, Zinc–Blende,	3
6	Spin-Dependent Effects, Energy Band Calculations, Temperature Dependence of Bands,	3
7	Effective Mass & Crystal Momentum, Constant Energy Surfaces.	3
8	DENSITY OF STATES: MANY – VALLEY MODEL: Semiconductor Statistics, Intrinsic Semiconductors, Electron Hole Statistics, Intrinsic Case, Boltzmann Approximation (Non-degeneration Semiconductor),	3
9	Law of Mass Action, Extrinsic Semiconductors, Picture of an Impurity, EMT or Hydrogenic Model.	3
10	TRANSPORT PROPERTIES: Charge-Carrier Transport, Electrical Conductivity:, One – valley Model, Effect of Electric Field: on a single electron – Zener Oscillations in an otherwise empty band.	3
11	BOLTZMANN TRANSPORT EQUATION: Relaxation Time Approximation, Charge Transport, Spherical Energy Surfaces – one Valley Model,	3
12	Transform the Current Integral to Energy Space, Non-degenerate Semiconductors with one – valley: Degenerate Semiconductors, Complete Expression for Conductivity in the one-valley Model: Many – Valley Semiconductors.	3
13	IMPURITY SCATTERING: Ionized Impurity Scattering, Neutral impurity scattering, Lattice Scattering.	3
14	Review	3
...	Examinations	3
Total		42

Phys625: Characterization of Advanced Materials

Course Objectives and Learning Outcomes

1. Course Description

In order to introduce the fundamentals of experimental physics to the students, a comprehensive course on basic experimental techniques including synthesis of advanced materials, their processing, characterization and data manipulation is required. The students become familiar with various techniques that can be used for study of materials from fabrication to characterization and applications. The students will be exposed to the basic idea of synthesis via different routes. The characterization techniques for the analysis of various fabricated nanoparticles will be overviewed. Finally a section will be devoted to the data acquisition and error analysis.

2. Course Main Objective

- The purpose of the course is to prepare the students for research in the field of experimental physics.
- In this course, students can utilize their knowledge in various fields of interest such as nanotechnology, plasma physics, experimental laser physics, and electronics etc.
- Awareness about thin film Physics and its preparation methods.
- Awareness about structural, electronic, optical, and thermal characterization techniques.

Course Learning Outcomes

	CLOs	Aligned-PLOs
1	**Knowledge:**	
1.1	Understand about: ▪ Experimental methods and problems ▪ Experimental parameters ▪ Reproducibility of Data ▪ Data and error analysis	Fundamental knowledge and interdisciplinary approach in Physics.
1.2	Understand the Principle and objectives of Etching methods	
2	**Skills :**	
2.1	Apply diffraction techniques to know about crystal structure.	Apply the theory and experimental concepts of Physics.
2.2	Use SEM and EDX to study the morphology and elemental compositions.	
2.3	Use optical techniques to study the optical properties of the nanostructures.	
3	**Competence:**	
3.1	Work effectively in groups as well as individuals.	Work effectively in groups as well as individually
3.2	Present a short report in a written form and orally using appropriate scientific language.	
3.3	Use information technology and modern computer tools to locate and retrieve scientific information relevant to electrodynamics	Use the appropriate tools and requisite media literacy to acquire, assess, and analyze data and information from diverse sources
3...		

Course Content

No	List of Topics	Contact Hours
1	Overview of Characterization of Advanced Materials: Experimental methods and problems, Experimental skills and design, Design of Experiment, Experimental parameters, Reproducibility of Data, Data and error analysis: Uncertainties and measurements	6
2	Principle and objectives of Etching methods, Characterizations in Physics: Physical Characterization of Materials (Bulk characterizations, Surface characterizations), Requirements of Characterizations (Kinetic theory concept of elements)	6
3	Diffraction techniques: Experimental methods for X-rays structure determination, Properties of X-rays, Experimental methods and crystal determination techniques., Optical Microscopy: Principle and objectives of optical microscopy	9
4	Electron Microscopy: Principle and objectives of SEM, EDX, Thermal Analysis: Principle and objectives of Differential scanning calorimetry (DSC)	9
5	Optical properties: Principle and objectives of Photoluminescence spectroscopy, Principle and objectives of FTIR spectroscopy, Principle and objectives of UV-Visible	12
6	Review	3
Total		45

Phys630: Research Methodology

Course Objectives and Learning Outcomes

1. Course Description

The purpose of the course is to prepare the students for research in the field of amorphous materials.

to understand the theories deal with the formation of amorphous materials including their structure.

Modern technology to understand Physics and physical phenomena is very important e.g.

Experimental or Theoretical Modeling

Equipment and Computer Interfacing to Collect and Process Data

Computer Simulations and Graphics

Research/Reference/Presentation, Reporting, and Displaying Information

Use of digital libraries like Saudi digital library (SDL)

2. Course Main Objective

1. **The definition of research and the scientific method.**
2. **The terminology used in scientific research.**
3. **The planning of research.**
4. **The data collection methods. The validity and reliability.**

5. **The data analysis**

Course Learning Outcomes

	CLOs	Aligned-PLOs
1	**Knowledge:**	
1.1	**Understand research and scientific methods.**	Fundamental knowledge and interdisciplinary approach in physics;
1.2	**Statistical error calculation and research ethics.**	
1.3	**Research design, planning, sampling, validity and reliability.**	identifying the key factors and applying appropriate principles and assumptions in the formulation of physics problems;
1...		
2	**Skills :**	
2.1	**Analyze writing research proposal and the possible outcomes**	Apply the theories and concepts of physics relations relating to the global research in local and international contexts;
2.2	**Reviewing the Literature.**	
2.3	**Experimental methods, data collection and evaluation of research.**	Explain to a general audience, both other experts in the field and to people outside the field, physics concepts and results
2...	**Data analysis.**	
3	**Competence:**	
3.1	Work effectively in groups as well as individuals.	Work effectively in groups as well as individually
3.2	Present a short report in a written form and orally using appropriate scientific language.	
3.3	Use information technology and modern computer tools to locate and retrieve scientific information relevant to solid state.	Use the appropriate tools and requisite media literacy to acquire, assess, and analyze data and information from diverse sources
3...		

Course Content

No	List of Topics	Contact Hours
1	Course introduction and course distribution. Research definition, research types and scientific methods.	6
2	Research design, planning, sampling, validity and reliability. Writing research proposal.	6
3	Reviewing the Literature. Experimental methods, data collection and evaluation of research.	6
4	Quantitative and qualitative data analysis.	6
5	Correlation between the analyzed data and previous research works.	6

6	Discussion and explanation of results.	6
7	Review	9
Total		45

Phys631: Applications of Ionizing Radiation Physics

Course Objectives and Learning Outcomes

1. Course Description

The basic principles of ionizing radiation, x-ray production, interactions of radiation, imaging equipment, radiation therapy equipment and the course will include lectures and demonstrations of clinical equipment applications. Provide a basic understanding of ionizing radiation. Course will also cover basic mathematical and physics concepts necessary in the understanding of the above topics. To achieve an understanding of medical X-ray and gamma ray imaging technology in terms of equipment components and their performance and to relate this to the needs of diagnostic medical imaging. To give the student a broad overview of the techniques used *in-vivo* and *in-vitro* nuclear medicine studies. To provide an overview of the use of radiopharmaceuticals in nuclear medicine. An appreciation of quality management, its aims and application to imaging and radiotherapy.

2. Course Main Objective

- The course will cover basic mathematical and physics concepts necessary in understanding the basic principles of ionizing radiation physics.
- Application of ionizing radiation for diagnostic and therapeutic purposes.
- An introduction is given to imaging systems: X-radiography, gamma cameras, X-ray computed tomography, single photon computer tomography (SPECT) and positron emission tomography (PET).
- An overview is given of radiotherapy techniques and the biological processes concomitant with this modality together with discussion of isodose curves and variation with incident radiation energy.

Course Learning Outcomes

	CLOs	Aligned-PLOs
1	**Knowledge:**	
1.1	Describe basic principles of ionizing radiation physics.	k1, k2
1.2	Describe Application of ionizing radiation for diagnostic and therapeutic purposes.	
1.3		
1...		
2	**Skills :**	
2.1	Apply the gained mathematical and experimental knowledge in any physical phenomena to understand its behavior.	s2
2.2	Solve the numerical problems with confidence.	
2.3		
2...		
3	**Competence:**	

CLOs		Aligned-PLOs
3.1	Work effectively in groups as well as individuals.	c1
3.2	Present a short report in a written form and orally using appropriate scientific language.	
3.3	Use information technology and modern computer tools to locate and retrieve scientific information relevant to radiation physics and dosimetry.	
3...		

Course Content

No	List of Topics	Contact Hours
1	Introduction to ionizing radiation and its classification, and sources; principal of applications: tracer concept, scattering and attenuation of radiation, radiation processing of materials;	6
2	Applications: 1. Health-care: Diagnostic application: Radioimmunoassay (RIA) and Related technique; Diagnostic nuclear medicine: Radiopharmaceuticals, Diagnostic techniques and its applications: Radiology: Single photon emission computed tomography (SPECT), Positron emission tomography (PET), X-rays, computed tomography (CT) Scan, therapeutic application: Radionuclide therapy, Radiotherapy. Risk/benefit analysis in mammography. Elements of the mammographic imaging system: dedicated X-ray sets, films, intensifying screens and film processing systems. Introduction to digital imaging modalities and their applications in mammography; Isodose curves and variation with incident radiation energy.	15
3	Applications: 2. Agriculture and industry: application in food and agricultural products: Food preservation; industry: radiation processing, non-destructive testing, radiotracer techniques, Facilities and devices for the application of nuclear techniques.	9
4	3. Application in Biology: Radiotracer, labeling methods; Labeled probe applications: In situ hybridization (ISH), DNA finger printing, molecular diagnostics, drug discovery.	6
5	Applications: 4. Environmental studies and Pollution control.	3
6	**X-rays, γ-rays, Modulation Transfer Function (MTF) and Receiver Operating Characteristic (ROC) Analysis:** Mathematical formulation of the imaging system; linear operator, principle of superposition, impulse response function, stationarity, line spread function, edge spread function, convolution integral, MTF. Usefulness of MTF, modulation input and output, measure of performance, cascade MTFs. Visual acuity, resolution criteria. Existence of observer, decision criteria, confidence thresholds, conditional	6

	probabilities, types of decision. Construction of the ROC curve and principle of ROC analysis.	
7		
Total		45

Phys632: Radiation Detection and Measurements

Course Objectives and Learning Outcomes

1. Course Description:

The course provides theoretical knowledge of the detection of ionizing radiation and a good knowledge on measurement techniques. The course covers the measurement of small currents and charges, pulse height analysis, statistics and dead time corrections. Gas, scintillation and semiconductor detectors are also treated, as well as neutron detectors. The course also covers gamma and alpha/beta spectrometry technique as well as the dosimeters and the calorimeter detectors.

2. Course Main Objective:

The main objectives are:

- Demonstrate an understanding of the principles of radiation detection and measurement as well as the used nuclear instruments.
- Gaining knowledge and skills on radiation detection, counting and spectrometry including shielding and health physics, as well as in radioactive sample preparation.
- Demonstrate an ability to understanding how to acquire, identify, quantify and assess radionuclides and report radiation data, uncertainty and detection limits.

Course Learning Outcomes

	CLOs	Aligned-PLOs
1	**Knowledge:**	
1.1	Understand of the role of fundamental processes involved with the interaction of x- and gamma-ray photons, charged particles and neutrons with matter.	k1
1.2	Detailed knowledge of the principles of operation of solid state semi-conductor detectors, scintillation counters, gas ionization detectors	k1, k2
1.3		
1...		
2	**Skills :**	
2.1	- Collect general information about radiation detection and technique of measurements.	s2
2.2	- Use the mathematical equations in understanding particles interactions.	s2
2.3	- Apply the gained mathematical and experimental knowledge in any physical related topic.	s2
2...		

CLOs		Aligned-PLOs
3	**Competence:**	
3.1	Learn how to search information through library	c2, c5

Course Content

No	List of Topics	Contact Hours
1	Radiation sources, interactions of particles (Heavy charged particles, electrons, neutrons, Gamma rays) with matter, Radiation Exposure and Dose	6
2	General properties of radiation detectors: Simplified Detector Model, Modes of Detector Operation, Pulse Height Spectra, Counting Curves and Plateaus, Energy Resolution, Detection Efficiency, dead time.	3
3	Counting statistics and error analysis: Characterization of data, Statistical models, Applications of statistical models, Limits of detectability, Distribution of time intervals.	6
4	Action of gas filled ionization chamber and proportional counters, gas multiplication; ion mobility, recombination, pulsed and direct current modes of operation; Geiger-Muller counter, internal and external quenching, practical devices	9
5	Scintillation counting with gases, liquids and solids; theory of operation, selection for various applications.	6
6	Semiconductor detectors (HPGe detector), Configurations of Germanium detectors, Germanium detector operational characteristics, Gamma-Ray spectrometry technique.	6
7	Dosimeters, calorimeters, chemical dosimetry, gas dosimetry, W-values, stopping power ratio.	3
8	Neutron activation, Neutron detection, fission track detectors, neutron spectrometry.	6
Total		45

Phys633: Detectors Instrumentation

Course Objectives and Learning Outcomes

1. Course Description

Topics will include the performance and use of preamplifiers, spectroscopy systems and multi-channel analyzers (MCAs). Digital methods for data acquisition, including digital pulse processing, pulse shape discrimination and digital MCA systems. Instrumentation for scintillators and gas detectors. The module will also cover digital signal processing and the role of noise in affecting detector performance.

2. Course Main Objective

- This course is designed to understand detectors instrumentation, its working and design for the radiation measurements. The course will cover basic mathematical and physics concepts necessary in understanding the basic principles of detector instrumentation.
- This module explores the theory of operation and practical aspects of instrumentation for radiation detection, covering both traditional analogue instrumentation techniques and the latest developments in digital pulse processing. Students will also critically evaluate the role of statistical processes in detector noise and electronic signal processing.

Course Learning Outcomes

	CLOs	Aligned-PLOs
1	**Knowledge:**	
1.1	Describe instrumentation for radiation detectors and signal processing.	k1, k2
1.2	Describe nuclear electronics, data collection and its analysis.	
1.3		
1...		
2	**Skills :**	
2.1	Apply the gained mathematical and experimental knowledge in any physical phenomena to understand its behavior.	s2
2.2	Solve the numerical problems with confidence.	
2.3		
2...		
3	**Competence:**	
3.1	Work effectively in groups as well as individuals.	c1
3.2	Present a short report in a written form and orally using appropriate scientific language.	
3.3	Use information technology and modern computer tools to locate and retrieve scientific information relevant to radiation physics and dosimetry.	
3...		

Course Content

No	List of Topics	Contact Hours
1	INTERACTION OF RADIATION WITH MATTER: A survey, IMPORTANT FEATURES OF RADIATION DETECTORS: Modes of detector operation, Counting curves and plateaus, Energy resolution, Calibration and Detection efficiency, Dead time, Quenching.	9

2	DETECTORS FOR NUCLEAR PARTICLES: Gas filled Detectors: Ionization chamber, Proportional counter, GM counter; Scintillation detectors; Semi-conductor detectors: HPGe detector: - Design and operation.	6
3	PARTICLE ACCELERATORS: Van de Graaff generator, Pelletron Accelerator; Linear Accelerators (LINAC), Cyclotron, Microtron, Betatron, Synchrotron: - Design and operation.	6
4	LINEAR AND LOGIC PULSE FUNCTIONS: Linear and Logic Pulses, Instrument Standards, Application Specific Integrated Circuits (ASICs), Summary of Pulse-Processing Units, Components Common to Many Applications, Pulse Counting Systems, Pulse Height Analysis Systems, Digital Pulse Processing, Systems Involving Pulse Timing, Pulse Shape Discrimination.	9
5	MULTICHANNEL PULSE ANALYSIS: Single-Channel Methods, General Multichannel Characteristics, The Multichannel Analyzer, Spectrum Stabilization and Relocation, Spectrum Analysis.	6
6	DATA ANALYSIS AND TECHNIQUES: Counting statistics and error predictions: Characterization of data, Statistical models and their applications, Chi-square test, Precision and accuracy, Error analysis, propagation of errors, Limits of detectability, Plotting of graphs, Least squares fitting, linear and nonlinear curve fitting, Poisson statistics, Fourier analysis.	9
7		
Total		45

Phys634: Radiation Protection

Course Objectives and Learning Outcomes

1. Course Description

1. What is the main purpose for this course?
This course describes the international legislative framework of radiation protection. From this starting point the course covers population and personal exposures to radiation, the principles of dose calculations, and example procedures for implementing radiation protection programmes
2. Briefly describe any plans for developing and improving the course that are being implemented. (e.g. increased use of IT or web based reference material, changes in content as a result of new research in the field)
- Annual review of the course using recent textbooks and others references.
- Electronic materials are updated frequently to support the lecture course.

2. Course Main Objective

The course gives a thorough understanding of the underlying philosophy and the practical implementation of the ICRP system of radiological protection. To encourage a quantitative approach to radiological protection; and to illustrate the need for a detailed understanding of the sources of radiation exposure and methods for applying the principles of radiation protection.

Course Learning Outcomes

	CLOs	Aligned-PLOs
1	**Knowledge:**	
1.1	knowledge of the fundamental principles for radiation protection	K1
1.2	basic knowledge of the origin of radiation, properties and biological impact	K2
1.3	knowledge of risks when working with radiation and how these risks relate to other risks in the society	K3
1.4	basic knowledge and skills in using radiation protection instruments	K4
2	**Skills :**	
2.1	Analysis of data to gain ability to perform simplified dose calculations	S1
2.2	Ability to understand the methods for applying the principles of radiation protection	S2
2.3		
2...		
3	**Competence:**	
3.1	Work effectively in groups as well as individuals.	C1
3.2	Present a short report in a written form and orally using appropriate scientific language.	C2
3.3	Use information technology and modern computer tools to locate and retrieve scientific information relevant to electrodynamics	C3
3...		

Course Content

No	List of Topics	Contact Hours
1	Quantities and measurements: Radiation field; fluence (rate); energy fluence (rate), mass attenuation coefficient; mass stopping power, Exposure (rate); kerma (rate); energy imparted; absorbed dose (rate); organ dose, Equivalent dose (rate); radiation weighting factor (wR); Effective dose, tissue weighting factor (wT).	6
2	The history of radiation protection. Radiation risks. The ICRP system of radiological protection. Future recommendations of the ICRP	6
3	Basic Safety Standards, Ionizing Radiations	6
4	First Mid-term Exam	2
5	Environmental radiation, natural sources, man-made sources and population exposures	3

6	Practical Radiation Protection, Radiation shielding. Gamma-ray attenuation and buildup processes. Point kernel calculations and their application to extended sources	6
7	Assessment of radiological risks	3
8	Second Mid-term Exam	2
9	Nuclear Industry Safety Case Principles	3
10	Phases of decommissioning, radiation sources and controls, options and assessment methods, economic considerations and examples Waste management and disposal, categorization and arising, disposal routes, inventory management and assay techniques	6
11	Final Exam	2
Total		45

Phys635: Heat Transfer in Microelectronics devices

Course Objectives and Learning Outcomes

1. Course Description

Introduction to nano heat transfer,
Boltzmann Equation for Phonon Transport;
Single and dual phase lag models;
Application to nanoscale heat transfer, Heat transfer in transistors

Introduction to heat transfer, Overview on heat transfer mechanisms, Conduction, Convection, Radiation Laws of macroscopic heat transfer; Heat Conduction in solids, Fourier law, Heat equation, Thermal resistance, Lumped capacity, Harmonic Cconduction regime, Limit of Fourier law; Transport in dilute medias, Distribution function, Boltzmann equation, Collision, Relaxatio, Mean free path, Knudsen number, Various transport regimes (ballistic, semi-ballistic and diffusive); Electrons and Phonons, Electrical conduction, Semi-classical approach, Electrical conductivity in the collisional regime, Electrical conduction in the ballistic regime, Vibrational modes in a lattice, Density of states, Optical and acoustic modes, Heat Flux, Heat capacity; Solution of the Boltzmann Equation for Phonon Transport; Single and dual phase lag models; Application to nanoscale heat transfer, Heat transfer in transistors

2. Course Main Objective

Introduction to nano heat transfer,
Boltzmann Equation for Phonon Transport;
Single and dual phase lag models;
Application to nanoscale heat transfer, Heat transfer in transistors

Course Learning Outcomes

	CLOs	Aligned-PLOs
1	**Knowledge:**	
1.1	nano heat transfer	

CLOs		Aligned-PLOs
1.2		
1.3		
1...		
2	**Skills :**	
2.1		
2.2	Boltzmann Equation for Phonon Transport	
2.3	Single and dual phase lag models	
2...		
3	**Competence:**	
3.1		
3.2	Application to nanoscale heat transfer, Heat transfer in transistors	
3.3		
3...		

Course Content

No	List of Topics	Contact Hours
1	Introduction to heat transfer, Overview on heat transfer mechanisms, Conduction, Convection, Radiation, Laws of macroscopic heat transfer	12
2	Transport in dilute medias, Distribution function, Boltzmann equation, Collision, Relaxatio, Mean free path, Knudsen number, Various transport regimes (ballistic, semi-ballistic and diffusive), Electrons and Phonons, Electrical Conduction, Semi-classical approach, Electrical conductivity in the collisional regime, Electrical conduction in the ballistic regime, Vibrational modes in a lattice, Density of states, Optical and acoustic modes, Heat Fl,	12
3	Solution of the Boltzmann Equation for Phonon Transport, Single and dual phase lag models,	12
4	Application to nanoscale heat transfer, Heat transfer in transistors.,	9
Total		45

Phys636: Solar Cells

Course Objectives and Learning Outcomes

1. Course Description

Aim of this course is to provide some understanding to students about that how solar cells convert light into electricity, how solar cells are manufactured, how solar cells are evaluated, what technologies are currently on the market, and how to evaluate the risk and potential of existing and emerging solar cell technologies. We will also try examine the potential & drawbacks of currently manufactured technologies (single- and multi-crystalline silicon, tandem cells, CdTe, CIGS, CPV, PVT), as well as pre-commercial technologies (organics, biomimetic, organic/inorganic hybrid, and nanostructure-based solar cells).

2. Course Main Objective

- By the year 2030, several hundred gigawatts of power must be generated from low-carbon sources to cap atmospheric CO2 concentrations at levels deemed "lower-risk" by the current scientific consensus.
- The necessity to develop low-carbon energy sources represents not only an awesome technological and engineering challenge, but also an equally large economic opportunity in a trillion-dollar energy market.
- Student can describe Fundamentals of photoelectric conversion into elecreical energy. They know about an overview of world energy requirement and its resources
- The students are expected to understand physical properties and working principal s of Solar cells and have an idea how to improve the efficiency of solar cells

Course Learning Outcomes

	CLOs	Aligned-PLOs
1	**Knowledge:**	
1.1	Back ground and development of fundamental knowledge in Physics	Fundamental knowledge and interdisciplinary approach in Physics.
1.2	Fundamental knowledge and mathematical approach in Physics	
1.3	To understand the Physics conceptus at an advanced level for solving complex problems.	
1.4	Identifying the key factors and applying appropriate principles and assumptions in the formulation of Physics problems	
2	**Skills :**	
2.1	Perform data analysis and draw results and conclusions	Apply and explain the theory and experimental data to concepts of Physics.
2.2	Apply the Physics theories and draw relations with research on related topics	
2.3	Ability to use analytical and/or computational methods to solve physics problems;	
2...	Explain to a general audience and experts in the field with concepts and results	
3	**Competence:**	
3.1	Applying appropriate scientific programming skills;	Use the appropriate tools and acquire requisite information from diverse sources
3.2	Use the appropriate tools and requisite media literacy to acquire, assess, and analyze data and information from diverse sources	
3.3	Having good time management skills.	Work effectively in groups as well as individually
3.4.	Work effectivily in group	

Course Content

No	List of Topics	Contact Hours
1	PHOTOVOLTAIC: Fundamentals of photoelectric conversion: charge excitation, conduction, separation, and collection. Commercial and emerging photovoltaic (PV) technologies. Cross-cutting themes in PV: conversion efficiencies, loss mechanisms, characterization, manufacturing, systems, reliability, life-cycle analysis, risk analysis.	3
2	Photovoltaic technology evolution in the context of markets, policies, society, and environment. Overview of world energy, Options for harnessing solar energy and their respective current and projected costs/potential, compared to traditional sources.	3
3	Minority carrier mobility, lifetime, diffusion length. Charge excitation in non-semiconducting materials. Conduction, dispersive hopping.	3
4	CHARGE SEPARATION: How voltage, current are formed. Minority-carrier devices: semiconductor pn-junctions.	3
5	IV curves. Majority-carrier devices (organics). Quantum-size effects of charge separation.	3
6	CHARGE COLLECTION, AND THE SOLAR CELL DEVICE: Metallization. Solar cell device architectures.	3
7	Common limitations of efficiency, short-circuit current, fill factor, open-circuit voltage.	3
8	COMMERCIAL TECHNOLOGIES-I : Crystalline silicon solar cells, Crystal growth: ingot silicon, ribbon and sheet silicon. Wafering. Cell fabrication: methods, architectures, concepts.	3
9	History, state-of-the-art. Emerging trends, cutting-edge technology. Role of innovation.	3
10	COMMERCIAL TECHNOLOGIES-II: Thin Films: thin film silicon (incl. amorphous, SiGe, micromorph, tandem cells), cadmium telluride, copper indium gallium diselenide.	3
11	Precursors. Deposition processes and technologies. Other technologies: concentrator devices and materials, heterojunction devices, photovoltaic thermal.	3
12	DEVELOPING TECHNOLOGIES: Organic PV. Organic/Inorganic hybrid systems (dye-sensitized, nano hybrid). Inorganic nanostructured materials, incl. quantum dots, nanostructured devices, and layered structures. Biological and biomimetic systems. Novel thin film materials, multiband semiconductors, hot carrier devices, spectrum splitting.	3
13	PHOTOELECTRIC CONVERSION EFFICIENCY: Theoretical efficiency limits. Efficiency loss mechanisms. Optical losses, recombination losses, surface	3

	recombination velocity, series and parallel resistance (shunts).Specific loss mechanisms in each technology class. Evaluation of loss mechanisms, common characterization tools.	
14	Review	3
...	Examinations	3
Total		42

Phys637: Non-Crystalline materials

Course Objectives and Learning Outcomes

1. Course Description

The purpose of the course is to prepare the students for research in the field of amorphous materials.
to understand the theories deal with the formation of amorphous materials including their structure.
to understand the preparation of the different types of amorphous materials.
to understand how to characterize with different techniques the amorphous materials.
to understand the theoretical approaches of the properties of the amorphous materials.

2. Course Main Objective

1. Current technology to understand Physics of amorphous materials is very important e.g.
2. Experiments of preparation the non-crystalline materials
3. Equipment and Computer Interfacing to Collect and Process Data
4. Computer Simulations and Graphics
5. Research/Reference/Presentation, Reporting, and Displaying Information
6. Use of digital libraries like Saudi digital library (SDL)

Course Learning Outcomes

	CLOs	Aligned-PLOs
1	**Knowledge:**	
1.1	Understand processes and phenomena in amorphous materials.	Fundamental knowledge and interdisciplinary approach in physics;
1.2	Recognize theories of amorphous structure.	
1.3	Describe features of physical characteristics of glasses.	identifying the key factors and applying appropriate principles and assumptions in the formulation of physics problems;
1...		
2	**Skills :**	
2.1	Analyze structure and formation of inorganic glass and polymers by applying techniques and theoretical studies to	Apply the theories and concepts of physics relations relating to

CLOs		Aligned-PLOs
	determine the mechanical and electrical properties of glasses and the possible outcomes	the global research in local and international contexts;
2.2	Apply the use of rare earth oxides in glasses to study their future applications.	
2.3	Choose the most appropriate and effective theoretical models, mathematical and numerical techniques, software packages and algorithms to solve non-standard problems of the amorphous structure.	Explain to a general audience, both other experts in the field and to people outside the field, physics concepts and results
2...	Compare the use of Judd-Ofelt theory and the other models deals with the electronic transitions in the amorphous structure.	
3	**Competence:**	
3.1	Work effectively in groups as well as individuals.	Work effectively in groups as well as individually
3.2	Present a short report in a written form and orally using appropriate scientific language.	
3.3	Use information technology and modern computer tools to locate and retrieve scientific information relevant to solid state.	Use the appropriate tools and requisite media literacy to acquire, assess, and analyze data and information from diverse sources
3...		

Course Content

No	List of Topics	Contact Hours
1	Introduction to glasses and their characteristization.	6
2	Different types of glasses: Structure, Formation and method of preparations.	6
3	Optical behaviors of dopants and defects in glasses and polymers..	6
4	Mechanical properties of glasses including theoretical approaches.	6
5	Thermal properties of glasses including theoretical models.	6
6	Electrical properties including Ac and DC conductivity along with theories such as polaron theory.	6
7	The use of amorphouse materials as smart materials and their future uses in optical filters, sensors and data storage.	9
Total		45

Phys638: Nanostructures Engineering

Course Objectives and Learning Outcomes

1. Course Description

This course introduces the theory and technology of micro/nano fabrication. Lectures sessions focus on basic processing techniques such as diffusion, oxidation, photolithography, chemical vapor deposition, and more.Through lab assignments (group), students are expected to gain an understanding of these processing techniques, and how they are applied in concert to device fabrication. Students enrolled in this course have a unique opportunity to test micro/nano-devices, using modern techniques and technology.

2. Course Main Objective

- This course introduces the theory and technology of micro/nano fabrication.
- Lectures sessions focus on basic processing techniques such as diffusion, oxidation, photolithography, chemical vapor deposition, and more.
- Through lab assignments (group), students are expected to gain an understanding of these processing techniques, and how they are applied in concert to device fabrication.
- Students enrolled in this course have a unique opportunity to test micro/nano-devices, using modern techniques and technology.

Course Learning Outcomes

	CLOs	Aligned-PLOs
1	**Knowledge:**	
1.1	Back ground and development of fundamental knowledge in Physics	Fundamental knowledge and interdisciplinary approach in Physics.
1.2	Fundamental knowledge and mathematical approach in Physics	
1.3	To understand the Physics conceptus at an advanced level for solving complex problems.	
1.4	Identifying the key factors and applying appropriate principles and assumptions in the formulation of Physics problems	
2	**Skills :**	
2.1	Perform data analysis and draw results and conclusions	Apply and explain the theory and experimental data to concepts of Physics.
2.2	Apply the Physics theories and draw relations with research on related topics	
2.3	Ability to use analytical and/or computational methods to solve physics problems;	
2...	Explain to a general audience and experts in the field with concepts and results	
3	**Competence:**	
3.1	Applying appropriate scientific programming skills;	Use the appropriate tools and acquire requisite information from diverse sources
3.2	Use the appropriate tools and requisite media literacy to acquire, assess, and analyze data and information from diverse sources	
3.3	Having good time management skills.	Work effectively in groups as well as individually
3.4.	Work effectivily in group	

Course Content

No	List of Topics	Contact Hours

1	IMPORTANCE OF NANOSCIENCE: Structures 1-100 nm in size, Quantum effects in nanostructure, Catalysis, Colours from colloidal nanostructures,	3
2	Moore's law, Spintronics, Biological systems	3
3	Buckyballs, Quantum dots, One dimensional systems: Metallic nanowires and quantum conductance, Carbon nanotubes and dependence on chirality,	3
4	Two dimensional systems: Quantum wells and modulation doping, Resonant tunnelling	3
5	OPTICAL PROPERTIES: Two dimensional systems (quantum wells), Absorption spectra, Excitons, Coupled wells and superlattices,	3
6	Quantum confined Stark effect, Quantum cascade laser, One dimensional systems (quantum dots)	3
7	MAGNETIC PROPERTIES: Transport in a magnetic field: Quantum Hall effect, Spin valves, Spin-tunnelling junctions, Domain pinning at constricted geometries, Magnetic vortices	3
8	FABRICATION OF NANOSCALE MATERIALS: TOP-DOWN VS BOTTOM-UP: Thin film deposition,	3
9	Epitaxial growth, CVD, MBE, plasma,	3
10	Lithographic, photo, e-beam, Etching, FIB,	3
11	Synthesis, Colloidal dispersions, Atomic and molecular manipulations, Self assembly: Growth modes, Stransky-Krastinov etc, Ostwald ripening	3
12	CHARACTERISATION OF NANOSTRUCTURS: Beam probe methods: TEM, EDX, EELS, SEM, EDX, X-ray scattering, Neutron scattering,	3
13	Scanning probe methods: STM, STS, spin-polarised STM, AFM, MFM, EFM, Other: Optical spectroscopy, Chromatography, Light scattering, Photoemission	3
14	Review	3
...	Examinations	3
Total		42

Phys640: Optical Properties of Nanostructures

Course Objectives and Learning Outcomes

1. Course Description

The course will cover the optical physics of semiconductors nanostructures. The course includes the quantum theory of the absorption and luminescence phenomena in semiconductors nanostructures. The exciton effects will be addressed. Quantum confinement of quantum well and nanostructure semiconductors will be covered including a brief description of luminescence centers of some metallic dopants in semiconductors nanostructures. The quantum theory treatment of luminescence related to phonon absorption will be included. The course will be ended by a brief introduction to nonlinear crystals and optical properties of new semiconductor materials.

2. Course Main Objective

- The purpose of the course is to prepare the students for research in the field of experimental physics.
- to understand the quantum theory of absorption and emission in semiconductor including defects and excitonic effects.
- to understand the effect of quantum confinement in nanostructural semiconductors nanostructures.
- to understand the complex optical phenomena related to optical centers and phonon absorptions.
- to understand the nonlinear optical properties

Course Learning Outcomes

	CLOs	Aligned-PLOs
1	**Knowledge:**	
1.1	To know the optical absorption in semiconductor nanostructures, luminescence in semiconductors nanostructures	Fundamental knowledge and interdisciplinary approach in Physics.
1.2	Recognize the Free electrons and Plasmonic effect, luminescence centers of some metallic dopants in semiconductors	
2	**Skills :**	
2.1	Analyze the optical properties of new emerging semiconductors.	Apply the theory and experimental concepts of Physics.
2.2	Use optical absorption and luminescence techniques identify the behaviors of dopants and defects in semiconductor's nanostructures	
3	**Competence:**	
3.1	Work effectively in groups as well as individuals.	Work effectively in groups as well as individually
3.2	Present a short report in a written form and orally using appropriate scientific language.	
3.3	Use information technology and modern computer tools to locate and retrieve scientific information relevant to electrodynamics	Use the appropriate tools and requisite media literacy to acquire, assess, and analyze data and information from diverse sources

Course Content

No	List of Topics	Contact Hours

1	Introduction to optical materials and characteristic of optical physics in solid states	6
2	Excitons: Weekly bound excitons, tightly bound excitons, excitons in molecular crystals and in nanostructures	3
3	Optical absorption in semiconductor nanostructures, luminescence in semiconductors nanostructures	3
4	Optical behaviors of dopants and defects in semiconductor's nanostructures	6
5	Quantum confinement effect in nanostructures, Free electrons and Plasmonic effect, luminescence centers of some metallic dopants in semiconductors	9
6	Nonlinear optical semiconductors	9
7	Review	3
Total		45

إجراءات تظلم الطالب والآلية المستخدمة:

- يحق للطالب أن يتقدم بطلب إعادة تصحيح أوراق إجابته خلال خمسة عشر يوماً من تاريخ إعلان نتيجة الاختبار النهائي محل الطلب، ويقدم الطلب للقسم الذي يتولى تدريس المقرر، ويدخل طلبه في النظام الأكاديمي ويسلّم له إشعار بذلك.
- يشترط ألا يكون الطالب قد سبق وتقدم بثلاثة طلبات لإعادة تصحيح أوراق إجابة اختبارات نهائية لمقررات سبق له دراستها، وصدر فيها قرارات نهائية بالرفض أو بالحفظ.
- على رئيس القسم أن يطلب إفادة من مدرس المقرر، وفي حال الإفادة بسلامة التصحيح، على رئيس القسم إطلاع الطالب على ورقة إجابته ومقارنتها بالإجابة النموذجية للاختبار، وعند اقتناع الطالب بسلامة التصحيح يوقع على طلبه بالتنازل، ويوقع رئيس القسم بحفظ الطلب، مع اعتبار هذا الطلب أحد الطلبات المشار إليها بالفقرة الثانية على ان يتم انهاء هذه الاجراءات خلال خمسة ايام عمل.
- في حال عدم اقتناع الطالب بسلامة التصحيح، على رئيس القسم أن يشكل لجنة من عضوين من هيئة التدريس بالقسم ليس من بينهما مدرس المقرر، وترفع تقريرها لرئيس القسم لاتخاذ قراره بتعديل درجة الطالب أو برفض الطلب، ويتم إبلاغ الطالب بالقرار.
- إذا كان رئيس القسم هو مدرس المقرر يقوم وكيل الكلية للشؤون الأكاديمية بالإجراءات السابقة.
- في حال عدم قبول الطالب بالقرار يجوز للطالب التظلم لمجلس الكلية من هذا القرار خلال خمسة عشر يوماً من تاريخ إعلامه به، ويقدم التظلم رسمياً لعميد الكلية متضمناً أسباب ومبررات تقديمه، وتعد استمارة تشمل البيانات التالية :

1. اسم الطالب
2. رقمه الجامعي
3. رقم المقرر الدراسي ورمزه واسمه
4. رقم الشعبة، الفصل الدراسي
5. المعدل التراكمي
6. نسبة الغياب
7. عدد الإنذارات
8. اسم مدرس المقرر
9. تاريخ الاختبار
10. مبررات طلب إعادة التصحيح
11. تعهد من الطالب بصحة المعلومات التي قدمها

12. بيان من عمادة القبول والتسجيل بطلبات إعادة التصحيح السابق تقديمها من الطالب إن وجدت والقرارات المتخذة فيها

- ترفع هذه الاستمارة مرفقاً بها كافة ما يتعلق بالتظلم لمجلس الكلية في أول جلسة انعقاد له بعد تقديم التظلم. يجوز لمجلس الكلية في حال عدم اقتناعه بجدية وكفاية أسباب التظلم أن يصدر قراراً مسبباً بحفظه، وفي حال موافقته على إعادة التصحيح يشكل لجنة من ثلاثة من أعضاء هيئة التدريس على الأقل يكون أحدهم من خارج القسم وليس من بينهم مدرس المقرر لإعادة تصحيح ورقة الإجابة، وترفع تقريرها للمجلس خلال عشر ايام من تاريخ صدور قرار تشكيلها، ويعرض على المجلس للبت فيه في أول جلسة انعقاد تالية، ويكون قرار المجلس نهائياً باعتماد محضر الجلسة وفقاً للإجراءات المنصوص عليها بالمادة (35) من نظام مجلس التعليم العالي والجامعات.

الاجراءات المتخذة

- يتقدم الطالب الذي لديه اعتراض على درجة الاختبار النهائي بطلب إعادة تصحيح أوراق إجابته خلال خمسة عشر يوماً من تاريخ إعلان نتيجة الاختبار النهائي محل الطلب، ويقدم الطلب للقسم الذي يتولى تدريس المقرر، ويدخل طلبه في النظام الأكاديمي ويسلّم له إشعار بذلك.
- يقوم رئيس القسم إطلاع الطالب على ورقة إجابته ومقارنتها بالإجابة النموذجية للاختبار، وعند اقتناع الطالب بسلامة التصحيح يوقع على طلبه بالتنازل، ويتم حفظ الطلب بعد أن يوقع رئيس القسم ، مع اعتبار هذا الطلب أحد الطلبات المشار إليها بالفقرة الثانية من القاعدة التنفيذية.
- في حال عدم اقتناع الطالب بسلامة التصحيح، يشكل رئيس القسم لجنة من عضوين من هيئة التدريس بالقسم ليس من بينهما مدرس المقرر، وترفع تقريرها لرئيس القسم لاتخاذ قراره بتعديل درجة الطالب أو برفض الطلب، ويتم إبلاغ الطالب بالقرار.
- في حال عدم اقتناع الطالب يجوز للطالب التظلم لمجلس الكلية من هذا القرار خلال خمسة عشر يوماً من تاريخ إعلامه به، ويقدم التظلم رسمياً لعميد الكلية متضمناً أسباب ومبررات تقديمه وتعهد من الطالب بصحة المعلومات التي قدمها، بيان من عمادة القبول والتسجيل بطلبات إعادة التصحيح السابق تقديمها من الطالب إن وجدت والقرارات المتخذة فيها.
- في حالة عدم اقتناع مجلس الكلية بجدية وكفاية أسباب التظلم يصدر قراراً مسبباً بحفظه.
- في حال موافقة مجلس الكلية على إعادة التصحيح يشكل لجنة من ثلاثة من أعضاء هيئة التدريس على الأقل يكون أحدهم من خارج القسم وليس من بينهم مدرس المقرر لإعادة تصحيح ورقة الإجابة، وترفع تقريرها للمجلس خلال خمسة عشر يوماً من تاريخ صدور قرار تشكيلها، ويعرض على المجلس للبت فيه في أول جلسة انعقاد تالية، ويكون قرار المجلس نهائياً باعتماد محضر الجلسة.

تنبيه

يشترط ألا يكون الطالب قد سبق وتقدم بثلاثة طلبات لإعادة تصحيح أوراق إجابة اختبارات نهائية لمقررات سبق له دراستها، وصدر فيها قرارات نهائية بالرفض أو بالحفظ.

إذا كان رئيس القسم هو مدرس المقرر يقوم وكيل الكلية للشؤون الأكاديمية بالإجراءات السابقة.