دليل الطالب

لمسار بولونيا التعليمي

قسم الفيزياء – كلية العلوم – جامعة تكريت

محتويات الدليل

الفصل الاول: التعاريف والمصطلحات

١) **مسار بولونيا Bolonga Process:** عملية متعددة الاهداف تعنى بوضع اطار يجعل المؤهلات في التعليم العالي متماثلة في شهاداتها والمعلومات المتوفرة فيها وتيسر مسار المقارنة في الدرجات الجامعية في دول الاتحاد الاوربي وتمكن من تبني معايير متماثلة في الجودة وتساعد التعليم العالي في توظيف الطالب والمنافسة العالمية.

يهدف اعتماد هذا المسار الى:

- تحسين الشفافية التعليمية.
- ترصين سمعة الجامعات والنظام التعليمي العراقي دوليا.
- تحسين جودة التعليم.
- تقليص الفجوة بين قطاع التعليم وسوق العمل.
- استخدام ادوات شفافية متعددة الابعاد.
- تصميم مناهج جديدة تلبي احتياجات سوق العمل وتعزز فرص الحصول على عمل للخريجين.
- جعل التعليم ممتعاً وعملياً للطالب لكي يستمتع بمسار التعليم والتعلم من خلال العمل الجماعي.
- التعلم فيه قد يكون بالتمحور حول الطالب مع سمة التعاون الدولي وتنقل الطلبة.
- تسهيل عملية تنقل الطلبة بين الجامعات والبلدان التي تتبنى مسار بولونيا.
- تبني نظام لقراءة الدرجات ومقارنتها ومواءمتها وايجاد فضاء يجعل معايير الدرجات الاكاديمية ومعايير الجودة اكثر قابلية للمقارنة والتطابق مع متطلبات سوق العمل والجامعات العالمية.
- انشاء نظام للوحدات الدراسية مثل النظام الأوربي لنقل الوحدات الدراسية يسهل عملية انتقال الطلبة بين الجامعات.

٢) **نظام الوحدات The European Credit Transfer and Accumulation System (ECTS):** هو نظام أوروبي تراكمي لتحويل الرصيد ويعتبر وسيلة معيارية لمقارنة الاعتمادات الأكاديمية، أي "حجم التعلم بناءً على مخرجات التعلم المحددة وعبئ العمل المرتبط بها" للتعليم العالي. يمثل نظام الوحدات هذا أساس مسار بولونيا، إذ يقاس جهد الطالب بالوحدات، ولكل مادة دراسية او مكون تعليمي عدد وحدات تعادل العبئ الدراسي المطلوب لاجتيازها.

٣) **مخرجات التعلم Learning Outcomes:** تتكون من مجموع المعارف والمهارات والكفاءات المراد أن يحصل عليها الطالب بعد انتهاء كل فصل دراسي بنجاح او انتهاء البرنامج الدراسي، ويجب أن تحدد مخرجات التعلم لكل مادة وفصل دراسي بالشكل الذي يصب في تحقيق اهداف البرنامج الدراسي.

٤) **العبئ الدراسي للطالب Student Workload:** يشير الى الوقت الذي يستغرقه الطالب للتعلم في كل مقرر دراسي متضمناً جميع الانشطة والواجبات التي يحققها الطالب داخل القاعة الدراسية وخارجها (محاضرات واجبات تقارير، سيمنارات (حلقات دراسية)، امتحانات بانواعها، ... الخ).

٥) **الفصل الدراسي Semester: عدد من الاسابيع الدراسية التي يقضيها الطالب في تعلم مواد دراسية لتحقيق مخرجات تعلم معينة.**

٦) **المواد الممهدة: هي المواد التي يجب على الطالب استكمال متطلباتها قبل التسجيل على المواد المكملة لها في الفصول اللاحقة.**

٧) **المواد المكملة: هي المواد التي لا يحق للطالب التسجيل عليها إذا لم يكن قد استوفى متطلبات المادة /المواد الممهدة لها في فصل فصول سابقة.**

٨) **التقييم التكويني Formative Assessment: هو نمط من التقييم يحدد نقاط القوة والضعف في أداء الطالب خلال الفصل الدراسي ويحدد مدى تقدم الطالب نحو تحقيق مخرجات التعلم. يتكون التقييم التكويني من مهام وواجبات يحددها استاذ المادة وتقر من قبل مجلس الكلية / المعهد وتتضمن على سبيل المثال الامتحانات اليومية ، الواجبات البيتية، التقارير، مشاريع عمل، الزيارات الميدانية، المناقشات، متطلبات سريرية وغيرها وبحسب طبيعة المادة الدراسية.**

٩) **التقييم التلخيصي Summative Assessment: وهو نمط من التقييم يتم في منتصف الفصل الدراسي ونهايته، وهو يقيم منجزات الطالب ويتأكد من ان الطالب قد حقق فعلا مخرجات التعلم ويتم من خلال الاختبارات، و يتكون التقييم التلخيصي من جزأين اختبار منتصف الفصل و الاختبارات النهائية ومن الممكن ان يتضمن امتحاناً عملياً أو سريرياً.**

١٠) **اطار المؤهلات الوطني National Qualifications Framework: هو هيكل رسمي يستخدم فيه وصف لمخرجات التعلم حسب مستويات الدراسة، و يحدد ما يتوقع أن يعرفه حامل الشهادة ويفهمه ويكون قادرا على القيام به.**

١١) **ملحق شهادة التخرج Diploma Supplement: تعطى للطالب بعد دراسته وفق مسار بولونيا و تخرجه وحصوله على شهادة التخصص وبعد تجميعه عدد الوحدات الاوربية ECTS المطلوبة. وتحوي ملحق الشهادة على جميع المعلومات الخاصة بنظام التعليم في العراق والبرنامج الدراسي ومخرجات التعلم والمواد التدريسية والدرجات التي تحصل عليها الطالب لكل المواد الدراسية مع وحداتها والمعدل العام التراكمي CGPA وكيفية حسابه.**

١٢) **معدل الفصل الدراسي Grade Point Average (GPA): يمثل معدل الطالب لفصل دراسي واحد و يحسب بجمع ناتج ضرب درجة كل مادة دراسية بوزنها من عدد الوحدات (ECTS)، ثم يقسم الناتج على عدد وحدات الفصل الدراسي.**

١٣) **معدل التخرج Cumulative Grade Point Average (CGPA): يمثل المعدل التراكمي للطالب عند انهائه البرنامج الدراسي في تخصص معين، و يحسب بجمع ناتج ضرب درجة كل مادة دراسية بوزنها من عدد الوحدات (ECTS) لكل المستويات الدراسية ، ثم يقسم الناتج على عدد الوحدات المطلوبة لكامل البرنامج الدراسي.**

الفصل الثاني: النظام الدراسي

أولاً: الفصول الدراسية

١) تتألف السنة الدراسية من فصلين دراسيين وهما الفصل الأول (الخريفي) والفصل الثاني (الربيعي).
٢) تكون مدة الدراسة الفعلية في كل من الفصلين (١٥) اسبوعا عدا مدة الامتحانات.
٣) تحدد توقيتات بدء الفصول الدراسية وانتهائها والامتحانات بموجب التقويم الجامعي الصادر عن وزارة التعليم العالي والبحث العلمي / دائرة الدراسات والتخطيط والمتابعة.

ثانياً: نظام الوحدات والعبئ الدراسي للطالب

١) لكل مادة دراسية عدد من الوحدات يتم تحديدها من قبل الاقسام العلمية وتعادل الوحدة الواحدة جهد (٢٥) ساعة تعلم من العبئ الدراسي للطالب.
٢) يجب ان لا يتجاوز عدد الوحدات الدراسية (٣٠) وحدة لكل فصل دراسي و(٦٠) وحدة لكل سنة دراسية إذ لا يتجاوز مجموع الساعات الدراسية (العبئ الدراسي) للطالب (٧٥٠) ساعة لكل فصل دراسي و(١٥٠٠) ساعة للسنة الدراسية الواحدة.
٣) يمثل العبئ الدراسي للطالب Student Workload (SWL) الوقت الذي يستغرقه الطالب لتحقيق مخرجات التعلم، ويمثل مجموع الساعات الدراسية المنتظمة والمجدولة للطالب داخل الصف Structured Student Workload (SSWL) ومجموع الساعات الدراسية غير المنتظمة وغير المجدولة للطالب خارج الصف Unstructured Student Workload (USSWL) ويكون لكل منهما الوزن ذاته عند احتساب الوحدات الدراسية ECTS.
٤) لا تقل الساعات الدراسية المنتظمة والمجدولة عن (٢٠) ساعة ولا تتجاوز (٢٥) ساعة اسبوعياً. وفي حال وجود مواد دراسية نظرية وعملية داخل جدول الدروس يجب ان لا تتجاوز الساعات الدراسية المنتظمة والمجدولة (٣٠) ساعة اسبوعياً.
٥) تقسم ساعات المادة الدراسية المنتظمة والمجدولة الى ساعات داخل الفصل (Class Hours) وساعات اونلاين (Lecture Hours) وسيمنارات (حلقات دراسية) (Seminars) وساعات عملية (Practical Hours) وساعات مختبرية (Lab Hours) وساعات مراجعة (Tutorial Hours) وساعات سريرية (Clinical Hours) وبحسب التخصص.

ثالثاً: متطلبات التخرج

١) يكون المجموع التراكمي للوحدات الواجب الحصول عليها لإكمال برنامج دراسي بحسب مستويات ذلك البرنامج وبواقع (٦٠) وحدة دراسية لكل مستوى دراسي (الفقرة (١) من البند أولا من الفصل الرابع).
٢) أن يكون الطالب قد استوفى التدريب الصيفي للتخصصات المشمولة.

رابعاً: البرنامج الدراسي

١) تم وضع المواد الدراسية ومناهجها بناءً على مخرجات التعلم (Learning Outcome) الخاصة بالبرنامج الدراسي من قبل القسم بما يحقق متطلبات سوق العمل والاطار الوطني للمؤهلات وبإقرار مجلس الكلية تماشياً مع الاطار العام الذي اقرته الوزارة.

٢) يتم ادارة المسيرة التعليمية للطالب (مناهج دراسية شؤون طلبة، تسجيل تحصيل دراسي..الخ) من خلال نظام الكتروني.

الفصل الثالث: القبول والتسجيل

اولاً: القبول والتسجيل في البرنامج الدراسي:

١) تعتمد شروط القبول في الجامعات العراقية المقرة من قبل وزارة التعليم العالي والبحث العلمي.
٢) تكون عملية تسجيل الطلبة الجدد في الكلية / المعهد على البرنامج الدراسي خلال مدة (١٠) ايام عمل من اعلان نتائج القبول وللقنوات كافة.
٣) يعد الطالب مؤجلا للفصلين الدراسيين في حال تسجيله في الكلية المعهد المرشح اليه بما لا يتجاوز شهر واحد من انتهاء المدة المحددة في الفقرة (٢) آنفا.
٤) يعد الطالب راسباً في الفصلين الدراسيين في حال تسجيله بعد مرور أكثر من شهر من انتهاء المدة المحددة في الفقرة (٢) آنفا.

ثانياً : التسجيل على المواد الدراسية

١) يعد الطالب الجديد الذي اكمل اجراءات التسجيل على البرنامج الدراسي في المستوى الأول ضمن التوقيت الموضح في لفقرة (٢) من البند أولا مسجلا على المواد الدراسية كافة للفصل الدراسي الاول والمقرة من قبل القسم العلمي.
٢) على الطالب المستمر بالدراسة التسجيل على المواد الدراسية المقرة من قبل القسم العلمي بمدة لا تتجاوز (٧) ايام قبل بدء الفصل الدراسي مع مراعاة ضرورة تسجيله على المواد الدراسية المطالب بها من فصول دراسية سابقة وبما لا يتجاوز (٣٠) وحدة للفصل الدراسي.
٣) يتولى القسم تكليف عدد من المشرفين العلميين بما يتناسب مع الطلبة بهدف ارشادهم وتوجيههم حول التسجيل والمواد الدراسية.
٤) يحق للطالب الانسحاب من مادة دراسية واحدة فقط بعد موافقة القسم وخلال مدة لا تتعدى اسبوعين من بدء الفصل الدراسي.
٥) لا يمكن التسجيل على مادة مكملة في البرنامج التعليمي في الفصل الدراسي إذا لم يكن الطالب قد اجتاز المادة الممهدة لها أو يكون قد اكمل جميع المتطلبات الخاصة بالمادة الممهدة في فصل دراسي سابق من حيث الحضور والتقييم التكويني و مشاركته بالامتحان النهائي (دون شرط النجاح فيه).
٦) يعد الطالب راسباً بالغياب للفصل الدراسي في حال عدم تسجيله على البرنامج الدراسي خلال مدة التسجيل المحددة بالفقرة (٢) اعلاه.
٧) تنتهي علاقة الطالب بالدراسة ويرقن قيده في حال عدم تسجيله على المواد الدراسية لأربعة فصول دراسية متتالية بدون عذر مشروع.
٨) القسم مسؤول عن تنفيذ ادارة تسجيل الطلبة ومتابعة موقفهم الدراسي عن طريق برنامج الكتروني.

الفصل الرابع: القبول والتسجيل

اولاً: ضوابط عامة

١) على الطالب اكمال الدراسة ضمن فصول دراسية لا يتجاوز عددها ثلاثة اضعاف مستويات الدراسة، على ان لا تحتسب فصول التأجيل وعدم الرسوب ضمنها.

٢) يتكون تقييم الطالب من جزأين: التقييم التلخيصي (Summative Assessment) والتقييم التكويني (Formative Assessment).

٣) يشكل التقييم التكويني (٤٠٪) من درجة المادة ويشكل التقييم التلخيصي (٦٠٪) من درجة المادة ويقسم بواقع (١٠%) لامتحان نصف الفصل و(٥٠%) للامتحان النهائي.

٤) تكون درجة النجاح الصغرى (٥٠%) لكل مادة دراسية.

٥) تقتصر معالجات حالات الطلبة الحاصلين على درجة نهائية بين (٤٩-٤٥٪) بأستاذ المادة حصراً (دون تدخل من الوزارة أو الجامعة أو الكلية او القسم عبر تكليف الطالب بعمل اضافي بحسب التخصص (مشروع ، تقرير الخ) وخلال مدة لا تتجاوز اسبوعاً من تاريخ تبليغ الطالب، على ان لا تتجاوز درجات المعالجة (٥) درجات لجميع المقررات التي رسب بها الطالب.

ثانياً: متطلبات الدوام والامتحانات

١) يتم تنبيه الطالب تحريرياً والكترونياً عند غيابه بنسبة (٧٪) من عدد الساعات المقررة للمادة (وبما يعادل الساعات المقررة للمادة في اسبوع دراسي) وينذر انذاراً نهائياً عند غيابه (١٤٪) من عدد الساعات المقررة للمادة (وبما يعادل الساعات المقررة للمادة في اسبوعين دراسيين) بدون عذر رسمي.

٢) لمجلس الكلية المعهد رفع نسبة الغياب المسموحة إلى (٢١٪) من عدد الساعات المقررة للمادة (وبما يعادل الساعات المقررة للمادة في ثلاثة اسابيع دراسية اذا تقدم الطالب بعذر مشروع.

٣) يعد الطالب راسبا بالغياب في المادة الدراسية اذا تجاوزت غياباته النسبة المحددة في الفقرتين (١ و ٢) آنفا ويطالب بإعادة دراسة المادة الدراسية دواماً وامتحاناً.

٤) يسمح للطالب الراسب بالغياب في بعض المواد الدراسية بإكمال السنة الدراسية واداء الامتحانات في المواد الدراسية الأخرى.

٥) على الطالب التسجيل للمشاركة في الامتحانات النهائية للفصل الدراسي للدروس المسجل عليها والمتضمنة دروس البرنامج الدراسي للفصل الدراسي فضلاً عن الدروس المطالب بها من فصول دراسية سابقة دواماً وامتحاناً.

٦) على الطالب التسجيل للمشاركة في الامتحانات النهائية للدروس التي لم ينجح فيها في محاولة سابقة.

٧) يسمح للطالب المستوفي لنصاب الدوام والحاصل على ما لا يقل عن ٣٥ من درجة التقييم التكويني التسجيل للمشاركة في الامتحانات النهائية وبخلافه يعد راسباً في المادة الدراسية، وعليه اعادتها دواماً وامتحاناً في فصل دراسي لاحق.

٨) تحتسب لكل فصل دراسي محاولتان امتحانيتان ويحق للطالب المشاركة في المحاولة الثانية في حال رسوبه في المحاولة الأولى.

٩) يحق للطالب الذي لم يحقق درجة النجاح الصغرى للمادة بعد اداء الامتحانات النهائية بالقيام بمحاولات أخرى في فصول دراسية لاحقة وتحتسب له درجتا التقييم التكويني وامتحان نصف الفصل الدراسي اللتان استوفاهما سابقا.

١٠)على الطالب المشاركة في الامتحانات النهائية وتعد مشاركته في الامتحان شرطاً اساسياً لنجاحه وبخلافه يعيد المادة الدراسية دواما وامتحانا حتى لو كان قد استوفى نصاب الدوام واكمل متطلبات التقييم التكويني المشار اليها في الفقرة (٧) آنفا.

١١)يحق للطالب الذي لم يشارك في المحاولة الاولى من الامتحان النهائي المشاركة في المحاولات اللاحقة مع الاحتفاظ بدرجة التقييم التكويني وامتحان نصف الفصل الدراسي اذا كانت عدم مشاركته بعذر مشروع يقره مجلس الكلية.

١٢)اذا ثبت غش الطالب او محاولته الغش في أي من الامتحانات اليومية او الاسبوعية او الشهرية او نصف الفصل او النهائية يعد راسبا في جميع المواد الدراسية المسجل عليها في الفصل الدراسي و في حال تكرار ذلك يفصل من الكلية المعهد و يرقن قيده من سجلاتها.

١٣)يطالب الطالب الراسب بالغش بإعادة مواد الفصل الدراسي دواما وامتحانا في المواد المسجل عليها والتي كان مطالبا بأدائها دواما وامتحانا.

١٤)يحق للطالب اداء (٤) محاولات امتحانية للمادة الدراسية الواحدة ضمن الحد الأعلى للفصول الدراسية المحدد بموجب الفقرة (١) من البند أولا من هذا الفصل وفي حال عدم اجتيازه للمحاولة الرابعة يرقن قيده من سجلات الكلية المعهد.

١٥)بإمكان الطالب الدارس ضمن قنوات التعليم المجاني والراسب في اربع محاولات امتحانية التسجيل لمحاولتين اضافيتين لقاء استيفاء اجور تعادل ما يتم استيفاؤه ضمن قناة التعليم الحكومي الخاص الصباحي للمادة المواد الدراسية المطالب بها.

١٦)بإمكان الطالب الدارس على نفقته (ضمن التعليم الحكومي الخاص الصباحي والدراسة المسائية والتعليم الأهلي والراسب في اربع محاولات امتحانية التسجيل لمحاولتين اضافيتين لقاء استيفاء اجور المادة / المواد الدراسية المطالب بها الطالب مضافا إليها (٢٥٪).

ثالثاً: النتائج الفصلية

١) يجبر كسر الدرجة النهائية للمواد الدراسية الى اقرب درجة صحيحة.

٢) يتم اعلان النتائج الفصلية للمواد الدراسية على وفق التقديرات الآتية:

Grade	Description	الدرجة / الوصف	التقدير
A - Excellent	Outstanding Performance	١٠٠-٩٠	امتياز
B - Very Good	Above average with some errors	٨٠- اقل من ٩٠	جيد جدا
C – Good	Sound work with notable errors	٧٠- اقل من ٨٠	جيد
D – Satisfactory	Fair but with major shortcomings	٦٠- اقل من ٧٠	متوسط
E – Sufficient	Work meets minimum criteria	٥٠- اقل من ٦٠	مقبول
FX – Fail (Conditional pass)	Credit awarded after submitting extra work	٥٠ بعد معالجة حالة الطالب الحاصل على درجة من ٤٥-٤٩ من قبل استاذ المادة.	مقبول بقرار
F – Fail	Considerable amount of work required	اقل من ٥٠ (راسب)	ضعيف

رابعاً: التأجيل

١) للطالب ان يؤجل دراسته لفصل دراسي او فصلين دراسيين لأسباب مشروعة يقتنع بها مجلس الكلية على أن يقدم طلب التأجيل بما لا يقل عن (٣٠) يوماً قبل بداية الامتحانات النهائية للفصل الدراسي.

٢) بناءً على توصية مجلس الكلية فإن لرئيس الجامعة ان يؤجل دراسة الطالب لفصل دراسي ثالث او رابع على ان يقدم طلب التأجيل بما لا يقل عن (٣٠) يوماً قبل بداية الامتحانات النهائية للفصل الدراسي.

خامساً: انتهاء علاقة الطالب بالدراسة

١) تنتهي علاقة الطالب بالدراسة ويرقن قيده في الحالات الآتية:

- عدم تسجيله على البرنامج الدراسي لسنتين متتاليتين.
- استنفاده عدد المحاولات المسموح بها المشار اليها في الفقرات (١٣ و ١٤ و ١٥) من البند ثانيا من هذا الفصل.
- تجاوزه الحد الأعلى للفصول الدراسية المسوح بها والواردة في الفقرة البند أولا من هذا الفصل.

٢) بإمكان الطالب المرقن القيد والذي كانت دراسته ضمن قنوات التعليم المجاني العودة الى مقاعد الدراسة للسنة الدراسية اللاحقة ويسمح له بالتسجيل على ما لا يزيد على ثلاثة أضعاف الفصول الدراسية المطلوبة لإنجاز المستويات الدراسية المتبقية لقاء استيفاء اجور تعادل اجور التعليم الحكومي الخاص الصباحي المقرة لتلك السنة لكل فصل دراسي.

٣) بإمكان الطالب المرقن القيد والذي كانت دراسته على نفقته الخاصة العودة الى مقاعد الدراسة للسنة الدراسية اللاحقة ويسمح لـ له بالتسجيل على ما لا يزيد على ثلاثة أضعاف الفصول الدراسية المطلوبة لانجاز المستويات الدراسية المتبقية لقاء استيفاء اجور تعادل الاجور المقرة لتلك السنة لكل فصل دراسي سجل فيه مضافا إليه (٢٥٪).

سادساً: معدل التخرج

١) يحسب معدل التخرج (CGPA) للطالب بجمع ناتج ضرب درجة كل مادة دراسية بوزنها من عدد الوحدات (ECTS) لكل المستويات الدراسية ، ثم يقسم الناتج على عدد الوحدات المطلوبة لكامل برنامج الدراسة الواردة في الفقرة (١) من البند أولا من هذا الفصل و كما هو مبين في المعادلة ادناه:

$$\text{معدل الطالب} = \frac{\text{مجموع ضرب}(\text{عدد وحدات المادة الدراسية} \times \text{درجة المادة})}{\text{عدد الوحدات الكلي}}$$

اذا ما كان الطالب قد اكمل البرنامج الدراسي للبكالوريوس ذي الاربع سنوات تصبح المعادلة:

$$\text{معدل التخرج} = \frac{\text{مجموع ضرب}(\text{عدد وحدات المادة الدراسية} \times \text{درجة المادة})}{٢٤٠}$$

مثال :حساب معدل الطالب لفصل دراسي واحد (GPA):

المادة الدراسية	الوحدات (٣٠)	الدرجة	التقدير
المادة ١	٥	٨٠	جيد جدا
المادة ٢	٦	٧٠	جيد
المادة ٣	٧	٩٠	امتياز
المادة ٤	٤	٨٠	جيد جدا
المادة ٥	٨	٩٠	امتياز

$$\text{معدل الفصل} = \frac{٩٠*٨+٨٠*٤+٩٠*٧+٧٠*٦+٨٠*٥}{٣٠} = \frac{٢٤٩٠}{٣٠} = ٨٣٪$$

٢) لا يجوز جبر كسور الدرجة الى درجة صحيحة بالنسبة للمعدل.

٣) يحسب معدل التخرج للطالب الذي يقبل في صف اعلى من الصف الاول (كالأوائل من خريجي المعاهد المقبولين في مراحل ما فوق الاولى وغيرها) لعدد الوحدات الكلي للمستويات التي درسها بعد قبوله فقط.

الفصل الخامس: اسس وشروط عامة

١) يحق للطالب الذي استوفى متطلبات التخرج المشار اليها في البند ثالثا من الفصل الثاني ملئ استمارة التخرج و تقديمها الى القسم لتأييد اكماله متطلبات البرنامج الدراسي كافة.

٢) من الممكن استيفاء الطالب لبعض المواد الدراسية التي لها مخرجات التعلم نفسها و بالرمز نفسه في اقسام علمية غير القسم العلمي الذي يدرس فيه في حال قدرة الجامعة على ذلك.

٣) يعتمد تحديد اجور الدراسة ضمن قناة التعليم الحكومي الخاص الصباحي و الدراسة المسائية و التعليم الاهلي على عدد الوحدات الدراسية التي يسجل عليها الطالب في الفصل الدراسي.

٤) في حال رسوب الطالب الدارس على وفق الانظمة الدراسية الاخرى المعتمدة في الجامعات العراقية و كان الفوج الدراسي اللاحق يعتمد على نظام الوحدات تكون المعالجة على النحو الآتي:

- طلبة المرحلة الأولى: يطالب طلبة المرحلة الأولى بجميع المواد المطلوبة مع اقرانهم الدارسين على وفق نظام الوحدات.
- طلبة المرحلتين الثانية والثالثة: تخير الجامعة اما بفتح صف دراسي لإكمال الطلبة متطلبات التخرج على وفق النظام السابق ذاته في حال توفر المستلزمات لذلك او اجراء مقاصة علمية لجميع المواد التي اجتازها الطالب على وفق النظام السابق وفق نظام الوحدات مع مراعاة اجراء المقاصة العلمية بالنظر الى مخرجات التعلم المرتبطة بالبرنامج الدراسي و ليس تسمية المواد الدراسية ليتم منحه شهادة وفق نظام الوحدات، مع مراعاة اجراء المقاصة العلمية بالنظر الى مخرجات التعلم المرتبطة بالبرنامج الدراسي وليس تسمية المواد الدراسية.
- طلبة المرحلة الرابعة صعوداً: تلتزم الكلية بفتح صف دراسي للطلبة لاستكمال متطلبات التخرج على وفق النظام السابق.

٥) تنفذ هذه الضوابط للدراسة الاولية للتخصصات الهندسية و العلوم ضمن الجامعات الحكومية و الجامعات الكليات الاهلية كافة.

٦) مراعاة ما جاء في دليل اجراءات شؤون الطلبة وضوابط القبول و شروطه عند اجراء انتقال واستضافة الطلبة بين الجامعات مع مراعاة اجراء المقاصة العلمية بالنظر الى مخرجات التعلم المرتبطة بالبرنامج الدراسي وليس تسمية المواد الدراسية.

٧) مراعاة ما جاء في دليل اجراءات شؤون الطلبة و ضوابط القبول و شروطه النافذة سنويا في كل ما لم يرد بشأنه نص ضمن هذا الدليل.

الملحق ١: دليل المنهاج الدراسي

يتضمن هذا الدليل المنهاج الكامل للمواد الدراسية لقسم الفيزياء لدورة دراسية كاملة والتي تتألف من اربع مستويات وثمان فصول دراسية (بواقع فصلين لكل مستوى دراسي) ويتألف كل فصل دراسي من (٦) مواد دراسية. اما عدد الوحدات الاوربية (ECTS) فعددها (٢٤٠) موزعة على هذه الفصول بحيث يشتمل كل فصل دراسي على (٣٠) وحدة اوربية، وتعادل كل وحدة اوربية (٢٥) ساعة، وبذلك يكون عدد الساعات الكلية لدورة دراسية كاملة (٦٠٠٠) ساعة بواقع (٧٥٠) ساعة لكل فصل دراسي (٧٥٠). ويوضح الجدول الآتي تفاصيل هذا التوزيع:

	Republic of Iraq - Ministry of Higher Education and Scientific Research University of Tikrit - College of Science Bachelor's degree in Physics Science (First cycle) Four years (Eight semesters)-240 ECTS credits - 1 ECTS = 25 hr Program Curriculum (2023 - 2024)	جمهورية العراق - وزارة التعليم العالي والبحث العلمي جامعة تكريت - كلية العلوم بكالوريوس علوم في الفيزياء (الدورة الأولى) أربع سنوات (ثمانية فصول دراسية) - ٢٤٠ وحدة اوربية - كل وحدة اوربية = ٢٥ ساعة المنهاج الدراسي للعام ٢٠٢٣-٢٠٢٤	

Level	UGI																							
Semester	One												Two											
No.	1	2	3	4	5	6		1	2	3	4	5	6											
Module Code	PHY1101	PHY1102	UNI1103	UNI1104	UNI1105	UNI1106		PHY1217	PHY1218	UNI1219	PHY12010	UNI12011	UNI12012											
Module Name in English	Mechanics	Electricity	Foundations and Algebraic Structure	Computers	Human Rights and Democracy	Arabic Language		Properties of Materials	Magnetism	Calculus	General Astronomy	General Chemistry	English Language I											
اسم المادة الدراسية	ميكانيك	كهربائية	اسس وبنى جبرية	حاسبات	حقوق الانسان والديمقراطية	اللغة العربية		خواص مادة	مغناطيسية	تفاضل وتكامل	فلك عام	كيمياء عامة	اللغة الانكليزية I											
Language	English	English	English	English	Arabic	Arabic	Total	English	English	English	Arabic	Arabic	English	Total										
SSWL (hr/w) CL (hr/w)	2	2	2	2	2	2	12	2	2	2	2	2	2	12										
SSWL (hr/w) Lect (hr/w)							0							0										
SSWL (hr/w) Lab (hr/w)	2	2	2	2			6	2	2					6										
SSWL (hr/w) Pr (hr/w)							0							0										
SSWL (hr/w) Tut (hr/w)	2	2	2				6	2	2	1	2			7										
SSWL (hr/w) Semn (hr/w)					2	1	3						1	1										
Exam hr/sem	4	4	3	4	4	3	22	4	4	3	4	4	3	22										
SSWL hr/sem	94	94	63	64	64	48	427	94	94	48	64	64	48	412										
USSWL hr/sem	81	81	62	36	36	27	323	81	81	52	36	61	27	338										
SWL hr/sem	175	175	125	100	100	75	750	175	175	100	100	125	75	750										
ECTS	7.00	7.00	5.00	4.00	4.00	3.00	30.00	7.00	7.00	4.00	4.00	5.00	3.00	30.00										
Module Type	C	C	B	B	S	S		C	C	B	B	B	S											
Prerequisite Module(s) Code								PHY1101	PHY1102	UNI1103														

Level	Semester	No.	Module Code	Module Name in English	اسم المادة الدراسية	Language	SSWL (hr/w) CL (hr/w)	Lect (hr/w)	Lab (hr/w)	Pr (hr/w)	Tut (hr/w)	Semn (hr/w)	Exam hr/sem	SSWL hr/sem	USSWL hr/sem	SWL hr/sem	ECTS	Module Type	Prerequisite Module(s) Code
UGII	Three	1	PHY23013	Atomic Physics	الفيزياء الذرية	English	2		2		1		4	79	71	150	6.00	C	
		2	PHY23014	Thermodynamic	ثرموداينمك	English	2		2		1		4	79	71	150	6.00	C	
		3	PHY23115	Introduction to Analytical Mechanics	مقدمة في الميكانيك التحليلي	English	2				2		3	63	62	125	5.00	C	PHY1101
		4	PHY23016	Analog Electronics	الكترونيات تماثلية	English	2		2		1		4	79	71	150	6.00	C	
		5	UNI23116	Differential Equations	معادلات تفاضلية	English	2				2		3	63	37	100	4.00	B	UNI1103
		6	UNI23117	English Language II	اللغة الانكليزية II	English	2				1		3	48	27	75	3.00	S	UNI2012
						Total	12	0	6	0	8	0	21	411	339	750	30.00		
	Four	1	PHY24118	Modern Physics	الفيزياء الحديثة	English	2		2		1		4	79	71	150	6.00	C	PHY23013
		2	PHY24119	Statistical Mechanics	الميكانيك الاحصائي	English	2		2		1		4	79	71	150	6.00	C	PHY23014
		3	PHY24120	Analytical Mechanics Applications	تطبيقات الميكانيك التحليلي	English	2				2		3	63	62	125	5.00	C	PHY23115
		4	PHY24021	Digital Electronics	الالكترونيات الرقمية	English	2		2		1		4	79	71	150	6.00	C	
		5	PHY24022	Sound and Wave Motion	الصوت والحركة الموجية	English	2				2		3	63	37	100	4.00	C	
		6	UNI24123	Matlab	ماتلاب	English	1		2				2	47	28	75	3.00	B	UNI1104
						Total	11	0	8	0	7	0	20	410	340	750	30.00		

Level	UGIII																							
Semester	Five												Six											
No.	1	2	3	4	5	6							1	2	3	4	5	6						
Module Code	PHY35024	PHY35026	PHY35127	PHY35028	PHY35029	UNI351330							PHY36031	PHY36132	PHY36133	PHY36134	PHY36035	PHY36036						
Module Name in English	Geometrical Optics	Laser Principles	Fundamentals of Quantum Mechanics	Material Physics	Molecular Physics	Methematics							Physical Optics	laser Application	Applications of Quantum Mechanics	Crystals	Spectra	Numerical Analytic						
اسم المادة الدراسية	بصريات هندسية	مبادئ الليزر	اساسيات ميكانيك الكم	فيزياء المواد	الفيزياء الجزيئية	رياضيات							بصريات فيزيائية	تطبيقات الليزر	تطبيقات ميكانيك الكم	بلورات	الاطياف	التحليل العددي						
Language	English	English	English	English	English	English							English	English	English	English	English	English						
SSWL (hr/w) CL (hr/w)	2	2	2	2	2	2	12						2	2	2	2	2	2	12					
SSWL (hr/w) Lect (hr/w)							0												0					
SSWL (hr/w) Lab (hr/w)	2	2		2			6						2	2		2		2	8					
SSWL (hr/w) Pr (hr/w)							0												0					
SSWL (hr/w) Tut (hr/w)	1	1	2	1	2	2	9						1		1		1		3					
SSWL (hr/w) Semn (hr/w)			3		3	3	21							1	1	1	1		4					
Exam hr/sem	4	4	3	4	3	3	21						4	4	3	4	3	3	21					
SSWL hr/sem	79	79	63	79	63	63	426						79	79	63	79	63	63	426					
USSWL hr/sem	71	71	37	71	37	37	324						71	71	37	71	37	37	324					
SWL hr/sem	150	150	100	150	100	100	750						150	150	100	150	100	100	750					
ECTS	6.00	6.00	4.00	6.00	4.00	4.00	30.00						6.00	6.00	4.00	6.00	4.00	4.00	30.00					
Module Type	C	C	C	C	C	B							C	C	C	C	C	B						
Prerequisite Module(s) Code			PHY23013			UNI1103								PHY35026	PHY35127		PHY35028							

Level	Semester	No.	Module Code	Module Name in English	اسم المادة الدراسية	Language	SSWL (hr/w) CL (hr/w)	Lect (hr/w)	Lab (hr/w)	Pr (hr/w)	Tut (hr/w)	Semn (hr/w)	Exam hr/sem	SSWL hr/sem	USSWL hr/sem	SWL hr/sem	ECTS	Module Type	Prerequisite Module(s) Code
UGIV	Seven	1	PHY47037	Fundamentals of Nuclear Physics	اساسيات الفيزياء النووية	English	2		2		1	1	4	94	56	150	6.00	C	
		2	PHY47138	Solid State Physics	فيزياء الحالة الصلبة	English	2		2		1	1	4	94	56	150	6.00	C	PHY35028
		3	PHY47039	Electromagnetic Theories	النظريات الكهرومغناطيسية	English	2				1	1	3	63	62	125	5.00	C	
		4	PHY47040	Mathematical Physics	الفيزياء الرياضية	English	2				2		3	63	37	100	4.00	B	
		5	PHY47041	Optional I	اختياري I	English	2					2	3	63	37	100	4.00	E	
		6	PHY47042	Research project	مشروع بحث	English			2				2	32	93	125	5.00	C	
						Total	10	0	6	0	5	5	19	409	341	750	30.0		
	Eight	1	PHY48143	Nuclear Physics Applications	تطبيقات الفيزياء النووية	English	2		2		1	1	4	94	56	150	6.00	C	PHY47037
		2	PHY48144	Solid State Physics	فيزياء الحالة الصلبة (متقدم)	English	2		2		1	1	4	94	56	150	6.00	C	PHY47138
		3	PHY48145	Electromagnetic Fields	المجالات الكهرومغناطيسية	English	2				2		3	63	62	125	5.00	C	PHY47039
		4	PHY48146	Mathematical Methods	طرق رياضية	English	2				2		3	63	37	100	4.00	C	PHY47040
		5	PHY48047	Plasma Physics	فيزياء البلازما	English	2				2		3	63	62	125	5.00	C	
		6	PHY48048	Optional II	اختياري II	English	2					1	3	48	52	100	4.00	E	
						Total	12	0	4	0	8	3	20	425	325	750	30.0		
						Total	93	0	50	0	53	16	166	3346	2654	6000	240.0	Must be 240 ECTS	

Note: The student should complete 4 weeks of Summer Internships to fulfil the requirements of the Bachelor's degree

SWL:	Student Workload
SSWL:	Structured SWL
USSWL:	Unstructured SWL

Module type	
B	Basic learning activities
C	Core learning activity
S	Suport or related learning activity
E	Elective learning activity

Structured SWL (hr/w) type	
CL	Class Lecture
Lab	Laboratory
Pr	Practical Training
Tut	Tutorial
Lect	Online lecture
Semn	Seminar

Note: Columns O, Q and R are progrmaed, protected and should not be edited

ملاحظات:

المادة (اختياري I) تعلى (فيزياء طبية) أو (طاقات متجددة).

المادة (اختياري II) تعلى (فيزياء الصحة والبيئة) و(اساسيات الالكترونيات البصرية).

بادئة الكودات (PHY) تشير الى الاحرف الثلاثة الاولى من كلمة الفيزياء، اما البادئة (UNI) فتشير الى الاحرف الثلاثة الاولى من كلمة الجامعة لكون هذه المواد عامة.

الملحق ٢: دليل البرنامج الدراسي

Program Catalog (2023 - 2024) دليل البرنامج الدراسي

University of Tikrit

جامعة تكريت

First Cycle - Bachelor's degree (B.Sc.) – Physics

الدورة الاولى – بكالوريوس علوم – علوم الفيزياء

Table of Contents جدول المحتويات

1. Mission & Vision Statement

➢ Vision Statement:

The physics academic staff of the Physics Sciences Department at University of Tikrit believe that students come to understand the discipline of physics through a combination of course work, laboratory experiences, research, and fieldwork. The combination of instructional methods leads students to a balanced understanding of the scientific methods used by physicists to make observations, develop insights and create theories about the different physical phenomena. Small class sizes within the physics program foster a close working relationship between academic staff and students in an informal and nurturing atmosphere.

➢ Mission Statement

The physics academic staff pursues a multifaceted charge at University of Tikrit. The Program seeks to provide all physics students with fundamental knowledge of physics, as well as a deeper understanding of a selected focus area within the physical sciences. The curriculum and advising have been designed to prepare graduates for their professional future, whether they choose to work as field physicists specializing in different physics disciplines, or to pursue advanced degrees in the physics sciences.

2. Program Specification

Program code:	**BSc-PHY**	**ECTS**	**240**
Duration	**4 Levels, 8 Semesters**	**Method of Attendance:**	**Full Time**

Physics is a wonderfully wide-ranging subject Level 1 exposes students to the fundamentals of physics, suitable for progression to all programs within the physics program group. Program-specific core topics are covered at Level 2 preparing for research-led subject specialist modules at Levels 3 and 4. A physics graduate is therefore trained to appreciate how research informs teaching, according to the University and School Mission statements. Decisions on what to study are made with input from personal tutors. The research ethos is developed and fostered from the start via practical, which are either embedded in lecture modules or taught in dedicated practical modules, research seminars and tutorials. At Level 4 all students carry out an independent research project. Academic tutorials are held at Levels 1 and 2 with the same future, who is also the personal tutor, providing continuity and progressive guidance. Level 1 and 2 tutorials include a number of workshops to teach skills, e.g. library use and presentation skills, followed by assessed exercises, e.g. essays and talks, as oppofiunities to practice these skills in a subject-specific context. International years and Industrial placements are also offered and individual needs are discussed with the appropriate tutor and accommodated wherever possible.

3. Program Goals

1. **To provide a comprehensive education in physics that stresses scientific reasoning and problem solving across the spectrum of disciplines within physics.**
2. **To prepare students for a wide variety of post-baccalaureate paths, including graduate school, professional training programs, or entry level jobs in any area of physics.**
3. **To provide extensive hands-on training in electronic technology, statistical analysis, laboratory skills, and field techniques.**
4. **To provide thorough training in written and oral communication of scientific information.**
5. **To enrich students with opportunities for alternative education in the area of physics through undergraduate research, internships, and study-abroad.**

4. Student Learning Outcomes

Specific statements of what students should be able to do as a result of the department's curricular and co-curricular experiences is developing for physics majors. The most important outcome for all students is that they enthusiastically engage in learning what is known about our world and develop a passion for participating in pushing the bounds of our knowledge even further. Physicists are renowned for the power of their problem-solving capabilities. Great emphasis and effort is spent providing students with tools and methods to approach and solve increasingly challenging problems. We hope that these challenges will not only broaden and deepen students' skills but will amplify their drive to participate in discovery.

Outcome 1: Specialized Subject Skills & Knowledge

- ✓ **Demonstrate knowledge and understanding of most fundamental physical laws and principles, and competence in the application of these principles to diverse areas of physics.**
- ✓ **Solve problems in physics using appropriate mathematical tools. Students should be able to identify the relevant physical principles and make approximations necessary to obtain solutions.**
- ✓ **Use mathematical techniques and analysis to model physical behaviour.**

Outcome 2: Academic Discipline Core Skills & Knowledge

- ✓ **Execute and analyses critically the results of an experiment or investigation and draw valid conclusions. Students should be able to evaluate the level of uncertainty in their results and compare these results with expected outcomes, theoretical predictions or with published data. They should be able to evaluate the significance of their results in this context.**
- ✓ **Make effective use of appropriate IT packages/systems for the analysis of data and the retrieval of appropriate information.**
- ✓ **Demonstrate a sound familiarity with laboratory apparatus and techniques.**

Outcome 3: Personal / Transferable / Employment Skills & Knowledge

- ✓ **Perform numerical manipulation and to present and interpret information graphically.**
- ✓ **Communicate scientific information. In particular, students should be able to produce clear and accurate scientific reports.**
- ✓ **Manage your own learning and to make use of appropriate texts, research-based materials or other learning resources.**

5. Mission & Vision Statement

١) أ.د. ياسين حميد محمود	١٦)م.د. حسين شهاب عبد
٢) أ.د. عواطف صابر جاسم	١٧)م. سيف عامر مهدي
٣) أ.د. فارس صالح عطاالله	١٨)م. شيماء محمد فياض
٤) أ.د. نجاة احمد دحام	١٩)م. سكينة اسكندر يوسف
٥) أ.د. عبدالسميع فوزي عبدالعزيز	٢٠)م.م. عمر صابر مصطفى
٦) أ.م.د. شريف فائق سلطان	٢١)م.م. ثريا يعرب صبري
٧) أ.م.د. رافع يونس جاسم	٢٢)م.م. مها محمد ابراهيم
٨) أ.م.د. هناء عيسى جاسم	٢٣)م.م. اياد فرعون مجيد
٩) أ.م.د. سحر ناجي رشيد	٢٤)م.م. شيماء جواد خضير
١٠)أ.م. سفيان حواس حميدي	٢٥)م.م. عثمان خلف زيدان
١١)م.د. فالح لفته مطر	٢٦)م.م. احمد عامر رجب
١٢)م.د. حسين خضير محمد	٢٧)م.م. عائدة عبد مظهر
١٣)م.د. امجد حسين جاسم	٢٨)م.م. نور لفته حمدان
١٤)م.د. ميادة خليل غفار	٢٩)م.م. عبدالقادر محمد محمود
١٥)م.د. ايهم عاصي حمود	

6. Credits, Grading and GPA

Credits

University of Tikrit is following the Bologna Process with the European Credit Transfer System (ECTS) credit system. The total degree program number of ECTS is 240, 30 ECTS per semester. I ECTS is equivalent to 25 hours student workload, including structured and unstructured workload.

Grading

Before the evaluation, the results are divided into two subgroups: pass and fail. Therefore, the results are independent of the students who failed a course. The grading system is defined as follows:

GRADING SCHEME مخطط الدرجات				
Group	**Grade**	**التقدير**	**Marks (%)**	**Definition**
Success Group (50 - 100)	**A** - Excellent	امتياز	90 - 100	Outstanding Performance
	B - Very Good	جيد جدا	80 - 89	Above average with some errors
	C - Good	جيد	70 - 79	Sound work with notable errors
	D - Satisfactory	متوسط	60 - 69	Fair but with major shortcomings
	E - Sufficient	مقبول	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	**FX** – Fail	راسب (قيد المعالجة)	(45-49)	More work required but credit awarded
	F – Fail	راسب	(0-44)	Considerable amount of work required
Note:				
Marks with decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.				

Calculation of the Cumulative Grade Point Average (CGPA)

The CGPA is calculated by the summation of each module score multiplied by its

ECTS, all are divided by the program total ECTS.

CGPA of a4-year B.Sc. degrees:

CGPA= [(1^{st} module score x ECTS) + (2^{nd} module score x ECTS) + ...] / 240

7. Curriculum/Modules

Semester 1 | 30 ECTS | 1 ECTS = 25 hours

Code	Module	SSWL	USSWL	ECTS	Type	Pre-request
PHY1101	Mechanics	94	81	7	C	
PHY1102	Electricity	94	81	7	C	
UNI1103	Foundations and Algebraic Structure	63	62	5	B	
UNI1104	Computers	64	36	4	B	
UNI1105	Human Rights and Democracy	64	36	4	S	
UNI1106	Arabic Language	48	27	3	S	

Semester 2 | 30 ECTS | 1 ECTS = 25 hours

Code	Module	SSWL	USSWL	ECTS	Type	Pre-request
PHY1217	Properties of Materials	94	81	7	C	PHY1101
PHY1218	Magnetism	94	81	7	C	PHY1102
UNI1219	Calculus	48	52	4	B	UNI1103
PHY12010	General Astronomy	64	36	4	B	
UNI12011	General Chemistry	64	61	5	B	
UNI12012	English Language I	48	27	3	S	

Semester 3 | 30 ECTS | 1 ECTS = 25 hours

Code	Module	SSWL	USSWL	ECTS	Type	Pre-request
PHY23013	Atomic Physics	79	71	6	C	
PHY23014	Thermodynamic	79	71	6	C	
PHY23115	Introduction to Analytical Mechanics	63	62	5	C	PHY1101
PHY23016	Analog Electronics	79	71	6	C	
UNI23116	Differential Equations	63	37	4	B	UNI1103
UNI23117	English Language II	48	27	3	S	UNI12012

Semester 4 | 30 ECTS | 1 ECTS = 25 hours

Code	Module	SSWL	USSWL	ECTS	Type	Pre-request
PHY24118	Modern Physics	79	71	6	C	PHY23013
PHY24119	Statistical Mechanics	79	71	6	C	PHY23014
PHY24120	Analytical Mechanics Applications	63	62	5	C	PHY23115
PHY24021	Digital Electronics	79	71	6	C	
PHY24022	Sound and Wave Motion	63	37	4	C	
UNI24123	Matlab	47	28	3	B	UNI1104

Semester 5 | 30 ECTS | 1 ECTS = 25 hours

Code	Module	SSWL	USSWL	ECTS	Type	Pre-request
PHY35024	Geometrical Optics	79	71	6	C	
PHY35026	Laser Principles	79	71	6	C	
PHY35127	Fundamentals of Quantum Mechanics	63	37	4	C	PHY23013
PHY35028	Material Physics	79	71	6	C	
PHY35029	Molecular Physics	63	37	4	C	
UNI351330	Mathematics	63	37	4	B	UNI1103

Semester 6 | 30 ECTS | 1 ECTS = 25 hours

Code	Module	SSWL	USSWL	ECTS	Type	Pre-request
PHY36031	Physical Optics	79	71	6	C	
PHY36132	laser Applications	79	71	6	C	PHY35026
PHY36133	Applications of Quantum Mechanics	63	37	4	C	PHY35127
PHY36134	Crystals	79	71	6	C	PHY35028
PHY36035	Spectra	63	37	4	C	
PHY36036	Numerical Analytic	63	37	4	B	

Semester 7 | 30 ECTS | 1 ECTS = 25 hours

Code	Module	SSWL	USSWL	ECTS	Type	Pre-request
PHY47037	Fundamentals of Nuclear Physics	94	56	6	C	
PHY47138	Solid State Physics	94	56	6	C	PHY35028
PHY47039	Electromagnetic Theories	63	62	5	C	
PHY47040	Mathematical Physics	63	37	4	B	
PHY47041	Optional I	63	37	4	E	
PHY47042	Research project	32	93	5	C	

Semester 8 | 30 ECTS | 1 ECTS = 25 hours

Code	Module	SSWL	USSWL	ECTS	Type	Pre-request
PHY48143	Nuclear Physics Applications	94	56	6	C	PHY47037
PHY48144	Solid State Physics (Advanced)	94	56	6	C	PHY47138
PHY48145	Electromagnetic Fields	63	62	5	C	PHY47039
PHY48146	Mathematical Methods	63	37	4	C	PHY47040
PHY48047	Plasma Physics	63	62	5	C	
PHY48048	Optional II	48	52	4	E	

الملحق ٣: دليل المواد الدراسية

Modulus Catalog (2023 – 2024) دليل المواد الدراسية

University of Tikrit

جامعة تكريت

First Cycle - Bachelor's degree (B.Sc.) – Physics

الدورة الاولى – بكالوريوس علوم – علوم الفيزياء

1. Overview

This catalogue is about the courses (modules) given by the program of Physics to gain the Bachelor of Science degree. The program delivers (48) Modules with (6000) total student workload hours and (240) total ECTS. The module delivery is based on the Bologna Process.

نظرة عامة

يتناول هذا الدليل المواد الدراسية التي يقدمها برنامج الفيزياء للحصول على درجة البكالوريوس في علوم الفيزياء. يقدم البرنامج (٤٨) بإجمالي (٦٠٠٠) ساعة حمل الطالب واجمالي (٢٤٠) وحدة اوربية. يعتمد تقديم المواد الدراسية على عملية بولونيا.

2. Undergraduate Courses 2023-2024

Module 1

Code	Course/Module Title	ECTS	Semester
PHY1101	Mechanics	7	1
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USSWL (hr/sem)**
2	4	94	81
Description			
This module uses lectures and guided self-study to develop students' understanding of Newtonian classical mechanics. Particular emphasis is placed on the precise and consistent application of the laws and methods. Our interest in mechanics arises from its general applicability to a vast number of familiar phenomena.			

Module 2

Code	Course/Module Title	ECTS	Semester
PHY1102	Electricity	7	1
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USSWL (hr/sem)**
2	4	94	81
Description			
The description of this course provides a necessary summary of the most important characteristics of the course and the learning outcomes for the student to achieve, demonstrating whether he has achieved the maximum available learning opportunities.			

Module 3

Code	Course/Module Title	ECTS	Semester
UNI1103	Foundations and Algebraic Structure	5	1
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USSWL (hr/sem)**
2	2	63	62
Description			
The description of this course provides a necessary summary of the most important characteristics of the course and the learning outcomes for the student to achieve, demonstrating whether he has achieved the maximum available learning opportunities. The aim of this module is to provide a firm foundation on which the follow-up module PHY1103 *Calculus* will build.			

Module 4

Code	Course/Module Title	ECTS	Semester
UNI1104	Computers	4	1
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USSWL (hr/sem)**
2	2	64	36
Description			
The description of this course provides a necessary summary of the most important characteristics of the course and the learning outcomes for the student to achieve, demonstrating whether he has achieved the maximum available learning opportunities. The aim of this module is to provide a firm foundation on which the follow-up module PHY24123 *Matlab II* will build.			

Module 5

Code	Course/Module Title	ECTS	Semester
UNI1105	Human Rights and Democracy	4	1
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USSWL (hr/sem)**
2	2	64	36
Description			
The description of this course provides a necessary summary of the most important characteristics of the course and the learning outcomes for the student to achieve, demonstrating whether he has achieved the maximum available learning opportunities.			

Module 6

Code	Course/Module Title	ECTS	Semester
UNI1106	Arabic Language	3	1
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USSWL (hr/sem)**
2	1	48	27
Description			
The description of this course provides a necessary summary of the most important characteristics of the course and the learning outcomes for the student to achieve, demonstrating whether he has achieved the maximum available learning opportunities.			

Module 7

Code	Course/Module Title	ECTS	Semester
PHY1217	Properties of Materials	7	2
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USSWL (hr/sem)**
2	4	94	81
Description			
The description of this course provides a necessary summary of the most important characteristics of the course and the learning outcomes for the student to achieve, demonstrating whether he has achieved the maximum available learning opportunities.			

Module 8

Code	Course/Module Title	ECTS	Semester
PHY1218	Magnetism	7	2
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USSWL (hr/sem)**
2	4	94	81
Description			
The description of this course provides a necessary summary of the most important characteristics of the course and the learning outcomes for the student to achieve, demonstrating whether he has achieved the maximum available learning opportunities.			

Module 9

Code	Course/Module Title	ECTS	Semester
UNI1219	Calculus	4	2
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USSWL (hr/sem)**
2	1	48	52
Description			
The description of this course provides a necessary summary of the most important characteristics of the course and the learning outcomes for the student to achieve, demonstrating whether he has achieved the maximum available learning opportunities.			

Module 10

Code	Course/Module Title	ECTS	Semester
PHY12010	General Astronomy	4	2
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USSWL (hr/sem)**
2	2	64	34
Description			
The description of this course provides a necessary summary of the most important characteristics of the course and the learning outcomes for the student to achieve, demonstrating whether he has achieved the maximum available learning opportunities.			

Module 11

Code	Course/Module Title	ECTS	Semester
UNI12011	General Chemistry	5	2
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USSWL (hr/sem)**
2	2	64	61
Description			
The description of this course provides a necessary summary of the most important characteristics of the course and the learning outcomes for the student to achieve, demonstrating whether he has achieved the maximum available learning opportunities.			

Module 12

Code	Course/Module Title	ECTS	Semester
UNI12012	English Language I	3	2
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USSWL (hr/sem)**
2	1	48	27
Description			
The description of this course provides a necessary summary of the most important characteristics of the course and the learning outcomes for the student to achieve, demonstrating whether he has achieved the maximum available learning opportunities.			

Module 13

Code	Course/Module Title	ECTS	Semester
PHY23013	Atomic Physics	6	3
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USSWL (hr/sem)**
2	3	79	71
Description			
The description of this course provides a necessary summary of the most important characteristics of the course and the learning outcomes for the student to achieve, demonstrating whether he has achieved the maximum available learning opportunities.			

Module 14

Code	Course/Module Title	ECTS	Semester
PHY23014	Thermodynamic	6	3
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USSWL (hr/sem)**
2	3	79	71
Description			
The description of this course provides a necessary summary of the most important characteristics of the course and the learning outcomes for the student to achieve, demonstrating whether he has achieved the maximum available learning opportunities.			

Module 15

Code	Course/Module Title	ECTS	Semester
PHY23115	Introduction to Analytical Mechanics	5	3
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USSWL (hr/sem)**
2	2	63	62
Description			
The description of this course provides a necessary summary of the most important characteristics of the course and the learning outcomes for the student to achieve, demonstrating whether he has achieved the maximum available learning opportunities.			

Module 16

Code	Course/Module Title	ECTS	Semester
PHY23016	Analog Electronics	6	3
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USSWL (hr/sem)**
2	3	79	71
Description			
The description of this course provides a necessary summary of the most important characteristics of the course and the learning outcomes for the student to achieve, demonstrating whether he has achieved the maximum available learning opportunities.			

Module 17

Code	Course/Module Title	ECTS	Semester
UNI23116	Differential Equations	4	3
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USSWL (hr/sem)**
2	2	63	37
Description			
The description of this course provides a necessary summary of the most important characteristics of the course and the learning outcomes for the student to achieve, demonstrating whether he has achieved the maximum available learning opportunities.			

Module 18

Code	Course/Module Title	ECTS	Semester
UNI1106	Arabic Language	3	3
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USSWL (hr/sem)**
2	1	28	1
Description			
The description of this course provides a necessary summary of the most important characteristics of the course and the learning outcomes for the student to achieve, demonstrating whether he has achieved the maximum available learning opportunities.			

Module 19

Code	Course/Module Title	ECTS	Semester
PHY24118	Modern Physics	6	4
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USSWL (hr/sem)**
2	3	79	71
Description			
The description of this course provides a necessary summary of the most important characteristics of the course and the learning outcomes for the student to achieve, demonstrating whether he has achieved the maximum available learning opportunities.			

Module 20

Code	Course/Module Title	ECTS	Semester
PHY24119	Statistical Mechanics	6	4
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USSWL (hr/sem)**
2	3	79	71
Description			
The description of this course provides a necessary summary of the most important characteristics of the course and the learning outcomes for the student to achieve, demonstrating whether he has achieved the maximum available learning opportunities.			

Module 21

Code	Course/Module Title	ECTS	Semester
PHY24120	Analytical Mechanics Applications	5	4
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USSWL (hr/sem)**
2	2	63	62
Description			
The description of this course provides a necessary summary of the most important characteristics of the course and the learning outcomes for the student to achieve, demonstrating whether he has achieved the maximum available learning opportunities.			

Module 22

Code	Course/Module Title	ECTS	Semester
PHY24021	Digital Electronics	6	4
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USSWL (hr/sem)**
2	3	79	71
Description			
The description of this course provides a necessary summary of the most important characteristics of the course and the learning outcomes for the student to achieve, demonstrating whether he has achieved the maximum available learning opportunities.			

Module 23

Code	Course/Module Title	ECTS	Semester
PHY24022	Sound and Wave Motion	4	4
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USSWL (hr/sem)**
2	2	63	37
Description			
The description of this course provides a necessary summary of the most important characteristics of the course and the learning outcomes for the student to achieve, demonstrating whether he has achieved the maximum available learning opportunities.			

Module 24

Code	Course/Module Title	ECTS	Semester
UNI24123	Matlab	3	4
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USSWL (hr/sem)**
1	2	47	28
Description			
The description of this course provides a necessary summary of the most important characteristics of the course and the learning outcomes for the student to achieve, demonstrating whether he has achieved the maximum available learning opportunities.			

Module 25

Code	Course/Module Title	ECTS	Semester
PHY35024	Geometrical Optics	6	5
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USSWL (hr/sem)**
2	3	79	71
Description			
The description of this course provides a necessary summary of the most important characteristics of the course and the learning outcomes for the student to achieve, demonstrating whether he has achieved the maximum available learning opportunities.			

Module 26

Code	Course/Module Title	ECTS	Semester
PHY35026	Laser Principles	6	5
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USSWL (hr/sem)**
2	3	79	71
Description			
The description of this course provides a necessary summary of the most important characteristics of the course and the learning outcomes for the student to achieve, demonstrating whether he has achieved the maximum available learning opportunities.			

Module 27

Code	Course/Module Title	ECTS	Semester
PHY35127	Fundamentals of Quantum Mechanics	4	5
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USSWL (hr/sem)**
2	2	63	37
Description			
The description of this course provides a necessary summary of the most important characteristics of the course and the learning outcomes for the student to achieve, demonstrating whether he has achieved the maximum available learning opportunities.			

Module 28

Code	Course/Module Title	ECTS	Semester
PHY35028	Material Physics	6	5
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USSWL (hr/sem)**
2	3	79	71
Description			
The description of this course provides a necessary summary of the most important characteristics of the course and the learning outcomes for the student to achieve, demonstrating whether he has achieved the maximum available learning opportunities.			

Module 29

Code	Course/Module Title	ECTS	Semester
PHY35029	Molecular Physics	4	5
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USSWL (hr/sem)**
2	2	63	37
Description			
The description of this course provides a necessary summary of the most important characteristics of the course and the learning outcomes for the student to achieve, demonstrating whether he has achieved the maximum available learning opportunities.			

Module 30

Code	Course/Module Title	ECTS	Semester
UNI351330	Mathematics	4	5
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USSWL (hr/sem)**
2	2	68	37
Description			
The description of this course provides a necessary summary of the most important characteristics of the course and the learning outcomes for the student to achieve, demonstrating whether he has achieved the maximum available learning opportunities.			

Module 31

Code	Course/Module Title	ECTS	Semester
PHY36031	Physical Optics	6	6
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USSWL (hr/sem)**
2	3	79	71
Description			
The description of this course provides a necessary summary of the most important characteristics of the course and the learning outcomes for the student to achieve, demonstrating whether he has achieved the maximum available learning opportunities.			

Module 32

Code	Course/Module Title	ECTS	Semester
PHY36132	laser Applications	6	6
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USSWL (hr/sem)**
2	3	79	71
Description			
The description of this course provides a necessary summary of the most important characteristics of the course and the learning outcomes for the student to achieve, demonstrating whether he has achieved the maximum available learning opportunities.			

Module 33

Code	Course/Module Title	ECTS	Semester
PHY36133	Applications of Quantum Mechanics	4	6
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USSWL (hr/sem)**
2	2	63	37
Description			
The description of this course provides a necessary summary of the most important characteristics of the course and the learning outcomes for the student to achieve, demonstrating whether he has achieved the maximum available learning opportunities.			

Module 34

Code	Course/Module Title	ECTS	Semester
PHY36134	Crystals	6	6
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USSWL (hr/sem)**
2	3	79	71
Description			
The description of this course provides a necessary summary of the most important characteristics of the course and the learning outcomes for the student to achieve, demonstrating whether he has achieved the maximum available learning opportunities.			

Module 35

Code	Course/Module Title	ECTS	Semester
PHY36035	Spectra	4	6
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USSWL (hr/sem)**
2	2	63	37
Description			
The description of this course provides a necessary summary of the most important characteristics of the course and the learning outcomes for the student to achieve, demonstrating whether he has achieved the maximum available learning opportunities.			

Module 36

Code	Course/Module Title	ECTS	Semester
PHY36036	Numerical Analytic	4	6
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USSWL (hr/sem)**
2	2	63	37
Description			
The description of this course provides a necessary summary of the most important characteristics of the course and the learning outcomes for the student to achieve, demonstrating whether he has achieved the maximum available learning opportunities.			

Module 37

Code	Course/Module Title	ECTS	Semester
PHY47037	Fundamentals of Nuclear Physics	6	7
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USSWL (hr/sem)**
2	4	94	56
Description			
The description of this course provides a necessary summary of the most important characteristics of the course and the learning outcomes for the student to achieve, demonstrating whether he has achieved the maximum available learning opportunities.			

Module 38

Code	Course/Module Title	ECTS	Semester
PHY47138	Solid State Physics	6	7
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USSWL (hr/sem)**
2	4	94	56
Description			
The description of this course provides a necessary summary of the most important characteristics of the course and the learning outcomes for the student to achieve, demonstrating whether he has achieved the maximum available learning opportunities.			

Module 39

Code	Course/Module Title	ECTS	Semester
PHY47039	Electromagnetic Theories	5	7
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USSWL (hr/sem)**
2	3	63	62
Description			
The description of this course provides a necessary summary of the most important characteristics of the course and the learning outcomes for the student to achieve, demonstrating whether he has achieved the maximum available learning opportunities.			

Module 40

Code	Course/Module Title	ECTS	Semester
PHY47040	Mathematical Physics	4	7
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USSWL (hr/sem)**
2	2	63	37
Description			
The description of this course provides a necessary summary of the most important characteristics of the course and the learning outcomes for the student to achieve, demonstrating whether he has achieved the maximum available learning opportunities.			

Module 41

Code	Course/Module Title	ECTS	Semester
PHY47041	Optional I	4	7
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USSWL (hr/sem)**
2	2	63	37
Description			
The description of this course provides a necessary summary of the most important characteristics of the course and the learning outcomes for the student to achieve, demonstrating whether he has achieved the maximum available learning opportunities.			

Module 42

Code	Course/Module Title	ECTS	Semester
PHY47042	Research project	5	7
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USSWL (hr/sem)**
0	2	32	93
Description			
The description of this course provides a necessary summary of the most important characteristics of the course and the learning outcomes for the student to achieve, demonstrating whether he has achieved the maximum available learning opportunities.			

Module 43

Code	Course/Module Title	ECTS	Semester
PHY48143	Nuclear Physics Applications	6	8
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USSWL (hr/sem)**
2	4	94	56
Description			
The description of this course provides a necessary summary of the most important characteristics of the course and the learning outcomes for the student to achieve, demonstrating whether he has achieved the maximum available learning opportunities.			

Module 44

Code	Course/Module Title	ECTS	Semester
PHY48144	Solid State Physics (Advanced)	6	9
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USSWL (hr/sem)**
2	4	94	56
Description			
The description of this course provides a necessary summary of the most important characteristics of the course and the learning outcomes for the student to achieve, demonstrating whether he has achieved the maximum available learning opportunities.			

Module 45

Code	Course/Module Title	ECTS	Semester
PHY48145	Electromagnetic Fields	5	10
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USSWL (hr/sem)**
2	2	63	62
Description			
The description of this course provides a necessary summary of the most important characteristics of the course and the learning outcomes for the student to achieve, demonstrating whether he has achieved the maximum available learning opportunities.			

Module 46

Code	Course/Module Title	ECTS	Semester
PHY48146	Mathematical Methods	4	8
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USSWL (hr/sem)**
2	2	63	37
Description			
The description of this course provides a necessary summary of the most important characteristics of the course and the learning outcomes for the student to achieve, demonstrating whether he has achieved the maximum available learning opportunities.			

Module 47

Code	Course/Module Title	ECTS	Semester
PHY48047	Plasma Physics	5	8
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USSWL (hr/sem)**
2	2	63	62
Description			
The description of this course provides a necessary summary of the most important characteristics of the course and the learning outcomes for the student to achieve, demonstrating whether he has achieved the maximum available learning opportunities.			

Module 48

Code	Course/Module Title	ECTS	Semester
PHY48048	Optional II	4	8
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USSWL (hr/sem)**
2	1	48	52
Description			
The description of this course provides a necessary summary of the most important characteristics of the course and the learning outcomes for the student to achieve, demonstrating whether he has achieved the maximum available learning opportunities.			

الملحق 4: وصف المادة الدراسية

Module Description Form (2023 – 2024) **وصف المادة الدراسية**

University of Tikrit

جامعة تكريت

First Cycle - Bachelor's degree (B.Sc.) – Physics

الدورة الاولى – بكالوريوس علوم – علوم الفيزياء

Module Information معلومات المادة الدراسية					
Module Title	Properties of materials			Module Delivery	
Module Type	Core			Class Lab. Tut.	
Module Code	PHY1217				
ECTS Credits	7				
SWL (hr/sem)	94				
Module Level	1		Semester (s) offered		1
Administering Department	Physics		College	Science	
Module Leader	Dr. Hussein Khudhayer Mohammad		e-mail	hussienalkhalid@yahoo.com	
Module Leader's Acad. Title	Lecture		Module Leader's Qualification		Ph.D.
Module Tutor			e-mail		
Peer Reviewer Name			e-mail		
Review Committee Approval			Version Number		1.0

Relation With Other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	Mechanics	Semester	1
Co-requisites module	-	Semester	-

Module Aims, Learning Outcomes, Indicative Contents and Brief Description أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية مع وصف مختصر	
Module Aims أهداف المادة الدراسية	Physical Sciences promotes knowledge and skills in scientific inquiry and problem solving; the construction and application of scientific and technological knowledge; an understanding of the nature of science and its relationships to technology, society and the environment.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	The students should be able to solve and find an appropriate solutions for general physical problems that they face.
Indicative Contents المحتويات الإرشادية	Aspects of Physics including vectors, energy, electricity, magnetism, and force. Assessment will contain Lab based experimental work.
Course Description	Physics is concerned with describing the interactions of energy, matter, space, and time, and it is especially interested in what fundamental mechanisms underlie every phenomenon. The concern for describing the basic phenomena in nature essentially defines the realm of physics.

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	The learning and teaching strategy is designed to: Carefully cover in lectures the necessary fundamental material and analytical techniques, and demonstrate concepts with appropriate (and, where possible practical) examples. Allow students adequate time to practice the techniques using a large number of carefully selected tutorial problems

Student Workload (SSWL) الحمل الدراسي للطالب			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	94	Structured SWL (h/w) الحمل الدراسي المنتظم للطالب أسبوعيا	6.5
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	81	Unstructured SWL (h/w) الحمل الدراسي غير المنتظم للطالب أسبوعيا	5.4
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	175		

Module Evaluation تقييم المادة الدراسية					
		Time (hr)	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	3	5% (5)		
	Assignments	2	5 % (5)		
	Lab	6	15% (15)		
	Tut.	2	5% (5)		
Summative assessment	Midterm Exam	2	20% (20)		
	Final Exam	3	50% (50)		
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
Week	Material Covered
Week 1	Rotational Motion
Week 2	Angular velocity and angular acceleration
Week 3	Angular force and angular acceleration
Week 4	Inertia
Week 5	Vibration
Week 6	Mass, density, and volume
Week 7	First exam
Week 8	Simple harmonic motion
Week 9	Spring and simple pendulum
Week 10	Elasticity
Week 11	Hooke’s law
Week 12	Pressure in liquids
Week 13	Stream-line and Turbulent Flow
Week 14	Bernoulli's principle
Week 15	Second exam

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	**Fundamentals of physics** **Halliday, D., Resnick, R., & Walker, J. (2013). .** **John Wiley & Sons.**	**No**
Recommended Texts		**No**
Websites	.	

GRADING SCHEME

مخطط الدرجات

Group	Grade	التقدير	Marks (%)	Definition
Success Group (50 - 100)	**A** - Excellent	امتياز	90 - 100	Outstanding Performance
	B - Very Good	جيد جدا	80 - 89	Above average with some errors
	C - Good	جيد	70 - 79	Sound work with notable errors
	D - Satisfactory	متوسط	60 - 69	Fair but with major shortcomings
	E - Sufficient	مقبول	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	**FX** – Fail	راسب (قيد المعالجة)	(45-49)	More work required but credit awarded
	F – Fail	راسب	(0-44)	Considerable amount of work required

Note:

Marks with decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.

Module Information معلومات المادة الدراسية				
Module Title	**Thermodynamics**		**Module Delivery**	
Module Type	**BASIC**		**Theory** **Lab** **Tutorial**	
Module Code	**PHY1217**			
ECTS Credits	6			
SWL (hr/sem)	**150**			
Module Level	1	**Semester (s) offered**	1	
Administering Department	**Physics**	**College**	Science	
Module Leader	Dr. Rafa Younus Jasim	**e-mail**	r.y.jasim@tu.edu.iq	
Module Leader's Acad. Title	Lecture	**Module Leader's Qualification**	Proof. Assist. Ph.D.	
Module Tutor	None	**e-mail**	None	
Peer Reviewer Name		**e-mail**		
Review Committee Approval		**Version Number**	1.0	

Relation With Other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	-	**Semester**	-
Co-requisites module	-	**Semester**	-
Module Aims, Learning Outcomes, Indicative Contents and Brief Description أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية مع وصف مختصر			
Module Aims	Physical Sciences promotes knowledge and skills in scientific inquiry and		

أهداف المادة الدراسية	problem solving; the construction and application of scientific and technological knowledge; an understanding of the nature of science and its relationships to technology, society and the environment.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	The students should be able to solve and find an appropriate solutions for general physical problems that they face, and specially in Thermodynamics.
Indicative Contents المحتويات الإرشادية	Aspects of Physics including Basic concepts in Thermodynamics, Thermodynamic systems, Types of Thermodynamic systems, Types of Thermodynamic walls, Thermal and Thermodynamic equilibrium, Properties of system, Thermodynamic processes, Heat and Work, Pressure and Temperature, Zero, First, Second, and Third laws in Thermodynamics, Electro-thermal phenomenon, Pure materials properties, Gases properties, Heat engines, and Super conductivity. Assessment will contain Lab based experimental work.
Course Description	Physics is concerned with describing the interactions of energy, matter, space, and time, and it is especially interested in what fundamental Thermodynamics underlie every phenomenon related with it. The concern for describing the basic phenomena in nature essentially defines the realm of physics.
Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	The learning and teaching strategy is designed to: Carefully cover in lectures the necessary fundamental of Thermodynamics and its techniques, and demonstrate concepts with appropriate (and, where possible practical) examples. Allow students adequate time to practice the techniques using a large number of carefully selected tutorial problems

Student Workload (SWL) الحمل الدراسي للطالب			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	**93**	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	**6.2**
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	**57**	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	**3.8**
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	150		

Module Evaluation تقييم المادة الدراسية					
		Time (hr)	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	3	5% (5)		
	Assignments	2	5 % (5)		
	Lab	6	15% (15)		
	Tut.	2	5% (5)		
Summative assessment	Midterm Exam	2	20% (20)		
	Final Exam	3	50% (50)		
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	Material Covered
Week 1	Basic concepts in Thermodynamics, Thermodynamic systems.
Week 2	Types of Thermodynamic systems, Open systems, Closed systems, and Isolated systems.
Week 3	Types of Thermodynamic walls, Adiabatic wall, Diathermy wall.
Week 4	Thermal and Thermodynamic equilibrium.
Week 5	Properties of systems.
Week 6	Thermodynamic processes, Adiabatic, Isothermal, Cyclic, unreflexively, and reflexively processes.
Week 7	Heat and Work, Concept of heat, Internal energy.
Week 8	Pressure and Temperature, Mechanical concept of pressure, Pressure caused by the depth of fluid, Atmospheric pressure, Atmospheric pressure Instruments, Barometer, Manometer, Inclined Manometer, Bourdon gauge.
Week 9	Zero, First, Second, and Third laws in Thermodynamics.
Week 10	Electro-thermal phenomenon, Thermal expansion, Thermal transfer.
Week 11	Pure materials properties, pure material phases, Change of material state, Gas and Vapor, Saturated and unsaturated vapors, Humidity, Behavior of pure material, Triple point of material, Mechanical equivalent of heat.
Week 12	Specific heat and heat capacity, First Law in Thermodynamics

Week 13	Gases properties, Real and ideal gases, Boil's Law, Char's Law, General law for ideal gases, Pressure of ideal gas
Week 14	Heat engines, heat pump and Refrigerator, Carnot's cycle, Newton's cooling law.
Week 15	Super conductivity.

Delivery Practical Plan (Weekly Syllabus) المنهاج الاسبوعي العملي	
	Material Covered
Week 1	Determination of the viscosity of water by flow through a capillary tube
Week 2	Determining the heating Power of an ohmic load in an AC circuit as a function of the applied voltage.
Week 3	Converting electrical energy into heat Measuring with a voltmeter and an ammeter.
Week 4	Determining the specific heat of solids.
Week 5	Determining the efficiency of a solar collector.
Week 6	Midterm Exam.
Week 7	Investigation the function of the expansion valve of the heat pump.
Week 8	Investigation the function of the expansion valve of the heat pump.
Week 9	Recording the Vapor – pressure curve of water – pressures up to 50 bar.
Week 10	Determination of the apparent expansions coefficient of liquid by using the density bottle.
Week 11	Determination of the apparent expansions coefficient of liquid by using the density bottle.
Week 12	Determining the thermal conductivity of building materials using the single – plate method.
Week 13	Conversion of mechanical energy into thermal energy.
Week 14	Review
Week 15	Final exam.

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	*Any References in Thermodynamics*	No
Recommended Texts	**أي مصدر من مصادر الثرموداينميك**	No
Websites		

Module Information معلومات المادة الدراسية					
Module Title	Health and Ecology Physics فيزياء الصحة والبيئة			Module Delivery	
Module Type	ELECTIVE			Theory	
Module Code	PHY48048				
ECTS Credits	4				
SWL (hr/sem)	100				
Module Level	1		Semester (s) offered	1	
Administering Department	Physics		College	Science	
Module Leader	Dr. Amjad Hussein Jassim		e-mail	Amjad@tu.edu.iq	
Module Leader's Acad. Title	Lecture		Module Leader's Qualification	Ph.D.	
Module Tutor	None		e-mail	None	
Peer Reviewer Name			e-mail		
Review Committee Approval			Version Number	1.0	

Relation With Other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	-	Semester	-
Co-requisites module	-	Semester	-
Module Aims, Learning Outcomes, Indicative Contents and Brief Description			

أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية مع وصف مختصر	
Module Aims أهداف المادة الدراسية	The main objective of teaching health and Ecology is to provide the student with information about the importance of preserving the environment from pollution and not to be one of the causes of pollution. He is also directed to identify the types of pollution and the dangers that befall the living as a result of pollution.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	That the student knows the importance of preserving the Ecology, what are the methods of preserving it, and how to prevent and avoid environmental risks represented by disasters or environmental pollution by humans.
Indicative Contents المحتويات الإرشادية	Avoiding pollutants, good and tight preservation of chemical materials, taking the necessary precautions if there is an emergency pollution
Course Description	The semester contains several themes, including definition of the environment and its sources of pollution, the impact of humans on the environment, and the risks of pollution, its causes, effects and types.
Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	The learning and teaching strategy is designed to: Carefully cover in lectures the necessary fundamental material and analytical techniques, and demonstrate concepts with appropriate (and, where possible practical) examples. Allow students adequate time to practice the techniques using a large number of carefully selected tutorial problems

Student Workload (SWL) الحمل الدراسي للطالب			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	**48**	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	**2**
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	**52**	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	**1**
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	100		

Module Evaluation تقييم المادة الدراسية				
	Time (hr)	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**

Formative assessment	**Quizzes**	3	5% (5)		
	Assignments	2	5 % (5)		
	Lab	6	15% (15)		
	Tut.	2	5% (5)		
Summative assessment	**Midterm Exam**	2	20% (20)		
	Final Exam	3	50% (50)		
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	Material Covered
Week 1	Definition of ecology, its history, scope and divisions; ecology of the individual; Community ecology
Week 2	The field of ecology and modern research methods in ecology, such as the methods of using field studies and extracting information from pollen records
Week 3	Basic concepts in ecology, as we learn about the environmental components that include the life cover, the ecosystem, and others
Week 4	Major environmental cycles, including the water cycle in nature, the carbon cycle, the phosphorus cycle, and the nitrogen cycle
Week 5	ecological succession and ecological persistence; As the factors

	affecting succession and the path of successive change are identified
Week 6	The problem of environmental pollution and what it includes in terms of definitions of pollution, the basics of pollution, the factors that aggravate pollution, the dangers of pollution, and the classification of the danger of pollution
Week 7	First exam
Week 8	Types of pollution, its sources and effects; Including air pollution, global air pollution, water pollution and soil pollution
Week 9	Radioactive contamination, its definition, forms and environmental repercussions that result from it
Week 10	Climate change, discussing the impact of humans on the atmosphere and clarifying the increase in greenhouse gas concentrations on the environment, and the most important human impacts on the atmosphere such as causing the erosion of the ozone layer
Week 11	Greenhouse gases and the phenomenon of global warming, and what are the consequences of human activities on the climate
Week 12	The environmental effects of global warming, and the consequences of that phenomenon on all aspects of life, such as ice shrinkage and

	lack of fresh water
Week 13	The problem of energy production, and some environmental problems associated with energy production in its various forms
Week 14	Energy sources, including nuclear bullets, oil and gas, and their environmental effects
Week 15	Second exam

Learning and Teaching Resources مقدمة في علم البيئة ومشكلاتها مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	Introduction to ecology and its problems	No
Recommended Texts		
Websites	.	

Module Information معلومات المادة الدراسية					
Module Title	**Statistical Mechanics** **الميكانيك الإحصائي**			**Module Delivery**	
Module Type	**Basic**			**Theory** **Lab** **Tutorial**	
Module Code	**PHY1217**				
ECTS Credits	**6**				
SWL (hr/sem)	**150**				
Module Level	**UGx11 1**		**Semester (s) offered**	**1**	
Administering Department	**Physics**		**College**	**Science**	
Module Leader	**Dr. Rafa Younus Jasim**		**e-mail**	**r.y.jasim@tu.edu.iq**	
Module Leader's Acad. Title	**Lecture**		**Module Leader's Qualification**	**Proof. Assist. Ph.D.**	
Module Tutor	**None**		**e-mail**	**None**	
Peer Reviewer Name			**e-mail**		
Review Committee Approval			**Version Number**	**1.0**	

Relation With Other Modules **العلاقة مع المواد الدراسية الأخرى**			
Prerequisite module	**-**	**Semester**	**-**
Co-requisites module	**-**	**Semester**	**-**
Module Aims, Learning Outcomes, Indicative Contents and Brief Description **أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية مع وصف مختصر**			
Module Aims **أهداف المادة الدراسية**	**Physical Sciences promotes knowledge and skills in scientific inquiry and problem solving; the construction and application of scientific and technological knowledge; an understanding of the nature of science and its relationships to technology, society and the environment.**		
Module Learning Outcomes **مخرجات التعلم للمادة الدراسية**	**The students should be able to solve and find an appropriate solutions for general physical problems that they face, and specially in Statistical Mechanics.**		
Indicative Contents **المحتويات الإرشادية**	**Aspects of Physics including Statistical Mechanics , Classical and Quantum Assemblies, Maxwell- Boltzmann distribution, Bose- Einstein distribution, Fermi-Dirac distribution, and their applications.**		
Course Description	**Physics is concerned with describing the interactions of energy, matter, space, and time, and it is especially interested in what fundamental Statistical mechanisms underlie every phenomenon related with it. The concern for describing the basic phenomena in nature essentially defines the realm of physics.**		
Learning and Teaching Strategies **استراتيجيات التعلم والتعليم**			
Strategies	**The learning and teaching strategy is designed to: Carefully cover in**		

	lectures the necessary fundamental Statistical mechanics and its techniques, and demonstrate concepts with appropriate (and, where possible practical) examples. Allow students adequate time to practice the techniques using a large number of carefully selected tutorial problems

Student Workload (SWL) **الحمل الدراسي للطالب**			
Structured SWL (h/sem) **الحمل الدراسي المنتظم للطالب خلال الفصل**	**93**	**Structured SWL (h/w)** **الحمل الدراسي المنتظم للطالب أسبوعيا**	**6.2**
Unstructured SWL (h/sem) **الحمل الدراسي غير المنتظم للطالب خلال الفصل**	**57**	**Unstructured SWL (h/w)** **الحمل الدراسي غير المنتظم للطالب أسبوعيا**	**3.8**
Total SWL (h/sem) **الحمل الدراسي الكلي للطالب خلال الفصل**	**150**		

Module Evaluation **تقييم المادة الدراسية**

As		Time (hr)	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	3	5% (5)		
	Assignments	2	5 % (5)		
	Lab	6	15% (15)		
	Tut.	2	5% (5)		
Summative assessment	Midterm Exam	2	20% (20)		
	Final Exam	3	50% (50)		
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
Week	Material Covered
Week 1	Introduction to Statistical Mechanics, Description of Assemblies (Phase space).
Week 2	The average properties of Assembly .
Week 3	Classical and Quantum Assemblies
Week 4	Maxwell- Boltzmann distribution, Distribution over energies, Weights of configurations.

Week 5	**The most probable configuration.**
Week 6	**The Sharpness of the maximum configuration.**
Week 7	**The Multiplier β, The Multiplier α, the differential expression of Maxwell- Boltzmann distribution.**
Week 8	**Applications of Maxwell- Boltzmann distribution, Studying the average properties of systems, Classical ideal gas, Mean and most probable velocities.**
Week 9	**Doppler broadening of spectral lines, Equip ration of energy.**
Week 10	**Specific heat of Gases, Einstein diffusion equation.**
Week 11	**Bose- Einstein distribution, Applications of Bose- Einstein distribution, Bose- Einstein Gas, Einstein condensation.**
Week 12	**Black-body radiation (Photon gas), Specific heat of solids (Phonon gas),**
Week 13	**Fermi-Dirac distribution.**
Week 14	**Applications of Fermi-Dirac distribution, Fermi-Dirac gas.**
Week 15	**Pauli Para magnetism, Thermionic emission.**

Learning and Teaching Resources **مصادر التعلم والتدريس**		
	Text	**Available in the Library?**
Required Texts	***An Introduction to Statistical Mechanics for Students., A. J. Pointon, 1967***	**No**
Recommended Texts	**مقدمة في الفيزياء الإحصائية للطلبة. تأليف أ. ج. بوينتون.** **ترجمة: د. رائد محمد ناصر & د. عبد الإمام علي الزبيدي**	**No**

	جامعة ناصر- كلية العلوم- قسم الفيزياء	
Websites		

Module Information معلومات المادة الدراسية					
Module Title	Sound and wave motion الصوت و الحركة الموجية			Module Delivery	
Module Type	BASIC			Theory Lab Tutorial	
Module Code	PHY1217				
ECTS Credits	6				
SWL (hr/sem)	150				
Module Level	1		Semester (s) offered	1	
Administering Department	Physics		College	Science	
Module Leader	Dr. Rafa Younus Jasim		e-mail	r.y.jasim@tu.edu.iq	
Module Leader's Acad. Title	Lecture		Module Leader's Qualification	Proof. Assist. Ph.D.	
Module Tutor	None		e-mail	None	
Peer Reviewer Name			e-mail		
Review Committee Approval			Version Number	1.0	

Relation With Other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	-	Semester	-
Co-requisites module	-	Semester	-
Module Aims, Learning Outcomes, Indicative Contents and Brief Description أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية مع وصف مختصر			
Module Aims	Physical Sciences promotes knowledge and skills in scientific inquiry and		

أهداف المادة الدراسية	problem solving; the construction and application of scientific and technological knowledge; an understanding of the nature of science and its relationships to technology, society and the environment.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	The students should be able to solve and find an appropriate solutions for general physical problems that they face, and specially in Sound and wave motion.
Indicative Contents المحتويات الإرشادية	Aspects of Physics including Basic concepts in Sound and wave motion, Sound concept, Main parameters for sound generation and propagation, Concept of wave motion, Types of Waves, Simple harmonic motion and its applications, Forced frequency and Resonance, Damping and Damping types, and Super conductivity.
Course Description	Physics is concerned with describing the interactions of energy, matter, space, and time, and it is especially interested in what fundamental of Sound and wave motion underlie every phenomenon related with it. The concern for describing the basic phenomena in nature essentially defines the realm of physics.
Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	The learning and teaching strategy is designed to: Carefully cover in lectures the necessary fundamental of Sound and wave motion and its techniques, and demonstrate concepts with appropriate (and, where possible practical) examples. Allow students adequate time to practice the techniques using a large number of carefully selected tutorial problems

Student Workload (SWL) الحمل الدراسي للطالب			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	**93**	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	**6.2**
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	**57**	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	**3.8**
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	150		

Module Evaluation
تقييم المادة الدراسية

		Time (hr)	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	**Quizzes**	3	5% (5)		
	Assignments	2	5 % (5)		
	Lab	6	15% (15)		
	Tut.	2	5% (5)		
Summative assessment	**Midterm Exam**	2	20% (20)		
	Final Exam	3	50% (50)		
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	Material Covered
Week 1	Sound concept, Main parameters for sound generation and propagation.
Week 2	Concept of wave motion.
Week 3	Types of Waves.
Week 4	Simple harmonic motion.
Week 5	Equation of Simple harmonic motion.
Week 6	Resolving of Simple harmonic motion equation.
Week 7	Applications of Simple harmonic motion equation.
Week 8	Simple Pendulum.
Week 9	Spiral pendulum.
Week 10	Floating body.
Week 11	Bending Pendulum.
Week 12	Forced frequency and Resonance.
Week 13	Dangerous of Resonance.
Week 14	Damping and Damping types.
Week 15	Superposition concept.

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	*Gurjiyah, A. A., "Sound and wave motion", AL Mosul university offset.*	No
Recommended Texts	**الصوت و الحركة الموجية** **د. أمجد عبد الرزاق كرجية- مطبعة جامعة الموصل** **و أي مصدر علمي آخر عن الصوت و الحركة الموجية**	No
Websites		

Module Information معلومات المادة الدراسية					
Module Title	**Geometrical Optics**			**Module Delivery**	
Module Type	**BASIC**			**Theory** **Lab** **Tutorial**	
Module Code	**PHY**				
ECTS Credits	6				
SWL (hr/sem)	**150**				
Module Level	2		**Semester (s) offered**	1	
Administering Department	**Physics**		**College**	Science	
Module Leader	Dr. YASEEN.H. Mahmood		**e-mail**	D.Yaseen.ph.sc@tu.edu.iq	
Module Leader's Acad. Title	Lecture		**Module Leader's Qualification**	Ph.D.	
Module Tutor	None		**e-mail**	None	
Peer Reviewer Name			**e-mail**		
Review Committee Approval			**Version Number**	1.0	

Relation With Other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	-	**Semester**	-
Co-requisites module	-	**Semester**	-
Module Aims, Learning Outcomes, Indicative Contents and Brief Description أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية مع وصف مختصر			
Module Aims	Communicating an overview of optical physics material and the		

أهداف المادة الدراسية	importance of this decision to physics departments. Students are also given some skills about the types of visual devices, their shapes, the way they operate and the visual ones that make them familiar with the most important subjects they can face in everyday working life.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	A1. Classify needs for the development of theoretical and practical reality in optical physics. A2. To become accustomed to the practice of the rules which teach him in his words and actions and interpret the phenomena A3. To positively criticize improper uses in devices with physical origins A4. To retrieve the information examined thoroughly and to achieve it in practice. A5. The unknown should be unmatched in relation to the known isotope Take note of visual physical terminology with its connotations.
Indicative Contents المحتويات الإرشادية	Aspects of visual physics such as polarization, interference and diffraction. The evaluation will contain experimental laboratory-based work.
Course Description	B1 - The student should devise solutions and explanations for visual physical phenomena, with some modernity and creativity. B2. The student's knowledge of the concept of theoretical and practical visual physics and adaptation to problem solving. B3. The student design a blueprint for studying the physical vocabulary in a new way Enabling students to analyse reality and phenomena with a physical perspective.
Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	1- The way to lecture lectures, and electronic(online). 2- Team Project. 3- Standard method. 4- Practical lectures

Student Workload (SWL) الحمل الدراسي للطالب			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	**93**	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	**6.2**
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	**57**	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	**3.8**

Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	150

Module Evaluation
تقييم المادة الدراسية

		Time (hr)	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	**Quizzes**	3	5% (5)		
	Assignments	2	5 % (5)		
	Lab	6	15% (15)		
	Tut.	2	5% (5)		
Summative assessment	**Midterm Exam**	2	20% (20)		
	Final Exam	3	50% (50)		
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)
المنهاج الاسبوعي النظري

	Material Covered
Week 1	Light , The Speed of Light, The Refractive Index
Week 2	Optical Path, Fermat's Principle, Laws of Reflection and Refraction
Week 3	The Critical Angle and Total Reflection , Problems
Week 4	Mirror , Mirror Formulas , Power of Mirrors
Week 5	Spherical mirrors , Focal point and focal length,
Week 6	Graphical construction , Mirror formulas
Week 7	Power of mirrors , Problems
Week 8	Focal Points , Focal Lengths , Image Formation M , Conjugate Points Planes
Week 9	The Parallel-Ray Method, The Oblique-Ray Method
Week 10	First exam
Week 11	The Lens Formula , Lateral Magnification, Virtual Images

Week 12	Object Space and Image Space , The Power of a Thin Lens
Week 13	Thin Lenses in Contact, Derivation of the Lens Formula
	Derivation of the Lens Makers' Formula, Focal Point and Focal Length, Problems
Week 15	Second exam

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	Jenkins and White-Fundamentals Of Optics, Physics Book 90 FUNDAMENTALS OF OPTICS FourthEdition Francis A. Jenkins Late Professor of Physics University of California, Berkeley Harvey E. White	No
Recommended Texts		No
Websites	.	

Module Information معلومات المادة الدراسية					
Module Title	**Physical Optics**			**Module Delivery**	
Module Type	**BASIC**			**Theory** **Lab** **Tutorial**	
Module Code	**PHY**				
ECTS Credits	6				
SWL (hr/sem)	**150**				
Module Level	2		**Semester (s) offered**	2	
Administering Department	**Physics**		**College**	Science	
Module Leader	Dr. YASEEN.H. Mahmood		**e-mail**	D.Yaseen.ph.sc@tu.edu.iq	
Module Leader's Acad. Title	Lecture		**Module Leader's Qualification**	Ph.D.	
Module Tutor	None		**e-mail**	None	
Peer Reviewer Name			**e-mail**		
Review Committee Approval			**Version Number**	1.0	

Relation With Other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	-	**Semester**	-
Co-requisites module	-	**Semester**	-

Module Aims, Learning Outcomes, Indicative Contents and Brief Description أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية مع وصف مختصر	
Module Aims أهداف المادة الدراسية	Communicating an overview of optical physics material and the importance of this decision to physics departments. Students are also given some skills about the types of visual devices, their shapes, the way they operate and the visual ones that make them familiar with the most important subjects they can face in everyday working life.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	A1. Classify needs for the development of theoretical and practical reality in optical physics. A2. To become accustomed to the practice of the rules which teach him in his words and actions and interpret the phenomena A3. To positively criticize improper uses in devices with physical origins A4. To retrieve the information examined thoroughly and to achieve it in practice. A5. The unknown should be unmatched in relation to the known isotope Take note of visual physical terminology with its connotations.
Indicative Contents المحتويات الإرشادية	Aspects of visual physics such as polarization, interference and diffraction. The evaluation will contain experimental laboratory-based work.
Course Description	B1 - The student should devise solutions and explanations for visual physical phenomena, with some modernity and creativity. B2. The student's knowledge of the concept of theoretical and practical visual physics and adaptation to problem solving. B3. The student design a blueprint for studying the physical vocabulary in a new way Enabling students to analyse reality and phenomena with a physical perspective.
Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	1- The way to lecture lectures, and electronic(online). 2- Team Project. 3- Standard method. 4- Practical lectures

Student Workload (SWL) الحمل الدراسي للطالب			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	**93**	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	**6.2**

Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	**57**	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	**3.8**
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	150		

Module Evaluation
تقييم المادة الدراسية

		Time (hr)	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	**Quizzes**	3	5% (5)		
	Assignments	2	5 % (5)		
	Lab	6	15% (15)		
	Tut.	2	5% (5)		
Summative assessment	**Midterm Exam**	2	20% (20)		
	Final Exam	3	50% (50)		
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)
المنهاج الاسبوعي النظري

	Material Covered
Week 1	Polarization . The Polarization of Light, Polarization by Reflection
Week 2	Representation of the Vibrations in Light, Polarizing Angle and Brewster's Law
Week 3	Polarization by a Pile of Plates , Law of Malus ,
Week 4	Polarization by Dichroic Crystals, Polarization by double refraction
Week 5	Interference , The Superposition of Wave ,
Week 6	Huygens' Principle , Young's Experiment
Week 7	Interference Fringes from a Double Source,
Week 8	First exam

Week 9	Diffraction , Fraunhofer Diffraction by a Single slit
Week 10	Fraunhofer Diffraction by a double slit
Week 11	Newton's Rings , Interference in thin film , The Fabry –perot Interferometer The Rectangular Aperture , The Circular Aperture
Week 12	Fresnel and Fraunhofer Diffraction
Week 13	Fresnel Diffraction
	Fresnel Diffraction Pattern
Week 15	Second exam

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	Jenkins and White-Fundamentals Of Optics, Physics Book 90 FUNDAMENTALS OF OPTICS FourthEdition Francis A. Jenkins Late Professor of Physics University of California, Berkeley Harvey E. White	No
Recommended Texts		No
Websites	.	

Module Information معلومات المادة الدراسية				
Module Title	Applications of quantum mechanics اساسيات تطبيقات ميكانيك الكم		**Module Delivery**	
Module Level	٣		**Semester (s) offered**	II
Administering Department	**Physics**	**College**	Science	
Module Leader	Dr. Shareef Faiq Sultan	**e-mail**	Shareef.ph.sc@tu.edu.iq	
Module Leader's Acad. Title	Lecture	**Module Leader's Qualification**	Ph.D.	

Module Aims, Learning Outcomes, Indicative Contents and Brief Description أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية مع وصف مختصر	
Module Aims أهداف المادة الدراسية	The aim of this module is to build upon the foundations laid in Quantum Mechanics I and develop the students' grasp of quantum mechanics - particularly its formalism and applications - to the point where they will be able to engage with contemporary research literature. The ability to explain the concepts of quantum physics. Interpretation of Schrödinger's equation in more than one case for the particle.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	describe the definition and interpretation of the wavefunction and of operators in quantum mechanics; discuss the origin of energy quantisation and quantum tunnelling effects; describe the general properties of the stationary states of quantum particles confined to simple symmetric potentials; perform calculations on wavefunctions, and solve the Schrödinger equation for a range of problems; use time-independent perturbation theory to solve problems and interpret results; explain the origin of the un-coupled set of quantum numbers for the hydrogen atom and the form of the associated eigenfunctions.
Course Description	This module introduces the mathematical expression of the basic principles of quantum mechanics and methods for finding solutions of problems that permit straightforward mathematical analysis. These solutions demonstrate many of the general features of the subject and will be applied in subsequent modules in the Physics programme.
Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	1-Develop methods and means of obtaining information related to quantum mechanics 2-Developing the student's personality to become a constructive personality that possesses scientific dialogue.

	3- Encourage students to request information from websites and libraries.

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	Material Covered
Week 1	The time dependent Schrödinger equation
Week 2	Solving the time-independent Schrödinger equation, interpretation of the wave function
Week 3	Using Schrödinger's equation to solve simple problems, applications of Schrödinger's equation
Week 4	Free particle
Week 5	Potential barrier, a particle in a box
Week 6	A particle in a three-dimensional box. The Potential Step
Week 7	The current density was calculated using the Schrödinger equations
Week 8	First month exam
Week 9	The harmonic oscillator and the binary oscillator
Week 10	Matrices in Quantum Mechanics
Week 11	Applications of matrices to the computation of characteristic functions
Week 12	Angular momentum effects, electron spin, total angular momentum
Week 13	Perturbation theory
Week 14	Solve examples and problems
Week 15	Second month exam

Learning and Teaching Resources مصادر التعلم والتدريس	
	Text
Required Texts	**اساسيات ميكانيك الكم تأليف سالم حسن الشماع وأمجد عبد الرزاق كرجية** Introduction to quantum mechanics, David J. Griffiths, Prentice Hall Inc., 1995

Module Information معلومات المادة الدراسية				
Module Title	Electricity الكهربائية		**Module Delivery**	
Module Level	1	**Semester (s) offered**		I
Administering Department	**Physics**	**College**	Science	
Module Leader	Dr. Faleh L. Mater Al-Jashaam	**e-mail**	Faleh.l.mater@tu.edu.iq	
Module Leader's Acad. Title	Lecturer	**Module Leader's Qualification**		Ph.D.

Module Aims, Learning Outcomes, Indicative Contents and Brief Description أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية مع وصف مختصر	
Module Aims أهداف المادة الدراسية	-Conveying a general idea about the electrical subject and the importance of this course for the physics departments. By teaching the electrical subject, students acquire some skills about the basics and principles of electricity, electrical devices and the parts that make them up, knowing their types, shapes, method of work, and connecting electrical circuits. Which makes students aware of the most important topics that they can face in daily practical life by dealing with resistors, capacitors, coils, alternating and continuous power generation sources of various types, methods of work and their importance. In addition to teaching the student the use of measuring devices related to electrical voltage, currents of all kinds, continuous and alternating, and frequencies. - Preparing efficient staff specialized in the field of electricity and power supplies in all its forms in Iraq. -Teaching the student the amount of electrical energy needed to operate engines, various machines, lights, computers, and office equipment.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1- To classify the needs for the development of theoretical and practical reality in the subject of electricity. 2- To get used to practicing what he has learned of rules and scientific studies in his daily life and work. 3- To positively criticize the improper uses of electrical appliances and components. 4- To retrieve the information that he carefully studied and to

	achieve it practically in finding appropriate solutions to problems related to electricity. 5- To decipher the unknown by analogy with the known counterpart using accurate measuring devices. 6- To take note of the electrophysical terminology with its implications, which help the student's future development. 7 - The student devises solutions and explanations for electrical problems with some modernity and creativity. 8 - The student's knowledge of the concept of theoretical and practical electricity physics and adaptation to overcome obstacles in this field. 9 - The student should design a plan to study the vocabulary of electrical subject in a new and accurate manner by building a solid scientific base for the student at the beginning of his undergraduate studies to base on when trying to develop himself in this field. 10- Enabling students to analyze reality and phenomena from an accurate scientific physical perspective.
Course Description	This module introduces electrical phenomena in nature, including the concepts of electrical charges, electric and magnetic fields, the application of Gauss' Law, electric potential, conductors and insulators, currents, basic circuits, and induction.
Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	1-Develop methods and means of obtaining information related to Electricity. 2-Developing the student's personality to become a constructive personality that possesses scientific dialogue. 3- Encourage students to request information from websites and libraries. 4- Work with confidence within the TEAMWORK group 5- Following up scientific developments in methods of studying and installing electrical circuits 6- Motivation over passion for initiative, identifying opportunities and developing ideas and solutions. 7- Participation in various dialogues through quick seminars offered by public universities. 8 - Participation in national scientific conferences.

Delivery Plan (Weekly Syllabus)
المنهاج الاسبوعي النظري

	Material Covered
Week 1	What is matter - structure of the atom - conductors and insulators - Coulomb's law
Week 2	Electric force calculation - electric force calculation applications
Week 3	Electric field- Electric lines of force- Calculation of electric field strength- Applications for calculating electric field strength-
Week 4	Electric field flux- Kauss law- Applications on Kauss law- Conductors in electrostatic equilibrium- Electron motion under the influence of a uniform electric field
Week 5	Electric potential - the relationship between potential difference and field strength -
Week 6	Electric potential and potential energy of a point charge - applications for calculating electric potential -
Week 7	Electric potential arising from a charged conductor - insulation intensity - voltage slope - isopotential surfaces - electric potential
Week 8	Exam.
Week 9	Electrical capacitance, electrical capacitances - how to calculate electrical capacitance - calculating capacitance for different types of capacitors (with two parallel plates, cylindrical, spherical) -
Week 10	Various examples of calculating electrical capacitance, the importance of using insulators in capacitors, connecting capacitors (respectively, in parallel) - applied examples for connecting Capacitors - energy stored in capacitors
Week 11	The effect of the electric field on the dielectric materials_ Generalization of Kauss's law for a dielectric medium_
Week 12	Polarization vector- Electric displacement vector- Energy density in the electric field
Week 13	Electric current - Resistance and specific resistance - Resistors color guide - Ohm's law - Thermal capacity in Ohms - Joule's law - Electromotive force - Calculation of current in electrical circuits -
Week 14	Calculation of potential difference in electrical circuits Connecting resistors (in series, in parallel), examples Application on connecting resistors -
Week 15	The RC circuit - studying the current and charge of the capacitor in the process of charging and discharging the capacitor - Kirchhoff's law, application examples of Kirchhoff's law

Learning and Teaching Resources

مصادر التعلم والتدريس

	Text
Required Texts	**١- اساسيات الكهربائية والمغناطسية / يحيى عبدالحميد الحاج علي, دار الكتب للنشر والطباعة,الموصل, ٢٠٠٠** **٢- د.طالب ناهي الخفاجي,"الكهربائية والمغناطيسية" ١٩٩٠.** **٣-William H. Hayt,"Engineering lectromagnatics"6th edition, 2001.** **٤-R.A.Serway,J.W.Jewett,"physics for Scintists and Engineering,6th edition, Thomson Books,2004.**

Module Information معلومات المادة الدراسية					
Module Title	Magnetism المغناطيسية			**Module Delivery**	
Module Level	1		**Semester (s) offered**		2
Administering Department	**Physics**		**College**	Science	
Module Leader	Dr. Faleh L. Mater Al-Jashaam		**e-mail**	Faleh.l.mater@tu.edu.iq	
Module Leader's Acad. Title	Lecturer		**Module Leader's Qualification**		Ph.D.

Module Aims, Learning Outcomes, Indicative Contents and Brief Description أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية مع وصف مختصر	
Module Aims أهداف المادة الدراسية	-Conveying a general idea about magnetism and its fields, the importance of this course, and electron accelerators. Through the teaching of magnetism, students acquire some skills about the basics and principles of magnetism, circuits that generate the magnetic field and the parts that are composed of them, knowing their types, shapes, method of work and connection, Which makes students aware of the most important topics that they may encounter in daily practical life by dealing with files, charged particle accelerators, magnets, wires, magnetic field generation sources of various types, methods of work and importance. In addition to teaching the student to use measuring devices related to the study of the intensity and strength of the magnetic field. - Preparing qualified and specialized staff in the study of magnetic fields in their various forms in Iraq. - Teaching the student the role of magnetic fields needed to operate engines, various machines, alternating and continuous power generators, charged particle accelerators (cyclotrons)
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1- To classify the needs for the development of theoretical and practical reality in the subject of Magnetism. 2- To get used to practicing what he has learned of rules and scientific studies in his daily life and work. 3- To positively criticize the improper uses of Magnetism appliances and components. 4- To retrieve the information that he carefully studied and to

	achieve it practically in finding appropriate solutions to problems related to Magnetism. 5- To decipher the unknown by analogy with the known counterpart using accurate measuring devices. 6 - The student devises solutions and explanations for Magnetism problems with some modernity and creativity. 7 - The student's knowledge of the concept of theoretical and practical Magnetism physics and adaptation to overcome obstacles in this field. 8 - The student should design a plan to study the vocabulary of Magnetism subject in a new and accurate manner by building a solid scientific base for the student at the beginning of his undergraduate studies to base on when trying to develop himself in this field. 9- Enabling students to analyze reality and phenomena from an accurate scientific physical perspective.
Course Description	This module introduces Magnetism phenomena in nature, including the concepts of Magnetism, magnetic field, magnetic flux, Hall effect, motion of charged particles in a magnetic field, cyclotron, magnetic force on electric current, magnetic moment.
Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	1-Develop methods and means of obtaining information related to Magnetism. 2-Developing the student's personality to become a constructive personality that possesses scientific dialogue. 3- Encourage students to request information from websites and libraries. 4- Work with confidence within the TEAMWORK group 5- Following up scientific developments in methods of studying and installing electrical and Magnetism circuits 6- Motivation over passion for initiative, identifying opportunities and developing ideas and solutions. 7- Participation in various dialogues through quick seminars offered by public universities. 8 - Participation in national scientific conferences.

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	Material Covered

Week 1	Magnetism, magnetic field, magnetic flux
Week 2	Hall effect, motion of charged particles in a magnetic field,
Week 3	cyclotron, magnetic force on electric current, magnetic moment
Week 4	Bayot and Savart's Law - Applications of Bayot and Savart's Law (straight wire, circular loop). Ampere's Law -
Week 5	Applications on Ampere's Law (for a long cylindrical wire, for a spiral coil) -
Week 6	The mutual force between two parallel wires
Week 7	Induced electromotive force - Fradi's law -
Week 8	**Exam**
Week 9	Lenz's law - changing magnetic fields - betatron - self-induction - mutual induction -
Week 10	circuit inductor and resistance in series - energy stored in the magnetic field
Week 11	Sinusoidal voltage-phase-representing sinusoidal voltage with a rotating vector- applying a sinusoidal voltage to a pure resistance-
Week 12	applying a sinusoidal voltage to a pure capacitor.-
Week 13	applying a sinusoidal voltage to a pure inductor Effective value of alternating current- Average value of alternating current-
Week 14	Electric power - Series circuit composed of resistance A series circuit consisting of a resistance and an inductor A series circuit composed of a resistance
Week 15	An inductor, and a capacitor Application examples

Learning and Teaching Resources
مصادر التعلم والتدريس

	Text
Required Texts	**١ـ اساسيات الكهربائية والمغناطسية / يحيى عبدالحميد الحاج علي, دار الكتب للنشر والطباعة,الموصل, ٢٠٠٠** **٢ـ د.طالب ناهي الخفاجي,"الكهربائية والمغناطيسية" ١٩٩٠.** **٣-William H. Hayt,"Engineering lectromagnatics"6th edition, 2001.** **٤-R.A.Serway,J.W.Jewett,"physics for Scintists and Engineering,6th edition, Thomson Books,2004.**

Module Information معلومات المادة الدراسية				
Module Title	Fundamentals of quantum mechanics اساسيات ميكانيك الكم		**Module Delivery**	
Module Level	٣	**Semester (s) offered**		I
Administering Department	**Physics**	**College**	Science	
Module Leader	Dr. Shareef Faiq Sultan	**e-mail**	Shareef.ph.sc@tu.edu.iq	
Module Leader's Acad. Title	Lecture	**Module Leader's Qualification**		Ph.D.

Module Aims, Learning Outcomes, Indicative Contents and Brief Description أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية مع وصف مختصر	
Module Aims أهداف المادة الدراسية	Quantum Mechanics is one of the fundamental building-blocks of Physics. It affects profoundly the way we think about the universe and is the basis for much of condensed-matter, nuclear and statistical physics. It also has a strong influence on technological developments, for instance in optical and electronic devices. This module aims to give students a firm grounding in the subject and to prepare them for future modules such as Nuclear and High-Energy Particle Physics.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	describe the definition and interpretation of the wavefunction and of operators in quantum mechanics; discuss the origin of energy quantisation and quantum tunnelling effects; describe the general properties of the stationary states of quantum particles confined to simple symmetric potentials; perform calculations on wavefunctions, and solve the Schrödinger equation for a range of problems;
Course Description	This module introduces the mathematical expression of the basic principles of quantum mechanics and methods for finding solutions of problems that permit straightforward mathematical analysis. These solutions demonstrate many of the general features of the subject and will be applied in subsequent modules in the Physics programme.
Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	1-Develop methods and means of obtaining information related to quantum mechanics

	2-Developing the student's personality to become a constructive personality that possesses scientific dialogue. 3- Encourage students to request information from websites and libraries.

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	Material Covered
Week 1	Simple mathematical concepts
Week 2	Complex numbers, properties of allowed functions
Week 3	The reason for the failure of classical mechanics and the emergence of quantum mechanics
Week 4	Black body radiation, photoelectric effect, Compton effect
Week 5	Atomic models to describe the atom
Week 6	Heisenberg's imprecision principle
Week 7	Basic principles of quantum mechanics
Week 8	Hermitian operator, the principle of superposition of states
Week 9	First exam
Week 10	Bohr's principle of opposition, Heisenberg representation
Week 11	Normative condition and regulation
Week 12	Orthogonality condition and its applications in quantum mechanics
Week 13	The characteristic function and the characteristic value
Week 14	The effect and the law of reciprocal arcs in quantum mechanics
Week 15	Second exam

Learning and Teaching Resources مصادر التعلم والتدريس	
	Text
Required Texts	**اساسيات ميكانيك الكم تأليف سالم حسن الشماع وأمجد عبد الرزاق كرجية** Introduction to quantum mechanics, David J. Griffiths, Prentice Hall Inc., 1995

Module Information معلومات المادة الدراسية					
Module Title	Properties of material خواص المادة			**Module Delivery**	
Module Type	**BASIC**			**Theory** **Lab** **Tutorial**	
Module Code	**UNI 1 104**				
ECTS Credits	8				
SWL (hr/sem)	**100**				
Module Level	1		**Semester (s) offered**	1	
Administering Department	**Physics**		**College**	Science	
Module Leader	**Dr. Sufyan Hawas Humeedi**		**e-mail**	sufyanhawas@yahoo.com	
Module Leader's Acad. Title	Assist. Prof.		**Module Leader's Qualification**	Ph.D.	
Module Tutor	None		**e-mail**	None	
Peer Reviewer Name			**e-mail**		
Review Committee Approval			**Version Number**	1.0	

Relation With Other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	-	**Semester**	-
Co-requisites module	-	**Semester**	-
Module Aims, Learning Outcomes, Indicative Contents and Brief Description أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية مع وصف مختصر			
Module Aims	The course is designed to aim at imparting a basic level appreciation		

أهداف المادة الدراسية	programme for the common man. After completing the course the incumbent is able to the use the computer for basic purposes of preparing his personnel/business letters, viewing information on Internet (the web), sending mails, using internet banking services etc. This allows a common man or housewife to be also a part of computer users list by making them digitally literate. This would also aid the PC penetration program. This helps the small business communities, housewives to maintain their small account using the computers and enjoy in the world of Information Technology.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	Students completing this module will be able to: – Understand basic computer terminology; – Identify components of a computer and peripheral devices; – Perform the basic computer functions by using a desktop or a laptop; – Develop an understanding of word processing capabilities of a computer; – Understand the concept and usage of the Internet and e-mails; – Use the acquired skills to pursue employment opportunities; – Enhance their computer literacy.
Indicative Contents المحتويات الإرشادية	Analyze a complex computing problem and to apply principles of computing and other relevant disciplines to identify solutions. Design, implement, and evaluate a computing-based solution to meet a given set of computing requirements in the context of the program's discipline.
Course Description	The areas that are covered in the fundamental Computer Course syllabus include computer fundamentals, office productivity tools, internet and web technologies, programming, database management systems, networking, and cybersecurity.
Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	Computer Strategies reserve the right to vary the description of the Services at any time, however Computer Strategies shall inform the Customer of such variations where Computer Strategies deems necessary to do so and where reasonably practicable in the circumstances.

Student Workload (SWL) الحمل الدراسي للطالب			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	**93**	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	**6.2**
Unstructured SWL (h/sem)	**57**	**Unstructured SWL (h/w)**	**3.8**

الحمل الدراسي غير المنتظم للطالب خلال الفصل		الحمل الدراسي غير المنتظم للطالب أسبوعيا	
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	100		

Module Evaluation
تقييم المادة الدراسية

		Time (hr)	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	**Quizzes**	3	5% (5)		
	Assignments	2	5 % (5)		
	Lab	6	15% (15)		
	Tut.	2	5% (5)		
Summative assessment	**Midterm Exam**	2	20% (20)		
	Final Exam	3	50% (50)		
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)
المنهاج الاسبوعي النظري

	Material Covered
Week 1	Definition of computer
Week 2	Central processing Unit (CPU), Read Only Memory (ROM)
Week 3	Secondary Memory Unit
Week 4	Software
Week 5	Task bar
Week 6	How to create a new folder on the desktop
Week 7	Erase the recycle bin and the way to restore the recycle bin to what it was
Week 8	Disc players
Week 9	Central processing Unit (CPU)
Week 10	Computer properties

Week 11	Types of computers according to the nature of their work
Week 12	Basic options when buying a computer
Week 13	Types of viruses and ways to prevent them
Week 14	Binary system
Week 15	Convert numbers from decimal to binary

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	**Computer Education – Learning and Teaching Resources (2022)**	No
Recommended Texts		No
Websites	.	

Module Information معلومات المادة الدراسية				
Module Title	**Material Physics**		**Module Delivery**	
Module Type	**BASIC**		**Theory** **Lab** **Tutorial**	
Module Code	**PHY35028**			
ECTS Credits	6			
SWL (hr/sem)	**150**			
Module Level	**UGIII**	**Semester (s) offered**	five	
Administering Department	**Physics**	**College**	Science	
Module Leader	**Prof. Dr. Najat Ahmed Dahham**	**e-mail**	Dr.najat1970@tu.edu.iq	
Module Leader's Acad. Title	professor	**Module Leader's Qualification**	Ph.D.	
Module Tutor	None	**e-mail**	None	
Peer Reviewer Name		**e-mail**		
Review Committee Approval		**Version Number**	4	

Relation With Other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	-	**Semester**	-
Co-requisites module	-	**Semester**	-
Module Aims, Learning Outcomes, Indicative Contents and Brief Description أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية مع وصف مختصر			
Module Aims	This course aims to underpin modern technology and is also important		

أهداف المادة الدراسية	because it provides the physical realization of much fundamental physics. This module aims to give the student a firm grounding in the traditional areas of the subject but also to introduce some of the latest
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	This module will Conveying a general idea about solid-state physics and the importance of this course for physics departments. The student is acquainted with the crystal structure of solids and the types of bonds that connect solid materials. Students are also given some skills about experimental methods of x-ray diffraction.
Indicative Contents المحتويات الإرشادية	the crystal structure of solids , the types of bonds that connect solid materials. Students are also given some skills about experimental methods of x-ray diffraction..
Course Description	This module will Conveying a general idea about solid-state physics and the importance of this course for physics departments. The student is acquainted with the crystal structure of solids and the types of bonds that connect solid materials. Students are also given some skills about experimental methods of x-ray diffraction.
Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	1- The ability to express ideas clearly and confidently in speech. 2 - Analyzing, investigating and collecting information in a systematic and scientific manner to establish facts and principles to solve the problem 3 - Motivation to work and the ability to take initiative, identify opportunities and put forward ideas and solutions. 4- Teamwork Work with confidence within the TEAMWORK group.

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Student Workload (SWL) الحمل الدراسي للطالب			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	**79**	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	**71**	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	150		

Delivery Plan (Weekly Syllabus)

Week	Subject Details
1st	Crystal structure: crystalline and amorphous materials - crystal formula for solids - crystal structure - transition vectors in the crystal unit cell
2nd	Primary and non-primary cells and their types
3rd	crystal systems, crystal symmetry Characteristics and types of cubic meshes
4th	filling fraction (packing fraction) of cubic lattice, crystal planes and their indics
5th	Crystal directions - Zones of planes - the angle between two planes
6th	Inter planer distance, position in the unit cel, simple crystal structure (cesium chloride - sodium chloride - diamond – close packed structures)
7th	Types of bonds: ionic bond – covalent bond - metallic bond van der Waals bond - Hydrogen bond
8th	Exam.
9th	Classification of Solid, crystal lattice energy
10th	Determination of Madelug Constant in one dimension, Determination of Madelug Constant in three dimensions
11th	The Radius of atoms and ions, coordination number
12th	Crystal Diffraction, X – rays photons, Electron Diffraction, Neutron Diffraction
13th	Bragg 's law of diffraction, Examples of Bragg 's law.
14th	Experimental methods for diffraction:١ - Laue method 2- Rotating Crystal Method 3- Socialating-Crystal method 4- powder method
15th	Exam.

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	Solid State Physics, Dr. Yahya Nouri El-Gammal 2000	yes
Recommended Texts	**1- Solid State Physics, Part One, Dr. Moayad Gabriel Youssef, 1989.** **2- Introduction to solid state , Charles kittle.8th edition,2004** **3-FUNDAMENTALS OF SOLID STATE ENGINEERING, *2nd Edition*, Manijeh Razeghi , 2006.**	No
Websites		

Module Information معلومات المادة الدراسية					
Module Title	**Crystal**			**Module Delivery**	
Module Type	**BASIC**			**Theory** **Lab** **Tutorial**	
Module Code	**PHY36134**				
ECTS Credits	6				
SWL (hr/sem)	**150**				
Module Level	**UGIII**		**Semester (s) offered**	six	
Administering Department	**Physics**		**College**	Science	
Module Leader	**Prof. Dr. Najat Ahmed Dahham**		**e-mail**	Dr.najat1970@tu.edu.iq	
Module Leader's Acad. Title	Professor		**Module Leader's Qualification**	Ph.D.	
Module Tutor	None		**e-mail**	None	
Peer Reviewer Name			**e-mail**		
Review Committee Approval			**Version Number**	4	

Relation With Other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	-	**Semester**	-
Co-requisites module	-	**Semester**	-
Module Aims, Learning Outcomes, Indicative Contents and Brief Description أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية مع وصف مختصر			
Module Aims أهداف المادة الدراسية	This course aims to deliver a general idea about the substance of crystals and the importance of this course for the departments of physics. The		

	student is also introduced to the reciprocal lattice, Lattice Dynamics and crystal defects
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	This module will: 1. State Laue equation and the relation with reciprocal lattice 2.describe the features of the vibrations of monatomic and of diatomic linear chains and explain the significance of dispersion curves in three dimensions; 3. discuss the scattering of phonons, and in particular the occurrence of Umklapp scattering of phonons. 4.Define the crystal defects
Indicative Contents المحتويات الإرشادية	The reciprocal lattice, Lattice Dynamics and crystal defects
Course Description	This module will explain reciprocal lattice and discuss particularly the relationship between real space and reciprocal space and the representation of elastic and inelastic scattering in both spaces. Both phonons and electrons are profoundly influenced by the crystal structure in which they propagate. And explain the vibrational excitations of the crystal lattice (phonons). The last section of this module considers crystal defects
Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	1- The ability to express ideas clearly and confidently in speech. 2 - Analyzing, investigating and collecting information in a systematic and scientific manner to establish facts and principles to solve the problem 3 - Motivation to work and the ability to take initiative, identify opportunities and put forward ideas and solutions. 4- Teamwork Work with confidence within the TEAMWORK group.

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Student Workload (SWL) الحمل الدراسي للطالب			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	**79**	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	**71**	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	150		

Delivery Plan (Weekly Syllabus)	
Week	**Subject Details**
1st	**Laue Derivation of Amplitude of Scattered Wave, Reciprocal lattice**
2nd	**How to draw (build) a Reciprocal lattice Reciprocal lattice vectors , Calculate the interplanar distance d_{hkl} for a cubic system using the Reciprocal lattice idea.**

3rd	**Finding the axes of the lattice of a simple cube (SC) using the idea of a Reciprocal lattice , The diffraction condition , Equivalence of Bragg and Laue conditions.**
4th	**Geometrical construction of the Ewald (reflection ball) the Ewald ball, Brillouin Zones, Geometrical structure factor**
5th	**Calculating the Geometric Structure Factor of a Simple Cubic Lattice (SC), Calculating the geometrical composition factor of a body centered cubic lattice (BCC), Calculate the composition factor for a face centered cubic lattice (FCC)**
6th	**Lattice Dynamics, Quantum of lattice vibrations, Inelastic scattering of photons by phonons, Inelastic scattering of neutrons by phonons**
7th	**Vibrational modes of linear monoatomic lattice, The velocity of the wave motion, Phase velocity and group velocity of a monoatomic linear lattice**
8th	Exam.
9th	**Vibrational modes of diatomic linear lattice, Acoustical branch for linear diatomic lattice, Optical branch for linear diatomic lattice.**
10th	**Crystal Defects, Types of crystal defects, Point defects -types of Point defects**
11th	**Calculate the number of Schottky voids generated by thermal excitation**
12th	**Calculate the number of Frenkel defects and their concentration in a crystal**
13th	**Line defects**
14th	**Surface defects and volumetric defects**
15th	Exam.

Learning and Teaching Resources
مصادر التعلم والتدريس

	Text	Available in the Library?
Required Texts	Solid State Physics, Dr. Yahya Nouri El-Gammal 2000	yes
Recommended Texts	**3- Solid State Physics, Part One, Dr. Moayad Gabriel Youssef, 1989.** **4- Introduction to solid state , Charles kittle.8th edition,2004** **3-FUNDAMENTALS OF SOLID STATE ENGINEERING, *2nd Edition,* Manijeh Razeghi , 2006.**	No
Websites		

Module Information معلومات المادة الدراسية					
Module Title	**Solid State Physics (Advanced)**			**Module Delivery**	
Module Type	**BASIC**			**Theory** **Lab** **Tutorial**	
Module Code	**PHY48144**				
ECTS Credits	6				
SWL (hr/sem)	**150**				
Module Level	**UGII**		**Semester (s) offered**	eight	
Administering Department	**Physics**		**College**	Science	
Module Leader	**Prof. Dr. Najat Ahmed Dahham**		**e-mail**	Dr.najat1970@tu.edu.iq	
Module Leader's Acad. Title	Professor		**Module Leader's Qualification**	Ph.D.	
Module Tutor	None		**e-mail**	None	
Peer Reviewer Name			**e-mail**		
Review Committee Approval			**Version Number**	2	

Relation With Other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	-	**Semester**	-
Co-requisites module	-	**Semester**	-
Module Aims, Learning Outcomes, Indicative Contents and Brief Description أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية مع وصف مختصر			
Module Aims أهداف المادة الدراسية	This course aims to introduce students to the theory of The band theory of solids, semiconductors, superconductors, and nanophysics.		

Module Learning Outcomes مخرجات التعلم للمادة الدراسية	١. explain qualitatively band theory and the concepts of Brillouin zone, density of states, Fermi energy, effective mass and holes; 2.use the nearly free electron model to account for the occurrence of energy gaps at the Brillouin zone edges, and the consequent. 3. behavior of the group velocity and effective mass of the electrons; 4 state Bloch's theorem, and sketch E-k diagrams; 5. describe acceptors, donors and the basic optical transitions in semiconductors; 6. distinguish between extrinsic and intrinsic properties of semiconductors; 7. explain Superconductivity theory and Applications of superconducting materials 8. state the concept of nanotechnology and Nanotechnology applications, in the industrial, medical and military fields
Indicative Contents المحتويات الإرشادية	The band theory of solids, semiconductors, superconductors, and nanophysics.
Course Description	This module will explain the band theory of solids, Energy Levels and Energy Bands , semiconductors, superconductors, and nanophysics.
Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	1-Develop methods and means of obtaining information related to Solid State Physics (Advanced) 2-Developing the student's personality to become a constructive personality that possesses scientific dialogue. 3- Encourage students to request information from websites and libraries. 4.To retrieve the information he studied accurately and verify it practically. 5- To take note of the physical terms with their implications.

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Student Workload (SWL) الحمل الدراسي للطالب			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	**94**	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	**56**	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	
Total SWL (h/sem)	150		

الحمل الدراسي الكلي للطالب خلال الفصل	

Delivery Plan (Weekly Syllabus)	
Week	**Subject Details**
1st	**The band theory of solids, Energy Levels and Energy Bands , Bloch function**
2nd	**Kronig-Penney model, Fermi surface, the velocity of electron Bloch** **Effective mass of an electron - Physical explanation of effective mass**
3rd	**Conductors, insulators and semiconductors - Some properties of semiconductors - Interpretation of the properties of intrinsic semiconductors - the gap**
4th	**Concentration of current carriers in an intrinsic semiconductor, mobility of an intrinsic semiconductor**
5th	**The doped semiconductors - donor impurities - acceptor impurities - thermal ionization of donors and acceptors**
6th	**Electrical conductivity of doped semiconductors at low temperatures**
7th	**p-n junction**
8th	Exam.
9th	**Superconductivity, Features of high-temperature critical superconducting materials, Applications of superconducting materials, Critical Temperature, transition(Critical) Magnetic Field, Meissner Effect.**
10th	**Superconductivity Theory , Penetration Depth.**
11th	**Nano physics, introduction, concept of nanotechnology ,history of nanotechnology, terminology of nanotechnology, Methods for preparing nanomaterials, properties of nanomaterials.**
12th	**shapes of nanomaterials: Classification of nanomaterials shape , The most important nanomaterials shape: Nanospheres, nanotubes, nanowires, quantum dots, nanofibers, bucky balls**
13th	**devices and scientific techniques used to examine and study the properties of nanomaterials: atomic force microscope AFM, scanning electron microscope SEM, transmission electron microscope TEM**
14th	**Nanotechnology applications, nanoparticle terms, Nanotechnology Criticisms.**

15th	Exam.

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	**Solid State Physics, Part One and Part Two, Dr. Moayad Gabriel Youssef, 1989.**	yes
Recommended Texts	**5- Introduction to solid state , Charles kittle** **3-FUNDAMENTALS OF SOLID STATE ENGINEERING, *2nd Edition*, Manijeh Razeghi , 2006.**	No
Websites		

Module Information معلومات المادة الدراسية					
Module Title	**Solid State Physics**			**Module Delivery**	
Module Type	**BASIC**			**Theory** **Lab** **Tutorial**	
Module Code	**PHY٤٧١٣٨**				
ECTS Credits	6				
SWL (hr/sem)	**150**				
Module Level	**UGII**		**Semester (s) offered**	seven	
Administering Department	**Physics**		**College**	Science	
Module Leader	**Prof. Dr. Najat Ahmed Dahham**		**e-mail**	Dr.najat1970@tu.edu.iq	
Module Leader's Acad. Title	Professor		**Module Leader's Qualification**	Ph.D.	
Module Tutor	None		**e-mail**	None	
Peer Reviewer Name			**e-mail**		
Review Committee Approval			**Version Number**	2	

Relation With Other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	-	**Semester**	-
Co-requisites module	-	**Semester**	-
Module Aims, Learning Outcomes, Indicative Contents and Brief Description أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية مع وصف مختصر			
Module Aims	This course aims to introduce the student to the thermal properties of solid		

أهداف المادة الدراسية	materials and the electrical properties represented by the classical and quantitative theories of the free electron
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1 - the student devise solutions and explanations for physical phenomena, with some modernity and creativity. 2 - The student's knowledge of the concept of theoretical physics and its practical analysis. 3 - The student should design a plan to study the physical vocabulary in a new way 4- Enabling students to analyze reality and phenomena from a physical perspective.
Indicative Contents المحتويات الإرشادية	thermal properties of solid materials and the electrical properties represented by the classical and quantitative theories of the free electron
Course Description	Thermal properties of solids represented by the classical theory of specific heat, Einstein's theory of specific heat, Debye's theory of specific heat and electrical properties represented by the classical theory of the free electron, the quantum theory of the free electron
Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	The learning and teaching strategy is designed to: 1- To classify the needs for the development of theoretical and practical reality in solid state physics. 2- To get used to practicing the rules he learned in his speech, actions, and interpretation of physical phenomena 3- To positively criticize improper uses in devices of physical origin 4- To retrieve the information he studied accurately and verify it practically. 5- To take note of the physical terms with their implications.

Student Workload (SWL) الحمل الدراسي للطالب			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	**94**	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	**56**	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	150		

	Delivery Plan (Weekly Syllabus)

Week	Subject Details
1st	Thermal Properties of solids, Specific Heat capacity of solids, Classical model of lattice energy.
2nd	Einstain's model of the specific heat, Debye model of the specific heat.
3rd	Thermal conductivity, Normal processes and Umklapp process.
4th	The classical theory of a free electron in a metal, metal, valence electrons and conduction electrons, typical properties of metals.
5th	Classical Velocity Distribution (Maxwell-Boltzmann Distribution), Drude's Theory for Metals, Electrostatic Conductivity
6th	Specific resistivity of metals, electronic thermal conductivity, Lorentz model.
7th	Hall effect, magnetic resistance, failures of classical models for metals.
8th	Exam.
9th	Quantum theory of free electrons, Bose Einstein statistics.
10th	Fermi-Dirac statistic, Energy levels of a free electron gas in one dimension.
11th	Density of states for a free electron gas in one dimension, energy levels for a free electron gas in three dimensions, Density of states for a free electron gas in three dimensions, Sommerfeld's ideas of free electrons.
12th	Dependence of Fermi energy on temperature, kinetic energy of a free electron gas in three dimensions, Electronic specific heat, electronic gas pressure, Somerfield electrical conductivity model.
13th	Somerfield model of thermal conductivity, electrical resistivity of metals, electrical resistivity changes with temperature.
14th	Electron motion in a magnetic field, cyclotron frequency, cyclotron resonance, failures of the quantum free electron model.
15th	Exam.

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	**Solid State Physics, Part One and Part Two, Dr. Moayad Gabriel Youssef, 1989.**	yes
Recommended Texts	**6- Introduction to solid state , Charles kittle** **3-FUNDAMENTALS OF SOLID STATE ENGINEERING, *2nd Edition*, Manijeh Razeghi , 2006.**	No
Websites	.	

Module Information معلومات المادة الدراسية					
Module Title	Electricity Lab. مختبر الكهربائية			**Module Delivery**	
Module Level	1		**Semester (s) offered**		I
Administering Department	**Physics**		**College**	Science	
Module Leader	Dr. Faleh L. Mater Al-Jashaam **&** A.t. Thuraya yarb sabri		**e-mail**	Faleh.l.mater@tu.edu.iq	
Module Leader's Acad. Title	Lecturer		**Module Leader's Qualification**		Ph.D.

Module Aims, Learning Outcomes, Indicative Contents and Brief Description أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية مع وصف مختصر	
Module Aims أهداف المادة الدراسية	The laboratory aims to train students to read laboratory electronic devices in measuring electrical quantities, to examine faulty electronic components, and to analyze electronic circuits related to electrical capacity. Moreover, The student will be able to: 1. Use the basic electronic equipment in the laboratory 2. Connects electronic components in simple electronic circuits 3. Knowledge of the specifications and features of electronic parts 4. Identify the applied circuits of some components and implement them
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	If the student completes this course successfully, he will be able to: 1- Calculating the voltage and current in DC circuits that contain resistors, current sources, voltage sources and non-independent voltage and current sources A 2- Calculating the voltage and current to connect the resistors in series or in parallel. A3- Calculating the power consumed by the circuit, the power drawn from the source, and the maximum power transmitted to the load A4- Calculating DC gain and operating point for operational

	amplifier circuits A 5- Calculating the charging and discharging of capacitors and inductors in direct current circuits
Course Description	This module introduces electrical phenomena in nature, Calculating the voltage and current, Calculating the charging and discharging of capacitors and inductors in direct current circuits.
Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	1-Develop methods and means of obtaining information related to Electricity. 2-Developing the student's personality to become a constructive personality that possesses scientific dialogue. 3- Encourage students to request information from websites and libraries. 4- Work with confidence within the TEAMWORK group 5- Following up scientific developments in methods of studying and installing electrical circuits 6- Motivation over passion for initiative, identifying opportunities and developing ideas and solutions. 7- Participation in various dialogues through quick seminars offered by public universities. 8 - Participation in national scientific conferences.

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري والعملي	
	Material Covered
Week 1	Introducing the student to the electrical laboratory - explaining public safety
Week 2	Explanation of the graphs and the important units in the graph and the scale of the graph
Week 3	Explanation of the use of measuring devices related to electrical voltage - currents - resistors
Week 4	Electrical resistance experiment
Week 5	fulfillment of Ohm's law

Week 6	Daily exam and discussion reports
Week 7	Monthly exam
Week 8	Connect electrical resistors in series
Week 9	Connect electrical resistors in parallel
Week 10	Connecting mixed electrical resistors
Week 11	Discussion reports
Week 12	Daily exam
Week 13	Reviewing weekly reports with students
Week 14	Review all experiments before the monthly exam
Week 15	Monthly exam

Learning and Teaching Resources
مصادر التعلم والتدريس

	Text
Required Texts	**١ـ اساسيات الكهربائية والمغناطسية / يحيى عبدالحميد الحاج علي, دار الكتب للنشر والطباعة,الموصل, ٢٠٠٠** **٢ـ د.طالب ناهي الخفاجي,"الكهربائية والمغناطيسية" ١٩٩٠.** **٣-William H. Hayt,"Engineering lectromagnatics"6th edition, 2001.** **٤-R.A.Serway,J.W.Jewett,"physics for Scintists and Engineering,6th edition, Thomson Books,2004.**

Module Information معلومات المادة الدراسية				
Module Title	Magnetism Lab. مختبر المغناطيسية		**Module Delivery**	
Module Level	1	**Semester (s) offered**		2
Administering Department	**Physics**	**College**	Science	
Module Leader	Dr. Faleh L. Mater Al-Jashaam **&** A.t. Thuraya Yarb Sabri	**e-mail**	Faleh.l.mater@tu.edu.iq	
Module Leader's Acad. Title	Lecturer	**Module Leader's Qualification**		Ph.D.

Module Aims, Learning Outcomes, Indicative Contents and Brief Description أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية مع وصف مختصر	
Module Aims أهداف المادة الدراسية	The laboratory aims to train students to read laboratory electronic devices in measuring electrical quantities, to examine faulty electronic components, and to analyze electronic circuits related to electrical capacity. Moreover, The student will be able to: 1. Use the basic Magnetism equipment in the laboratory 2. Connects electronic components in simple electronic circuits with coils. 3. Knowledge of the specifications and features of electronic parts 4. Identify the applied circuits of some components and implement them
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	If the student completes this course successfully, he will be able to: 1- Calculating the self-inductance of a coil with an AC voltage source 2- Calculating the voltage and current to connect the resistors in series or in parallel with coils. 3- Metric bridge experiment

	4- Series Resonance circuits.
Course Description	This module introduces Magnetism phenomena in nature, find the self-inductance of a coil with an AC voltage source, Calculating the charging and discharging of capacitors and inductors in direct current circuits. Achieve discharge of a charged capacitor and calculate its time constant.
Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	1-Develop methods and means of obtaining information related to Magnetism. 2-Developing the student's personality to become a constructive personality that possesses scientific dialogue. 3- Encourage students to request information from websites and libraries. 4- Work with confidence within the TEAMWORK group 5- Following up scientific developments in methods of studying and installing electrical and Magnetism circuits 6- Motivation over passion for initiative, identifying opportunities and developing ideas and solutions. 7- Participation in various dialogues through quick seminars offered by public universities. 8 - Participation in national scientific conferences.

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	Material Covered
Week 1	Introducing the student to the Magnetism laboratory - explaining public safety
Week 2	Explanation of the graphs and the important units in the graph and the scale of the graph
Week 3	Explanation of the use of measuring devices related to electrical voltage - currents - resistors
Week 4	Metric bridge experiment

Week 5	Achieve discharge of a charged capacitor and calculate its time constant
Week 6	Daily exam and discussion reports
Week 7	Monthly exam
Week 8	find the self-inductance of a coil with an AC voltage source
Week 9	Find the capacitive reactance of a capacitor in the presence of an AC voltage source
Week 10	Series Resonanace circuits
Week 11	Discussion reports
Week 12	Daily exam
Week 13	Reviewing weekly reports with students
Week 14	Review all experiments before the monthly exam
Week 15	Monthly exam

Learning and Teaching Resources
مصادر التعلم والتدريس

	Text
Required Texts	**١ـ اساسيات الكهربائية والمغناطسية / يحيى عبدالحميد الحاج علي, دار الكتب للنشر والطباعة,الموصل, ٢٠٠٠** **٢ـ د.طالب ناهي الخفاجي,"الكهربائية والمغناطيسية" ١٩٩٠.** **٣-William H. Hayt,"Engineering lectromagnatics"6th edition, 2001.** **٤-R.A.Serway,J.W.Jewett,"physics for Scintists and Engineering,6th edition, Thomson Books,2004.**

Module Information معلومات المادة الدراسية					
Module Title	Medical Biophysics			**Module Delivery**	
Module Type	**BASIC**			**Theory** **Lab** **Tutorial**	
Module Code	**PHY48048- Optional II**				
ECTS Credits	4				
SWL (hr/sem)	**100**				
Module Level	4		**Semester (s) offered**	2	
Administering Department	**Physics**		**College**	**Science**	
Module Leader	**Dr. Hussein Sh. Abed**		**e-mail**	Hussein.s.abed@tu.edu.iq	
Module Leader's Acad. Title	Lecture		**Module Leader's Qualification**	Ph.D.	
Module Tutor	None		**e-mail**	None	
Peer Reviewer Name			**e-mail**		
Review Committee Approval			**Version Number**	1.0	

Relation With Other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	-	**Semester**	-
Co-requisites module	-	**Semester**	-
Module Aims, Learning Outcomes, Indicative Contents and Brief Description أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية مع وصف مختصر			
Module Aims	In this module we will review in detail several important modern physical		

أهداف المادة الدراسية	science concepts, models, laws, tools and techniques that can be applied to addressing real biological questions, with a thorough discussion of the underlying physics. Physical science methods historically have been key to providing enormous breakthroughs in our understanding of fundamental biology - stemming from the early development of optical microscopy in understanding the cellular nature of life, through to complex structural biology techniques to elucidate the shape of vital biomolecules including proteins and DNA. In the first half of this module we will introduce the key biological macromolecules, the forces that are involved in maintaining their structure and how structure is determined. We will next discuss key physical science developments that have involved methods to study single cells in their native context, single- molecule biophysical methods that permit dynamic and mechanistic information to be extracted with unprecedented precision, and ground-breaking developments in areas of super-resolution imaging and biosensing. In the second half of the module we will discuss tools and techniques that, broadly, permit the detection and characterization of biological material using non-visible electromagnetic radiation, and methods used to manipulate and quantify biological forces, with particular emphasis throughout placed on real applications. Examples of such tools discussed include electron microscopy, nuclear magnetic resonance spectroscopy and atomic force microscopy. We will also discuss optical and magnetic tweezers for single biological molecule manipulation, ion channel measurements in living cells and core physics concepts of fundamental biological processes which are interrogated using these modern instruments. Lectures will focus on both the core concepts of biophysics tools and techniques and on real research applications, including 'guest' lectures given by expert researchers in several different specific areas of biophysics, in addition to core lectures. Lecture material will be available to download on the VLE, and lectures will include worked-through problem solving and active discussion sessions and so physical attendance at the lectures is strongly encouraged.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	Medical Biophysics is a multi-disciplinary field that encompasses the applications of physics, engineering, and mathematics to quantitative studies of biological and physiological processes. The long-range mission is to develop novel or improved diagnostics and therapeutics for a wide range of human illnesses, including cardiovascular disease and cancer. We believe that this goal is best achieved through interdisciplinary learning and collaborative research that crosses the traditional boundaries of scientific and medical disciplines. The module will focus on a number of concepts, models, laws, tools and techniques of physical science that underpin biophysical methods. It will address a broad range of challenging biological questions. During this module students will:

	• Comprehend the use of physical concepts and laws to produce models of biological systems, and quantitatively analyse these models. • Critically analyse the validity of assumptions made in these models and assess their impact on the validity of the results. • Understand the physical basis of experimental techniques used to study the biological systems introduced and explain the key results. • Assess the key features and biological significance of the systems introduced. • Demonstrate an understanding of the key physical principles behind several important biological processes underpinning living matter. • Apply modern biophysical tools and techniques to real applications.
Indicative Contents المحتويات الإرشادية	The lecture course will discuss the scope of modern biophysics, and introduce students to the fundamentals of chemical bonding, and the structure and function of biological molecules including sugars, lipids, proteins, nucleic acids and molecular machines. Biophysical techniques including optical spectroscopy, dynamic light scattering, fluorescence spectroscopy and the basics of light microscopy will then be discussed in detail. Insights into single-molecule imaging and spectroscopy will then be provided before a series of lectures on super-resolution approaches. Next, students will encounter techniques which use non-optical waves in their mode of operation, including electron microscopy, X-ray spectroscopy and nuclear magnetic resonance spectroscopy. Experimental techniques which rely on forces, including atomic force microscopy and optical tweezers will then be discussed in detail. Complementary and emerging experimental techniques will also be presented, as well as detailed analysis of molecular dynamics simulations. The lecture course will also include revision of the course material and guest research lectures from specialists in the field. Examples of guest research lectures include, but are not limited to: Digital Holographic Microscopy, Biofilms, Biophotonics and Raman Spectroscopy.
Course Description	Interdisciplinary biophysical course is at the forefront of modern science, emerging as a prime area in industry and academia. Key to recent advances has been the development of pioneering experimental techniques and advanced theoretical/modelling approaches capable of assessing the nanoscale dynamics of nature's biomolecules. This modern armoury of the physicist constitutes a powerful toolbox which can be used to tackle a multitude of open questions related to our understanding of human life and disease. In this module we will cover an exciting array of experimental and theoretical tools from modern biophysics, addressing their purpose, instrumentation, underlying physics, limitations and applications. We will study analysis methods used in research labs around the world and showcase their application to current research activities.
Learning and Teaching Strategies استراتيجيات التعلم والتعليم	

Strategies	Separate goals are defined for both research and teaching within the department over the next 3-5 years: A. The four key research strategies are to: 1. Increase Departmental cohesion and identity 2. Build research capacity through recruitment in key areas of strength 3. Increase collaborative funding and industrial partnerships.

Student Workload (SWL) الحمل الدراسي للطالب			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	**93**	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	**6.2**
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	**57**	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	**3.8**
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	150		

Module Evaluation
تقييم المادة الدراسية

		Time (hr)	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	**Quizzes**	3	5% (5)		
	Assignments	2	5 % (5)		
	Lab	6	15% (15)		
	Tut.	2	5% (5)		
Summative assessment	**Midterm Exam**	2	20% (20)		
	Final Exam	3	50% (50)		
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	Material Covered
Week 1	Physical Foundations of Biophysics / Molecular Biophysics
Week 2	Cellular Biophysics /Basic Biophysical Techniques
Week 3	Biostatistics & Computer Fundamentals

Week 4	Membrane Biophysics
Week 5	Physiological Biophysics
Week 6	Immunology
Week 7	Bioinformatics & Structural Biology
Week 8	Radiation Biophysics
Week 9	Medical Biophysics
Week 10	Optical Techniques
Week 11	Hydrodyanamic Techniques
Week 12	Practical's based Molecular Biophysics
Week 13	Membrane Biophysics
Week 14	Molecular Biology
Week 15	Physiological Biophysics

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	Leake MC: Biophysics: tools and techniques (CRC Press, 1st Ed, 2016) Leake MC: Single-Molecule Cellular Biophysics (CUP, 1st Ed, 2013) Alberts A et al: Molecular Biology of the Cell (Garland Science, 6th Ed, 2014)	No
Recommended Texts	Molecular & Cellular Biology, D Roberties, Biophysical Aspects of Transmembrane signaling, Sandor D (2005), Springer Biophysics, Vasant Pattabhi, Gautam (2002), Narosa Biomembrane structure and Function, Chapman D. Introduction to Biological Membrane, Jain R K Biophysics, Hopp, Lohman, Mark and Ziegler Advances in Biophysics, Vol 18, 15 3.5 Molecular and Cellular Biophysics, Meyer B Jackson (2006), Cambridge) Text Book of Physiology, Guyton & Hall, 11th Ed. 2006	No
Websites	http://www.phas.ubc.ca/~jrottler/phys305.html. Homework assignments will be posted on the webpage and will be distributed in class. Watch for updates.	

Module Information معلومات المادة الدراسية					
Module Title	Digital electronics			**Module Delivery**	
Module Type	**BASIC**			**Theory** **Lab** **Tutorial**	
Module Code	**PHY24021**				
ECTS Credits	6				
SWL (hr/sem)	**150**				
Module Level	4		**Semester (s) offered**	1	
Administering Department	**Physics**		**College**	**Science**	
Module Leader	**Dr. Hussein Sh. Abed**		**e-mail**	Hussein.s.abed@tu.edu.iq	
Module Leader's Acad. Title	**Lecture**		**Module Leader's Qualification**	**Ph.D.**	
Module Tutor	None		**e-mail**	None	
Peer Reviewer Name			**e-mail**		
Review Committee Approval			**Version Number**	1.0	

Relation With Other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	-	**Semester**	-
Co-requisites module	-	**Semester**	-
Module Aims, Learning Outcomes, Indicative Contents and Brief Description أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية مع وصف مختصر			
Module Aims	This module aims to provide students with knowledge of:		

أهداف المادة الدراسية	▪ A knowledge of basic design methods for combinational and sequential logic circuits. ▪ An understanding of number systems such as binary, hexadecimal, BCD ▪ A knowledge of the laws of Boolean algebra.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	A. Understand the capabilities of synchronous digital systems. B. Apply the theoretical knowledge to the design of a stable and robust digital system. C. Acquire the experience and practical skills in building and debugging digital systems.
Indicative Contents المحتويات الإرشادية	This module is delivered through lectures and tutorials. Problems are embedded within lectures and knowledge of the lecture material is tested by weekly homework delivered on the web-based system. Students will use the knowledge developed in the Laboratories included in the Experimental Skills module.
Course Description	Digital electronics is the study of electronic circuits that are used to process and control digital signals. In contrast to analog electronics, where information is represented by a continuously varying voltage, digital signals are represented by two discrete voltages or logic levels.
Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	This course provides an introduction to the control of engineering systems using microprocessors, sensors and actuators. Within this context it introduces the fundamentals of combinational logic, Boolean algebra, digital arithmetic, sequential logic, and microprocessor instruction set architecture and I/O. Learning opportunities include: online presentations with integrated practice exercises; tutorials in which small teams work together to explore, discuss, analyse and explain digital electronic circuits; and practicals in which theory is put to useful application. The course is designed to be one of the first undertaken by new students in electrical and electronic engineering such that its successful completion will provide the necessary foundation for more specialist learning in digital microelectronics and computer engineering.

Student Workload (SWL) الحمل الدراسي للطالب			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	**93**	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	**6.2**
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	**57**	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	**3.8**
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	150		

Module Evaluation تقييم المادة الدراسية					
		Time (hr)	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	3	5% (5)		
	Assignments	2	5 % (5)		
	Lab	6	15% (15)		
	Tut.	2	5% (5)		
Summative assessment	Midterm Exam	2	20% (20)		
	Final Exam	3	50% (50)		
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	Material Covered
Week 1	Introduction / Logic gates and boolean algebra
Week 2	Logic minimisation
Week 3	Binary adders
Week 4	Multilevel logic and hazards
Week 5	Beyond simple logic gates
Week 6	Introduction to hardware practical classes
Week 7	Introduction, latches and flip-flops
Week 8	Flip-flop applications
Week 9	Synchronous state machines 1
Week 10	Synchronous state machines 2
Week 11	Further considerations
Week 12	Introduction to processor architecture
Week 13	Electronics, devices and circuits - underlying concepts
Week 14	Transistors and gates

Week 15	Interfacing to the analogue world

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	David Harris and Sarah Harris, Digital Design and Computer Architecture, Elsevier, Second Edition (2013). The full text of this book is available electronically from the University of Adelaide Library. Lecture slides, tutorial questions, practical instructions, practice questions, worked solutions, and other supporting materials are available on the course web site.	No
Recommended Texts	1. Fundamental of Digital Circuits, A. Anand Kumar, PHI. 2. Digital Logic Design, Morries Mano, PHI. 3. Modern Digital Electronics, 2nd Edition, R.P. Jain. Tata Mc Graw Hill Company Limited. 4. Digital circuits and design,4th editionn,S. Salivahanan& S. Arivazhagan,Vikas Publising House Pvt. Ltd. 5. Digital Electronics and integrated circuits, 2nd edition, Soumitra Kr. Mandal, Mc Graw Hill Company.	No
Websites	▪ all announcements ▪ lectures slides, practice and tutorial questions, practical instructions, and other resources ▪ online quizzes ▪ communication of marks using the gradebook ▪ a discussion board for course-related discussion ▪ lecture recordings and key-concept videos	

Level: UGII **Semester: Four**

Module Aims

Make the student able to understand atomic models, particle and wave duality, the photoelectric phenomenon, Einstein's equation for x-rays and their source, and a simple idea of quantum mechanics and the principle of imprecision thereof.

The following skills objectives are related to the course.

1 - The ability to interpret the particle characteristics of waves

2 - relying on one's own abilities to solve all issues related to basic concepts.

3 - Understand the difference between quantum numbers.

Course Description

1-Understand the atomic structure of matter.

2-Interpretation of the special theory of relativity.

3-Explain the dual behavior of particles.

4 -Understand the electronic structure of atoms with multiple electrons.

Week	Subject Details
1st	**Special Theory of Relativity** Introduction, The Michelson-Morley Experiment, Time Dilation, Example1,2, Length contraction, Example1,2, Home Works.
2nd	The Lorentz Transformation, The inverse Lorentz transformations, Velocity addition.
3rd	Relativistic Mass, Relativistic Momentum, Example1, Relativistic Force, Example2, Relativistic Energy, Relationship between Energy and Momentum, Electron-volt, Example3, Home Works.
4th	**X-Ray** Introduction, Wave Length of X-Ray, X-Ray generation, X-Ray Spectrum, X – ray

	Reaction With Matter, X-Ray Diffraction.
5th	X-ray diffraction by crystalline powder, X-ray refraction, X-ray reflection from a diffraction grating, X-ray absorption coefficients.
6th	**Monthly Exam.**
7th	X-ray absorption methods, Determine the distance between the atomic levels of a crystal of the salt, Example1,2,3, Home Works .
8th	**Molecular Physics** Molecular structure, Bonds Formed, Electrons Sharing, Molecular rotation and vibration, Molecular Rotation Energy, Example1, Molecular Vibration Energy, Example2.
9th	Molecular Spectra, Rotational spectra, Example1, Vibrational spectra, **Solid State Physics** Crystalline and Amorphous Solid, Types of crystalline solids
10th	The quantum numbers, Energy levels and energy bands, Fermi energy.
11th	**Nuclear conversions** Introduction, Charge and Mass, Example1, Size and Structure of Nuclei, Nuclear Stability, Nuclear Spin and Magnetic Moment, Nuclear Magnetic Resonance and Magnetic Resonance Imaging.
12th	Binding Energy and Nuclear Forces, Nuclear Models(Liquid-Drop Model,Independent-Particle Model, Collective Model)
13th	Radioactive decay, Example2,3 Decay Processes (Alpha Decay, Beta Decay, Gamma Decay
14th	Carbon Dating , Natural Radioactivity (Four Radioactive Series).
15th	**Monthly Exam**

Level: UGII **Semester: Three**

Module Aims

Make the student able to understand atomic models, particle and wave duality, The Quantum Theory Of Light, The Particle Nature of Matter, and a simple idea of quantum mechanics and the principle of imprecision thereof and Atomic Structure

.

The following skills objectives are related to the course.

1 - The ability to interpret the particle characteristics of waves

2 - relying on one's own abilities to solve all issues related to basic concepts.

3 - Understand the difference between quantum numbers.

Course Description

1-Understand the atomic structure of matter.

2-Interpretation of the special theory of relativity.

3-Explain the dual behavior of particles.

4 -Understand the electronic structure of atoms with multiple electrons.

Week	Subject Details
1st	**The Quantum Theory Of Light** The nature of light and electromagnetic radiation, Thermal Radiation, Emission and Absorption of Radiation, Blackbody radiation, Blackbody radiation Spectrum.
2nd	Wien's distribution law, Rayleigh-Jeans' law, Home Work, Planck's Law of Radiation, Derivation Wien's law from Planck's law , Derivation of Rayleigh-Jeans' law from Planck's law, Derivation of Stefan's Law from the Planck Distribution, Photoelectric Effect,
3rd	Einstein's interpretation of photoelectric effect, Applications of Photoelectric effect, Home Works,

4th	**The Particle Nature of Matter** The Composition Of Atoms, Faraday's electrolysis experiment, Thomson's model of the atom.
5th	Rutherford's Model of the Atom, Millikan's Value of the Elementary Charge, Home works.
6th	**Monthly Exam.**
7th	The Bohr Atom, Spectral Series, Bohr's Quantum Model of the Atom, Energy levels and spectra.
8th	Atomic excitation: The Franck–Hertz Experiment, Bohr's Correspondence Principle,
9th	**MATTER WAVES** De Broglie hypothesis, De Broglie wavelength, De Broglie wave velocity, Phase and group velocities, The Heisenberg uncertainty principle, Electron diffraction, neutron diffraction.
10th	**QUANTUM MECHANICS IN ONE DIMENSION** Introduction, Wave function for a free particle, Schrödinger equation: Time dependent form, Schrödinger equation: steady-state form, The particle in a box: energy quantization. Harmonic oscillator. The Harmonic oscillator: solution of Schrödinger's equation, Home works
11th	Expectation Values, Observable , Operators, Operator equation, Operator's properties, Example 1, Example2, Home works. Eigen value equation, Example 1, Example2, Home works, Quantum Uncertainty and the Eigenvalue Property.
12th	**TUNNELING PHENOMENA** The Square Barrier, Barrier Penetration: Some Applications, Field Emission, Ammonia Inversion, Decay of Black Holes
13th	**Atomic Structure** Orbital Magnetism and the Normal Zeeman Effect, The Spinning electron,
14th	The spin–orbit interaction and other magnetic effect, Exchange Symmetry and the Exclusion Principle, The Periodic Table.
15th	**Monthly Exam**

Level: UGII **Semester: Four**

Module Aims

Make the student able to understand atomic models, particle and wave duality, the photoelectric phenomenon, Einstein's equation for x-rays and their source, and a simple idea of quantum mechanics and the principle of imprecision thereof. The ability to explain the concepts of modern physics.

The following skills objectives are related to the course.

1 - The ability to interpret the particle characteristics of waves

2 - relying on one's own abilities to solve all issues related to basic concepts.

3 - Understand the difference between quantum numbers.

Course Description

1 . The link between theory and practical experiments.

2. Learn the scientific way of thinking.

3. Gaining enthusiasm, developing personality and social competence, and developing the cooperative education process

4. Gaining the ability to summarize important ideas in the experiment and elaborate as needed.

5. Helping the student to differentiate between conclusions based on theoretical foundations or practical experiments.

6. Acquisition of initial experience in the method of observation and the development and testing of hypotheses.

7. Learn the correct way to write down experiences

Week	Subject Details

1st	Introduction to the theory of x-rays
2nd	Daily exam and discussion reports
3rd	Explanation of the working principle of the x-ray generator
4th	Daily exam and discussion reports
5th	Continuous X-ray spectrum experiment
6th	Daily exam and discussion reports
7th	Field visit to laboratories in other colleges
8th	Monthly exam.
9th	X-ray linear spectrometry experiment
10th	Daily exam and discussion reports
11th	An experiment to study the intensity change of the K_α and K_β lines with the anode voltage
12th	Daily exam and discussion reports
13th	Determination the interfacial distances for NaCl and LiF crystals
14th	Experiment to find the permeability as a function of aluminum thickness
15th	**Monthly Exam**

Level: UGII **Semester: Three**

Module Aims

The ability to explain the concepts of modern physics. Acquisition of practical skills in analyzing and estimating errors, and learn how to design an experiment and interpret the data, and make the student able to understand atomic models, particle and wave duality, the photoelectric phenomenon, Einstein's equation for x-rays and their source, and a simple idea of quantum mechanics and the principle of imprecision thereof.

The following skills objectives are related to the course.

1 - The ability to interpret the particle characteristics of waves

2 - relying on one's own abilities to solve all issues related to basic concepts.

3 - Understand the difference between quantum numbers.

Course Description

1 . The link between theory and practical experiments.

2. Learn the scientific way of thinking.

3. Gaining enthusiasm, developing personality and social competence, and developing the cooperative education process

4. Gaining the ability to summarize important ideas in the experiment and elaborate as needed.

5. Helping the student to differentiate between conclusions based on theoretical foundations or practical experiments.

6. Acquisition of initial experience in the method of observation and the development and testing of hypotheses.

7. Learn the correct way to write down experiences

Week	Subject Details

1st	Photoelectric effect experiment
2nd	Daily exam and discussion reports
3rd	Experiment with the visible spectrum of the hydrogen atom
4th	Daily exam and discussion reports
5th	Rydberg constant mapping experiment.
6th	Daily exam and discussion reports
7th	Field visit to laboratories in other colleges
8th	Monthly exam.
9th	Frank-Hertz experiment
10th	Daily exam and discussion reports
11th	Schuster's method to find the specific charge of the electron e/m
12th	Daily exam and discussion reports
13th	Stefan Boltzmann's radiation law experiment
14th	Electron diffraction experiment
15th	**Monthly Exam**

Module Information معلومات المادة الدراسية					
Module Title	General Astronomy			Module Delivery	
Module Type	Basic			Class Lab. Tut.	
Module Code	PHY12010				
ECTS Credits	4				
SWL (hr/sem)	64				
Module Level	1		Semester (s) offered	2	
Administering Department	Physics		College	Science	
Module Leader	Dr. Sahar Naji Rashid		e-mail	Sahar83@tu.edu.iq	
Module Leader's Acad. Title	Assistant Prof.		Module Leader's Qualification	Ph.D.	
Module Tutor			e-mail		
Peer Reviewer Name			e-mail		
Review Committee Approval			Version Number	1.0	

Relation With Other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	None	Semester	-
Co-requisites module	-	Semester	-

Module Aims, Learning Outcomes, Indicative Contents and Brief Description أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية مع وصف مختصر	
Module Aims أهداف المادة الدراسية	Conveying a general idea about astronomy, the history of its inception, and the importance of this course for students of the Department of Physics to get acquainted with the most important names and astronomical phenomena and how to apply physical laws in the astronomical aspect.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	For the student to know what this science is, its history and fields, and to identify the relationship of applied sciences to this science. As well as knowing how to make some simple astronomical calculations. Learn about the most important components of space and astronomical phenomena and their causes. And to take note of the astrophysical terms with their implications.
Indicative Contents المحتويات الإرشادية	Gain the ability to express ideas clearly and confidently in speech. Teamwork Work with confidence within the TEAMWORK group. Analyze, investigate and gather information systematically and scientifically to establish facts and principles as a solution to a problem. Motivation to work and the ability to take initiative, identify opportunities and develop ideas and solutions.
Course Description	This course description provides a necessary summary of the most important characteristics of the course and the learning outcomes expected of the student to achieve, demonstrating whether he has made the most of the available learning opportunities. It must be linked to the program description.

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	**Thinking skill according to the student's ability (Let's Think about Thinking Ability) The goal of this skill is for the student to believe concretely (the student's abilities), to understand when, what and how they should think and to improve the ability to think sensibly. High thinking skill (the aim of this skill is to teach thinking well before making the decision that determines the life of the student).**

Student Workload (SSWL) الحمل الدراسي للطالب			
Structured SWL (h/sem) **الحمل الدراسي المنتظم للطالب خلال الفصل**	**64**	**Structured SWL (h/w)** **الحمل الدراسي المنتظم للطالب أسبوعيا**	**4.4**
Unstructured SWL (h/sem) **الحمل الدراسي غير المنتظم للطالب خلال الفصل**	**36**	**Unstructured SWL (h/w)** **الحمل الدراسي غير المنتظم للطالب أسبوعيا**	**2.4**
Total SWL (h/sem) **الحمل الدراسي الكلي للطالب خلال الفصل**	**100**		

Module Evaluation تقييم المادة الدراسية					
		Time (hr)	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	**3**	**5% (5)**		
	Assignments	**2**	**5 % (5)**		
	Lab	**6**	**15% (15)**		
	Tut.	**2**	**5% (5)**		
Summative assessment	**Midterm Exam**	**2**	**20% (20)**		
	Final Exam	**3**	**50% (50)**		
Total assessment			**100% (100 Marks)**		

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
Week	**Material Covered**
Week 1	**الفصل الاول) علم الفلك وتاريخه: مقدمة، علم الفلك في حضارة وادي الرافدين، انجازات سكان وادي الرافدين في مجال علم الفلك**
Week 2	**تطور علم الفلك عبر العصور، الآلات الفلكية عند العرب، مجالات علم الفلك، فروع علم الفلك، اهمية علم الفلك**
Week 3	**الفصل الثاني) الميكانيك السماوي: مقدمة، قانون نيوتن في الجذب العام، تطبيق لقانون الجذب العام، قوانين كبلر**
Week 4	**الكرة السماوية، القبة السماوية، البروج**
Week 5	**الفصول الفلكية الاربعة، وحدات القياس الفلكية**
Week 6	**الفصل الثالث) المنظومة الشمسية: مكونات المنظومة الشمسية، الشمس، الخواص الفيزيائية للشمس، قياس قطر الشمس وكتلتها ودرجة حرارتها**

Week 7	جو الشمس، الظواهر السطحية للشمس، الاشعاعات والرياح الشمسية، الطاقة الشمسية والثابت الشمسي
Week 8	الامتحان الاول
Week 9	القمر، الخواص الفيزيائية للقمر، حركات القمر المدارية والمحورية، الخسوف والكسوف
Week 10	الفصل الرابع) الكواكب السيارة: الدراسات الفلكية للكواكب السيارة، قطر الكوكب، بعد الكوكب عن الشمس، كتلة الكوكب، كثافة الكوكب، معدل الجاذبية السطحية للكوكب، مدة دوران الكواكب حول نفسها، لمعان الكوكب ودرجة حرارته
Week 11	تسلسل الكواكب السيارة، الكويكبات، الضوء البروجي، الشهب والنيازك، المذنبات وتكوينها
Week 12	الفصل الخامس) النجوم: مقدمة، اقدار النجوم، الاقدار الظاهرية، الاقدار المطلقة، الاقدار المضرمية او البولومترية، نورانية النجوم، علاقة نورانية النجوم بأقدارها، علاقة كتلة النجوم بنورانيتها
Week 13	العوامل المؤثرة على قياس السرع النجمية، اطياف النجوم، مخطط هيرتز سبرانك – رسل (H-R)، عمر النجوم
Week 14	التطور النجمي (دورة حياة النجوم)، خلاصة دورة حياة الشمس، النجوم النيوترونية، النجوم الثنائية، العناقيد النجمية، النجوم السوداء (الثقوب السوداء)، السدم، المادة ما بين النجوم
Week 15	الامتحان الثاني

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	Available in the Library?
Required Texts	كتاب منهجي	No
Recommended Texts		No
Websites	.	

GRADING SCHEME

مخطط الدرجات

Group	Grade	التقدير	Marks (%)	Definition
Success Group (50 - 100)	A - Excellent	امتياز	90 - 100	Outstanding Performance
	B - Very Good	جيد جدا	80 - 89	Above average with some errors
	C - Good	جيد	70 - 79	Sound work with notable errors
	D - Satisfactory	متوسط	60 - 69	Fair but with major shortcomings
	E - Sufficient	مقبول	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	FX – Fail	راسب (قيد المعالجة)	(45-49)	More work required but credit awarded
	F – Fail	راسب	(0-44)	Considerable amount of work required

Note:

Marks with decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.

Module Information معلومات المادة الدراسية					
Module Title	Laser Principles			Module Delivery	
Module Type	Core			Class Lab. Tut.	
Module Code	PHY35026				
ECTS Credits	6				
SWL (hr/sem)	79				
Module Level	3		Semester (s) offered	5	
Administering Department	Physics		College	Science	
Module Leader	Dr. Sahar Naji Rashid		e-mail	Sahar83@tu.edu.iq	
Module Leader's Acad. Title	Assistant Prof.		Module Leader's Qualification	Ph.D.	
Module Tutor			e-mail		
Peer Reviewer Name			e-mail		
Review Committee Approval			Version Number	1.0	

Relation With Other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	None	Semester	-
Co-requisites module	-	Semester	-

Module Aims, Learning Outcomes, Indicative Contents and Brief Description أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية مع وصف مختصر	
Module Aims أهداف المادة الدراسية	Learn about the basic principles of laser, its advantages, the idea and principle of its work, its basic components and types.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	For the student to know what this science is, its history and fields, and to identify the relationship of applied sciences to this science.
Indicative Contents المحتويات الإرشادية	Gain the ability to express ideas clearly and confidently in speech. Teamwork Work with confidence within the TEAMWORK group. Analyze, investigate and gather information systematically and scientifically to establish facts and principles as a solution to a problem. Motivation to work and the ability to take initiative, identify opportunities and develop ideas and solutions.
Course Description	This course description provides a necessary summary of the most important characteristics of the course and the learning outcomes expected of the student to achieve, demonstrating whether he has made the most of the available learning opportunities. It must be linked to the program description.

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	**Thinking skill according to the student's ability (Let's Think about Thinking Ability) The goal of this skill is for the student to believe concretely (the student's abilities), to understand when, what and how they should think and to improve the ability to think sensibly. High thinking skill (the aim of this skill is to teach thinking well before making the decision that determines the life of the student).**

Student Workload (SSWL) الحمل الدراسي للطالب			
Structured SWL (h/sem) **الحمل الدراسي المنتظم للطالب خلال الفصل**	**79**	**Structured SWL (h/w)** **الحمل الدراسي المنتظم للطالب أسبوعيا**	**5.4**
Unstructured SWL (h/sem) **الحمل الدراسي غير المنتظم للطالب خلال الفصل**	**71**	**Unstructured SWL (h/w)** **الحمل الدراسي غير المنتظم للطالب أسبوعيا**	**4.7**
Total SWL (h/sem) **الحمل الدراسي الكلي للطالب خلال الفصل**	**150**		

Module Evaluation تقييم المادة الدراسية					
		Time (hr)	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	**3**	**5% (5)**		
	Assignments	**2**	**5 % (5)**		
	Lab	**6**	**15% (15)**		
	Tut.	**2**	**5% (5)**		
Summative assessment	**Midterm Exam**	**2**	**20% (20)**		
	Final Exam	**3**	**50% (50)**		
Total assessment			**100% (100 Marks)**		

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
Week	**Material Covered**
Week 1	**Ch.1) Basic Concept:** Historical Vision, Laser Definition, Laser Components
Week 2	Laser Working Principle, Laser Generation Conditions
Week 3	Laser Properties
Week 4	**Ch.2) Pumping Processes:** Pumping, Pumping Types
Week 5	Pumping Plans
Week 6	**Ch.3) Resonator:** Resonator Definition, Resonator Types
Week 7	Resonator Stability, (Examples)
Week 8	**First Exam**
Week 9	Emission Linewidth, Resonator Patterns
Week 10	Optical Feedback, Reverse Population & Threshold Condition, Quality Factor

	of Resonator
Week 11	**Ch.4) Radiation Interaction With Matter:** Introduction, Blackbody Radiation
Week 12	Boltzmann Statistics, Transition Cross Section
Week 13	Einstein Transactions, Molecule Energy Levels
Week 14	Spectral Line Broadening Mechanism, Laser-Matter Interaction
Week 15	**Second Exam**

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	**كتب منهجية**	**No**
Recommended Texts		**No**
Websites	.	

GRADING SCHEME

مخطط الدرجات

Group	Grade	التقدير	Marks (%)	Definition
Success Group (50 - 100)	A - Excellent	امتياز	90 - 100	Outstanding Performance
	B - Very Good	جيد جدا	80 - 89	Above average with some errors
	C - Good	جيد	70 - 79	Sound work with notable errors
	D - Satisfactory	متوسط	60 - 69	Fair but with major shortcomings
	E - Sufficient	مقبول	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	FX – Fail	راسب (قيد المعالجة)	(45-49)	More work required but credit awarded
	F – Fail	راسب	(0-44)	Considerable amount of work required

Note:

Marks with decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.

Module Information معلومات المادة الدراسية					
Module Title	laser Applications			Module Delivery	
Module Type	Core			Class Lab. Sem.	
Module Code	PHY36132				
ECTS Credits	6				
SWL (hr/sem)	79				
Module Level	3		Semester (s) offered	6	
Administering Department	Physics		College	Science	
Module Leader	Dr. Sahar Naji Rashid		e-mail	Sahar83@tu.edu.iq	
Module Leader's Acad. Title	Assistant Prof.		Module Leader's Qualification	Ph.D.	
Module Tutor			e-mail		
Peer Reviewer Name			e-mail		
Review Committee Approval			Version Number	1.0	

Relation With Other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	PHY35026	Semester	5
Co-requisites module	-	Semester	-

Module Aims, Learning Outcomes, Indicative Contents and Brief Description أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية مع وصف مختصر	
Module Aims أهداف المادة الدراسية	Learn about the modifications of laser output, its interactions with matter, its most important applications, and safety conditions in dealing with this radiation.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	For the student to know what this science is, its history and fields, and to identify the relationship of applied sciences to this science.
Indicative Contents المحتويات الإرشادية	Gain the ability to express ideas clearly and confidently in speech. Teamwork Work with confidence within the TEAMWORK group. Analyze, investigate and gather information systematically and scientifically to establish facts and principles as a solution to a problem. Motivation to work and the ability to take initiative, identify opportunities and develop ideas and solutions.
Course Description	This course description provides a necessary summary of the most important characteristics of the course and the learning outcomes expected of the student to achieve, demonstrating whether he has made the most of the available learning opportunities. It must be linked to the program description.

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	**Thinking skill according to the student's ability (Let's Think about Thinking Ability) The goal of this skill is for the student to believe concretely (the student's abilities), to understand when, what and how they should think and to improve the ability to think sensibly. High thinking skill (the aim of this skill is to teach thinking well before making the decision that determines the life of the student).**

Student Workload (SSWL) الحمل الدراسي للطالب			
Structured SWL (h/sem) **الحمل الدراسي المنتظم للطالب خلال الفصل**	**79**	**Structured SWL (h/w)** **الحمل الدراسي المنتظم للطالب أسبوعيا**	**5.4**
Unstructured SWL (h/sem) **الحمل الدراسي غير المنتظم للطالب خلال الفصل**	**71**	**Unstructured SWL (h/w)** **الحمل الدراسي غير المنتظم للطالب أسبوعيا**	**4.7**
Total SWL (h/sem) **الحمل الدراسي الكلي للطالب خلال الفصل**	**150**		

Module Evaluation تقييم المادة الدراسية					
		Time (hr)	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	**3**	**5% (5)**		
	Assignments	**2**	**5 % (5)**		
	Lab	**6**	**15% (15)**		
	Tut.	**2**	**5% (5)**		
Summative assessment	**Midterm Exam**	**2**	**20% (20)**		
	Final Exam	**3**	**50% (50)**		
Total assessment			**100% (100 Marks)**		

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
Week	**Material Covered**
Week 1	**Ch.1) Modulations of the Laser Output:** Introduction, Measure the Dimensions of Laser Beam, Laser Frequency Stabilization
Week 2	Laser Emission Lines Selection, Single-Mode Operation, Continuous and Pulsed Operate
Week 3	Q-Switching, Q-Switching Methods, Mode Locking
Week 4	Generate Harmonics, Physical Interpretation of Nonlinear Optics, Nonlinear Optical Materials, Optical Parametric Oscillation (OPO)
Week 5	**Ch.2) Types of Laser:** Introduction, Solid State Laser
Week 6	Gas State Laser
Week 7	Dye Laser
Week 8	**First Exam**

Week 9	Semiconductor Laser
Week 10	Chemical Laser, Laser Classifications
Week 11	**Ch.3) Laser Applications:** Introduction, Laser Applications in Physics & Chemistry, Laser Applications in Biology
Week 12	Laser Applications in Medicine, Laser Applications in Optical Communications, Laser Applications in Holography
Week 13	Laser Applications in Industry, Laser Applications in the Military Field, Laser Applications in Agriculture, Construction and Roads, Commercial Laser Applications
Week 14	**Ch.4) Hazards and Safety Conditions:** Hazards in Laser Laboratories, Guidelines of Working in Laser Laboratories (Safety Conditions)
Week 15	**Second Exam**

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	**كتب منهجية**	**No**
Recommended Texts		**No**
Websites	.	

GRADING SCHEME

مخطط الدرجات

Group	Grade	التقدير	Marks (%)	Definition
Success Group (50 - 100)	A - Excellent	امتياز	90 - 100	Outstanding Performance
	B - Very Good	جيد جدا	80 - 89	Above average with some errors
	C - Good	جيد	70 - 79	Sound work with notable errors
	D - Satisfactory	متوسط	60 - 69	Fair but with major shortcomings
	E - Sufficient	مقبول	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	FX – Fail	راسب (قيد المعالجة)	(45-49)	More work required but credit awarded
	F – Fail	راسب	(0-44)	Considerable amount of work required

Note:

Marks with decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.

Syllabus of Laser Principle (Lab.) **Assistant Prof. Dr. Sahar Naji Rashid**

Level: 3rd **Semester: 5th**

Week	Subject Details
1st	Review general information about lasers
2nd	Introducing the laser laboratory and devices
3rd	Identify security and safety conditions in laser laboratories
4th	Directionality Experiment
5th	Quiz
6th	Brightness Experiment
7th	Divergence Angle Experiment
8th	Seminar
9th	Quiz
10th	Spectral Purity Experiment
11th	Laser Beam Narrowing Experiment
12th	Deliver Reports
13th	Exam
14th	Seminar
15th	Review

Syllabus of Laser Applications (Lab.) **Assistant Prof. Dr. Sahar Naji Rashid**

Level: 3rd **Semester: 6th**

Week	Subject Details
1st	Review general information about lasers
2nd	An overview of laser applications
3rd	Identify the classifications of laser devices according to the degree of their danger
4th	Experiment of Using a Laser to Measure Thickness
5th	Quiz
6th	Experiment of Investigation of Laws of Refraction Using Laser
7th	Experiment of Investigation of Laws of Reflection Using Laser
8th	Experiment of Determination of the Absorption Coefficient Using a Laser
9th	Quiz
10th	Experiment of Determination of the Absorption Coefficient Using a Laser
11th	Experiment of Using a Laser to Find the Diameter of a Thin Wire
12th	Deliver Reports
13th	Exam
14th	Seminar
15th	Review

Syllabus of Physical Optics (Lab.) **Assistant Prof. Dr. Sahar Naji Rashid**

Level: 3rd **Semester: 6th**

Week	Subject Details
1st	Introducing the physical optics laboratory and devices
2nd	Photoelectrical Cell Experiment
3rd	Beer Lambert Law Experiment
4th	Experiment of Malse's Law of Polarization
5th	Naughty Yonk Experiment
6th	Quiz
7th	Newton's Rings Experiment
8th	Michelson Experiment in Interference
9th	Experiment of Fabry-Perot Interferometer
10th	Diffraction Grating Experiment
11th	Important Terms
12th	Deliver Reports
13th	Exam
14th	Seminar
15th	Review

Syllabus of Engineering Optics (Lab.) **Assistant Prof. Dr. Sahar Naji Rashid**

Level: 3rd **Semester: 5th**

Week	Subject Details
1st	Review general information about optics
2nd	Introducing the engineering optics laboratory and devices
3rd	Experiment of Determine the Refractive Index of a Liquid
4th	Experiment of Determine the Refractive Index of Glass
5th	Experiment of the General Law of Lenses
6th	Experiment of the General Law of Spherical Mirrors
7th	Quiz
8th	Experiment of Field of Vision
9th	Spherometer Experiment
10th	Experiment of Measurement of the refractive index of a prism material
11th	Important Terms
12th	Deliver Reports
13th	Exam
14th	Seminar
15th	Review

Syllabus of Nuclear physics **A.t. Maha Mohammed Ibrahim**

Level : 4

Semester: 7

Week	Subject Details
1st	Radiation safety.
2nd	Types of radiation.
3rd	Health effects of ionizing radiation.
4th	Means of prevention.
5th	First exam.
6th	Radiation units.
7th	Geiger- Muller counter.
8th	The method of work Geiger- Muller counter.
9th	Isotropic curve of a Geiger- Muller counter.
10th	Second exam.
11th	Realization of the invers square law nuclear radiation.
12th	Calculate the absorption coefficient of nuclear radiation.
13th	Directional emission of a radioactive source.
14th	Calculate the attenuation coefficient
15th	Third exam

Syllabus of Nuclear physics **A.t. Maha Mohammed Ibrahim**

Level : 4

Semester: 8

Week	Subject Details
1st	Radioactive decay.
2nd	Radioactive decay properties.
3rd	Mathematical statistics in nuclear measurements.
4th	Average value
5th	The deviation from the mean value.
6th	Standard deviation.
7th	First exam.
8th	Radioactivity
9th	The statistical nature of radiation.
10th	Nuclear radiation count statistics.
11th	Gaussian distribution.
12th	Second exam.
13th	Poisson distribution.
14th	Bernoulli distribution.
15th	Third exam

Level: UGIV **Semester: Eight**

Week	Subject Details
1st	**Radiation Detectors (Atomic and nuclear radiation detectors, semiconductor detectors)**
2nd	**Integrated dosimeters, Gas filled detector, scintillation detectors**
3rd	**Nuclear reaction (types of nuclear reaction, Theories of nuclear reactions)**
4th	**Nuclear Models, Liquid drop Model, Coulomb Energy of Spherical Nuclei Collective Model (Rotational Model),**
5th	**Shell Model** **Single Particle, Shell Model**
6th	**Nuclear fission**
7th	**Nuclear fusion**
8th	**Exam monthly**
9th	**absorbed dose, Dose equivalent, Exposure**
10th	**Radiation quantities and units**
11th	**The biological effect of Radiation**
12th	**Radiation protection**
13th	**Nuclear reactors**
14th	**Radiation hazard**
15th	**Exam monthly**

Syllabus of Nuclear Physics **Dr. Aiham Al-assie**

Level: UGIV **Semester: Seven**

Week	Subject Details
1st	Introduction, BASIC CONCEPTS (History and Overview, The nucleus and its structure, Rutherford-atomic nuclei)
2nd	Basic Nuclear Properties, commonly used and dimensions in nuclear physics. (charge, Radius, Distance of closest Approach, Mass)
3rd	Binding energy, separation energy)
4th	spin, parity, nuclear magnetic dipole moment, nuclear electric Quadrupole moment,
5th	quantum statics of nuclear particles
6th	Radioactivity (The radioactivity decay law, Half-Life, Mean Life)
7th	Exam monthly
8th	Total Number of radioactive nuclei, Measurement of Half-Life, Dating, Specific Activity
9th	Interactions of radiation with matter (braking radiation, interaction of charged particles with matter, The range
10th	Interaction of electrons, interaction of neutrons with matter
11th	Alpha Decay (Radioactive series, Energy of alpha decay, alpha decay systematics, Range- energy relationship
12th	Beta decay (Neutrino Hypothesis, Energy release in Beta decay, selection Rules)
13th	Gamma Decay (Energetics of Gamma decay, Interaction of Gamma Rays with matter
14th	Interaction of positron with matter, selection rules, measurement of mean life of excited states)
15th	Exam monthly

Syllabus of Mathematical **Dr. Mayadah Kh.Ghaffar**

Level: 3 **Semester: 6**

Week	Subject Details
1st	**Linear Algebra, Matrices, Vectors, Determinants. Linear Systems**, Matrices, Vectors
2nd	Linear Systems of Equations, Gauss Elimination, Gauss-Jordan Elimination, Linear Independence
3rd	Solving a Homogeneous System of Linear Equations,
4th	**Quiz and solution exercises**
5th	**Matrices ,** Operations with Matrices **,** Identity, Transposes**,** Finding the Inverse of a Matrix by Row Operations
6th	Applications of Linear Systems**:** Network Analysis (Traffic Flow), Electrical Circuits
7th	**First exams**
8th	**Determinants,** Determinant of 2x2 and 3x3 Matrices, Minors and Cofactors of a Square Matrix .
9th	Definition of the Determinant of a Square Matrix (Cofactor Theorem), Properties of Determinants, Cramer's Rule, **Quiz**
10th	**Linear Transformations:** Linear Transformations and Matrices for Linear Transformation,
11th	Kernel and Range of a Linear Transformations, Change of Basis
12th	**Eigenvalues and Eigenvectors:** Definition of Eigenvalue and Eigenvector, Diagonalization **, Quiz and solution exercises**

13th	Complex Vector Space**,** Application: Differential Equations
14th	Application: Dynamical Systems and Markov Chains
15th	**Second exams**

Syllabus of Numerical analysis **Dr. Mayadah Kh.Ghaffar**

Level: 3 **Semester: 6**

Week	Subject Details
1st	**Numerical computations**: Taylor's Theorem, Number Representation, Error Considerations: (Absolute and Relative Errors, Round-off Errors, Truncation Errors)
2nd	**Numerical Solutions of Nonlinear Equations**: Bisection (Interval Halving) Method, Fixed Point Method
3rd	Newton Method, Secant Method, **Quiz and solution exercises**
4th	**Solving Systems of Linear Equations**: Gaussian Elimination, Gauss-Jordan Elimination Method
5th	LU Factorization Method , Matrix Norm, Iterative Methods , Jacobi Method, **solution exercises**
6th	**First Eames**
7th	**Interpolation and Extrapolation**: Finite Difference Operators, Newton Interpolation, Error in the Interpolation Formula
8th	Lagrange Interpolation , Hermite's Interpolation Formula, Divided Differences, Cubic Spline Interpolation.
9th	**Quiz and Solution exercises**

10th	**Numerical Differentiation**
11th	**Numerical Integration**
12th	**Numerical Solution of ordinary differential Equations**: Step-by-Step Methods or Marching Methods, Euler's Method
13th	Runge-Kutta Methods, Predictor-Corrector Methods
14th	**Solution exercises**
15th	**Second exam**

Syllabus of Analog Electronic **Prof. Dr. Faris Saleh Atallah**

Level: UGI **Semester: one**

Week	Subject Details
1st	Semiconductors, silicon crystals
2nd	intrinsic and doping a semiconductors
3rd	Diode theory, diode circuits, Half and Full-Wave rectifiers
4th	Special-purpose Diodes , zener diode, the loaded zener regulator
5th	Bipolar Junction Transistors, Transistor Fundamentals, the load line, the operating point
6th	Transistor Biasing , voltage-divider , Base-biased Amplifier, Emitter-bias Amplifier
7th	Small-signal operating ,Analyzing an Amplifier, Voltage Amplifiers , voltage gain
8th	Multistage Amplifier , two stages feedback
9th	The loading effect of input impedance Amplifier, Output impedance ,Cascading CE and C

10th	Comment Emitter , Comment-Base and Comment – Collector Amplifier, current and voltage gain
11th	Power Amplifiers , Two load lines, Class A operation,
12th	Class B Operation , Push-pull Emitter follower Amplifier
13th	Field Effect Junction Transistor (FET), Basic idias , The Transconductance Curv JFET Amplifiers ,
14th	The Depletion –mode MOSFET , The Enhancement –mode MOSFET, E-MOSFET Amplifier
15th	The Operational Amplifier, inverting , noninverting , OP. Amplifier Applications

Syllabus of Plasma **Dr. Awatif Saber Jasim**

Level: ……. **Semester: ……**

Week	Subject Details
1st	**Definition of plasma and its importance, the most important reactions of nuclear fusion**
2nd	**Maxwell's equations, Pontek's theory**
3rd	**The distribution of velocity of gaseous particles (Maxwell–Boltzmann distribution). Ionization and Saha equations, frequency of plasma**
4th	**Studying plasma as a gas, distribution function, rate calculation, Boltzmann equation ,Boltzmann-Vlasov Equation / Krok's model of collisions**
5th	**Debye length, relaxation time, Plasma as a fluid**
6th	**Monthly exam**

7th	**Plasma measurements, measurements by electric probes, Langmuir probe, double probe**
8th	**Engineering designs of probes, electronic circuits of probes, pulse method, measurements by emission spectra, microwave measurements**
9th	**The temperature, density, and potential barrier of a nuclear fusion reaction**
10th	**Monthly exam , Lawson base and ionization operations**
11th	**Laser fusion, particle fusion, electrolytic fusion**
12th	**Containment using tokamak**
13th	**Energy conversion by two-phase plasma using Caesium vapor, Caesium ion engine**
14th	**Magnetic piston and plasma accelerator, ring accelerator**
15th	**Monthly exam**

Syllabus of *Mathematical Physics* **Dr. Awatif Saber Jasim**

Level: ……. **Semester: ……**

Week	Subject Details
1st	Determinants, properties of determinants, determinants and linear equations in physics
2nd	Applications about determinants and solving exercises for applications
3rd	Apply Kirchhoff's law to electrical circuits as determinants

4th	Matrices, their types with examples, matrix determinant
5th	Transpose Matrix, Inverse Matrix, Orthogonal Matrices
6th	Monthly exam
7th	Characteristic equation, eigenvalues, and eigenvectors
8th	Distribution functions using Lagrangian's equations as mathematical applications
9th	Substitution method and Lagrangian coefficients
10th	Maxwell-Boltzmann distribution and finding alpha coefficients
11th	Bernoulli's Equation, Using the Equation to Solve Differential Equations
12th	Basic physical concepts and relationships of DC and AC circuits
13th	Heterogenous differential equations and converting them into a homogeneous differential equation
14th	nth-root test
15th	Monthly exam

Syllabus of Democracy and human rights M. Raid Khalil Ibrahim

Level: The first stage Semester: ……

Week	Subject Details
1st	**Human rights in ancient civilizations**
2nd	**Human rights in laws and religions**

3rd	human rights sources
4th	international sources
5th	local sources
6th	Human rights guarantees at the domestic and international levels
7th	Exam
8th	The concept of democracy
9th	Historical development of democracy
10th	Principles of democracy
11th	forms of democracy
12th	Parliamentary democracy
13th	Parliamentary System Mechanism (Election)
14th	electoral systems
15th	Exam