جـــــــــامـــعة بنـــهـا

كـــــلية الهندســـــــة ببنـــــــها

برامج قسم الهندسة الكهربية

كلية الهندسة ببنـها ـ جامعة بنـها
اللائحة الموحدة لبرامج البكالوريوس بنظام الساعات المعتمدة


وقل
رب زدني علما

أولا: مقدمة

لقد بدأ التعليم الهندسى فى نهاية القرن التاسع عشر كإحدى الركائز المطلوبة للاستفادة من ثورة الاكتشافات العلمية التى صاحبت الثورة الصناعية. ومع التطور الذى حدث فى نهاية القرن التاسع عشر وبداية القرن العشرين وُضعت مهمتان رئيسيتان هما مهمة العلم والعالم ومهمة الهندسة والمهندس ، حيث تسعى الأولى إلى توسيع إطار المعرفة فى المجالات التى تفيد البشرية، فى حين تسعى المهمة الثانية إلى الاستفادة من المعرفة العلمية في ما ينفع الإنسان والمجتمع من خلال تطوير منتجات جديدة أو فتح مجالات جديدة تلبي احتياجات الإنسان والمجتمع.
ومن الواضح أن التعليم الهندسى يهدف إلى توفير الكوادر القادرة على الاستفادة من التقدم العلمى فى استنباط منتجات جديدة تلبي متطلبات المجتمع، إلا أن استفادة المجتمع من تلك المنتجات الجديدة لا تتحقق إلا بتصنيعها، الأمر الذي يتطلب توفير الطاقات الإنتاجية المناسبة وإعداد المستندات الفنية والهندسية وتوفير العدد والآلات ومعدات القياس وتخطيط ومتابعة الإنتاج ومراقبة الجودة والعناية بالصيانة وتصنيع قطع الغيار وغيرها من العناصر الإنتاجية.

إن احتياج سوق العمل لكوادر بشرية مدربة ومؤهلة للعمل في المجالات الهندسية المختلفة يتطلب إعداد مهندس على معرفة كافية بالعلوم الهندسية الحديثة إلى جانب القدرة على التطبيق والمزج بين فروع المعرفة المختلفة.

لقد أوضحت هذه الرؤية منذ سنوات عديدة لدى الدول المتقدمة والرائدة فى المجالات الصناعية والهندسية، وبعض دول العالم الثالث كفاءتها، وكان من أهم أثار ذلك ما نراه ونلمسه واضحا من تقدم علمى وصناعى وتكنولوجى جعل هذه الدول رائدة فى تلك المجالات.

إن مواكبة التقدم العلمي والتكنولوجي المتنامي يتطلب التطوير المستمر لبرامج التعليم الهندسي اللازمة لإعداد أجيال من المهندسين تساهم في التطوير والدعم الهندسي المطلوب للقطاعات الصناعية والمدنية وخدمة المجتمع.

الرؤية والرسالة وأوجه التميز

أ. الرؤية

تتطلع الكلية لتحقيق مكانة متميزة على المستوى القومي و الإقليمي و الدولي في التعليم الهندسي و البحث العلمي و الابتكار لتحقيق التنمية المستدامة للمجتمع.

ب. الرسالة

تلتزم الكلية بإعداد كوادر هندسية مزودة بالمعارف والمهارات اللازمة للمنافسة فى سوق العمل ، وقادرة على استخدام وتطوير التكنولوجيا الحديثة، وتقديم بحوث فى المجالات الهندسية بما يخدم المجتمع والبيئة.

ت. أوجه التميز في هذه الخطة

تتوجه الخطة الجديدة إلى التأكيد على أهمية الربط بين التعليم و التعلم، كذلك تعتمد على إدخال تكنولوجيات حديثة في أساليب التعليم مثل التعليم الإلكتروني و التعليم عن بعد بالإضافة إلى التوجه للتعليم المتكامل و ذلك من خلال:

1 ـ برامج دراسية حديثة تتوافق مع احتياجات سوق العمل.

2 ـ محتوى علمى يركز على الجوانب الهندسية والتطبيقية.

3 ـ برامج للتدريب الميدانى تصقل مهارات الطالب وتؤهله لمواكبة سوق العمل.

4 ـ التركيز على استخدام تطبيقات الحاسب الآلى فى الهندسة.

5 ـ إثراء الطالب باللغة الأجنبية الفنية.

6 ـ حزمة من المواد الاختيارية تحقق طموح الطلاب فى برامج دراسية مرنة.

تطور إنشاء الكلية وأقسامها العلمية

أُنشئت كلية هندسة بنها عام 1988م تحت مسمى المعهد العالى للتكنولوجيا ببنها التابع لوزارة التعليم العالى وكانت مدة الدراسة به خمس سنوات للحصول على درجة البكالوريوس في الهندسة. وفى عام 1993 م بدأت برامج الدراسات العليا في الكلية ببرنامجين لنيل درجة الماجستير والدبلوم. وانضم المعهد العالى للتكنولوجيا ببنها تحت مظلة جامعة بنها عام 2006 م، وتم تغيير مسمى المعهد العالى للتكنولوجيا ببنها إلى كلية الهندسة ببنها عام 2011 م. ومنذ بدايتها سارت الكلية على طريق النمو الكمي والتطور النوعي، ففي عام 2012 تم اعتماد وتطبيق اللائحة الجديدة لكلية الهندسة ببنها. وفى عام 2013 تم اعتماد وتطبيق اللائحة الجديدة للدراسات العليا لتشمل برنامجاً لنيل درجة الدكتوراه بالإضافة إلي برنامجي الماجستير و الدبلوم.

وتشهد الكلية زيادة مضطردة في أعداد طلابها وفي أعداد أعضاء هيئة التدريس فيها. ومنذ انشائها يتمتع خرجيها بمستوى فنى متميز وأكاديمي رفيع، كما أن إنتاجها العلمي والبحثي إنتاج متميز ومعروف على المستوى الدولي. وبدأت الكلية بثلاثة أقسام هي: الهندسة الميكانيكية و الهندسة الكهربائية والهندسة المدنية بالإضافة لقسم العلوم الهندسية الأساسية، ثم سعت ادارة الكلية مؤخرا لإنشاء قسم الهندسة المعمارية لسد عجز المجتمع المحيط بالكلية لهذا التخصص، وقد تم تحديث لائحة الكلية عام 2016 لتشمل قسم الهندسة المعمارية، وتم اعتمادها من لجنة قطاع الدراسات الهندسية والمجلس الأعلى للجامعات في نوفمبر 2016.

تضم الكلية العديد من المعامل والمختبرات المزودة بأحدث التقنيات والتجهيزات الحديثة التي تساعد الطالب والباحث في إجراء البحوث والدراسات. وتسعى الكلية ببذل كل جهد لخدمة المجتمع ومهنة الهندسة من خلال

تقديم برامج متخصصة متميزة وتقديم الاستشارات الهندسية للقطاع الخاص والحكومي وتقديم الدورات التدريبية وورش العمل المتخصصة وكذلك عقد المؤتمرات والمشاركة في الملتقيات العلمية محليا ودوليا.

وتضم الكلية الأقسام العلمية التالية :

1. قسم الهندسة الميكانيكية.
2. قسم الهندسة الكهربية.
3. قسم الهندسة المدنية.
4. قسم العلوم الهندسية الأساسية.
5. قسم الهندسة المعمارية .

النظرة المستقبلية

كانت كلية الهندسة ببنها - جامعة بنها دائما سبّاقة في إنشاء التخصصات الجديدة والتي يحتاجها المجتمع المحلى والإقليمي والدولي مثل شعبة الهندسة الطبية وشعبة هندسة الميكاترونيات، ومع التقدم الصناعي في المجالات المختلفة على المستوى المحلي والمستوى الإقليمي والدولي بالإضافة إلى النهضة التى تشهدها مصر للمشاريع القومية فلقد برزت الحاجة إلى إنشاء عدد من البرامج متعددة التخصصات (Inter-Disciplinary Programs) لمنح درجة بكالوريوس العلوم في الهندسة في التخصصات التالية :

- الهندسة الكهروميكانيكية.
- هندسة وإدارة التشييد.
- هندسة المرافق والبنية التحتية
- هندسة الميكاترونيات و الأتمتة

الأهداف الأستراتيجية للكلية

- تخريج مهندسين على معرفة بالأساليب الهندسية الحديثة.
- إعداد الكوادر القادرة على إيجاد حلول للمشاكل الهندسية واتخاذ القرارات.
- إعداد مهندسين قادرين على المنافسة في سوق العمل.
- تنمية القيم الأخلاقية والتربوية للخريجين بخلق مناخ تعليمي وتربوي متكامل.
- الإسهام في التطوير والدعم الهندسي اللازم للقطاعات الصناعية والخدمية وخدمة المجتمع.
- توفير دراسات عليا تتسم بمزج العلوم الهندسية بالتجريب والتطبيق لتنمية الفكر الابتكاري المتطور واللازم لتطور المجتمع.

- توفير دورات تعليم وتدريب مستمر تهدف إلى تطوير أداء المهندسين في المجالات الحديثة وغير التقليدية.
- استخدام إمكانيات الكلية بما يخدم المجتمع المحيط ويوفر فرصة لتدريب الطلاب.
- العمل كمركز للبحوث ودراسات الجدوى لحل المشاكل المرتبطة بالصناعة والإنتاج في البيئة المحيطة وتقديم الاستشارات الهندسية للمنشآت ولمشروعات البنية الأساسية بكافة أنواعها.

ثانيا: الأحكام العامة و الانتقالية و مواد اللائحة

مادة (1) أحكام عامة

1. تطبق أحكام قانون تنظيم الجامعات ولائحته التنفيذية واللائحة الداخلية للكلية وغيرها من اللوائح الجامعية فيما لم يرد فى شأنه نص فى هذه اللائحة
2. يخضع الطالب لقانون تنظيم الجامعات ولائحته التنفيذية و القواعد المنظمة الصادرة من الجامعة . أما مالم يذكر فيه نص فتطبق عليه أحكام هذه اللائحة.
3. يسمح للكلية بإضافة مقررات لقائمة المقررات الاختيارية وذلك بموافقة مجلس القسم العلمي ومجلسي الكلية والجامعة دون الرجوع للجنة القطاع الهندسى.
4. لمجلس الكلية بعد موافقة مجلس القسم العلمي المختص، الموافقة على تغيير جزئي للمحتوى العلمى للمقرر بما لايتعارض مع اسم المقرر وأهدافه بنسبة لاتتعدى 20%.

مادة (2) أحكام إنتقالية

1- تعقد المحاضرات لعدد لا يزيد عن مائة وعشرين طالبا ويلقيها أحد الأساتذة أو الأساتذة المساعدين أو المدرسين، وعلى القائم بالتدريس الإشراف على التمارين والتمارين التطبيقية وتحتسب ساعات إشراف بواقع عدد ساعات التمرين و التمرين التطبيقي المحددة للمقرر.

2- يقوم بتدريس التمارين عضو من هيئة التدريس وأحد معاونيه أو اثنان من معاونى أعضاء هيئة التدريس لكل مجموعة مكونة من 20 طالبا.

3- تعامل التمارين التطبيقية تعامل معاملة التمارين ويقوم بتدريس المواد التطبيقية للمجموعة المكونة من 10 طلاب عضو هيئة تدريس وأحد معاونيه أو اثنان من معاونى أعضاء هيئة التدريس بالإضافة إلى اثنين من القائمين بالتدريب العملى بالورش أو المعامل.

4- بالنسبة للتدريب الميدانى يتم فى المراكز الصناعية والشركات الهندسية ويشرف على التدريب عضو هيئة تدريس واحد وأحد معاونيه ويعاون فى تنظيم التدريب إدارى واحد من الكلية لما لايقل عن 5 طلاب في المجموعة الواحدة ، بالإضافة إلى مهندس من المصنع لكل خمسة طلاب على أن تصرف لكل منهم مكافأة بواقع 5 % من أساس المرتب عن كل يوم تدريب.

مادة (3) منح الدرجات العلمية

تقدم كلية الهندسة ببنها مجموعة من البرامج الهندسية. ويدير البرنامج مجلس إدارة للبرنامج. تنقسم البرامج إلى برامج تخصصية والبرامج متعددة التخصصات (Inter-Disciplinary Programs). يتم اختيارهم بعناية لتلبية احتياجات المجتمع والصناعة وكذلك الاحتياجات الإقليمية التي تستقطب العديد من الخريجين المصريين.

جدول (1) قائمة البرامج التي تقدمها كلية الهندسة ببنها – جامعة بنها

البرامج الهندسية	البرامج التخصصية	الهندسة الميكانيكية	1	هندسة التصميم والإنتاج الميكانيكي Mechanical Design and Production Engineering Program
			2	هندسة القوي الميكانيكية Mechanical Power Engineering Program
			3	هندسة الميكاترونيات Mechatronics Engineering Program
		الهندسة الكهربية	4	هندسة الإلكترونيات والاتصالات الكهربية Electronics and Electrical Communications Engineering Program
			5	الهندسة الطبية الحيوية Biomedical Engineering Program
			6	هندسة القوي والآلات الكهربية Electrical Power and Machines Engineering Program
			7	هندسة الحاسبات ونظم التحكم Computer and Control Systems Engineering Program
		الهندسة المدنية	8	الهندسة المدنية Civil Engineering Program
		الهندسة المعمارية	9	الهندسة المعمارية Architectural Engineering Program
	البرامج متعددة التخصصات (Inter-Disciplinary Programs)	الهندسة الكهروميكانيكية	10	Elctromechanical Engineering Program
		هندسة و إدارة التشييد	11	Construction Engineering and management Program
		هندسة المرافق و البنية التحتية	12	Infrastructure and Utilities Program
		هندسة الميكاترونيات و الأتمتة	13	Mechatronics Engineering and Automation Program

تمنح جامعة بنها بناء على طلب من مجلس كلية الهندسة ببنها درجة البكالوريوس فى التخصصات التالية :

1- بكالوريوس العلوم في الهندسة الميكانيكية

- برنامج هندسة التصميم والإنتاج الميكانيكي.
- برنامج هندسة القوي الميكانيكية.
- برنامج هندسة الميكاترونيات.
- برنامج الهندسة الكهروميكانيكية
- برنامج هندسة الميكاترونيات و الأتمتة

2- بكالوريوس العلوم في الهندسة الكهربية

- برنامج هندسة الإلكترونيات والاتصالات الكهربية.
- برنامج الهندسة الطبية الحيوية.
- برنامج هندسة القوي والآلات الكهربية.
- برنامج هندسة الحاسبات ونظم التحكم.

3- بكالوريوس العلوم في الهندسة المدنية

- برنامج الهندسة المدنية.
- برنامج هندسة و إدارة التشييد
- برنامج هندسة المرافق و البنية التحتية

4- بكالوريوس العلوم في الهندسة المعمارية

- برنامج الهندسة المعمارية.

ويشترط على الطالب إتمام المتطلبات الأكاديمية اللازمة لأحد تلك البرامج للحصول على الدرجة العلمية فى التخصص المطلوب وتكون الدراسة فى هذه البرامج بنظام الساعات المعتمدة وباللغة الإنجليزية.

مادة(4) الأقسام العلمية

تقدم المقررات في كلية الهندسة ببنها من خلال خمسة أقسام علمية جدول (2).

جدول (2) الأقسام العلمية – كلية الهندسة ببنها – جامعة بنها

م	القسم العلمي
1	قسم العلوم الهندسية الأساسية
2	قسم الهندسة الميكانيكية
3	قسم الهندسة الكهربية
4	قسم الهندسة المدنية
5	قسم الهندسة المعمارية

تقع مسؤولية القسم العلمي كالتالي:

- تدريس المقررات لجميع البرامج والتي تحتاج إلى مقررات في تخصص القسم و كذلك البحث العلمي.
- القسم العلمي هو المسؤول عن تدريس المحتوى العلمي للمقرر وترشيح أعضاء هيئة التدريس لكل مقرر سواء من القسم أو من قسم آخر أو من خارج الكلية.
- إقتراح انتداب أعضاء هيئة التدريس من خارج الكلية خاضع لموافقة مجلس الكلية إذا دعت الحاجة.
- القسم هو المسؤول عن التطوير المستمر لمناهج التدريس والمحتوى العلمي للمقررات.

الموضوعات التالية خاصة بالقسم العلمي المختص بالتدريس وإجراء البحوث فيها على النحو التالي:

1. قسم العلوم الهندسية الأساسية: الرياضيات والفيزياء والميكانيكا والكيمياء.
2. قسم الهندسة الميكانيكية:

- تخصص هندسة التصميم والإنتاج: تكنولوجيا السباكة واللحام، هندسة صناعية، هندسة مواد، ميكانيكا القياسات، ميكانيكا الآلات والتحكم الآلي، التصميم والرسم الهندسي، قطع المعادن، تشكيل المعادن، التصنيع الرقمي، تخطيط المصانع، هندسة الجودة.
- تخصص هندسة القوى الميكانيكية: الديناميكا الحرارية وديناميكا الغازات، انتقال الحرارة والكتلة، ميكانيكا الموائع، الاحتراق، أنظمة الطاقة الحرارية ومحركات الاحتراق الداخلي والتكييف والتبريد، التحكم الآلي والقياسات للنظم الحرارية، أنظمة الطاقة الجديدة و المتجددة.
- تخصص الميكاترونيات: الأتمتة والتحكم، التصميم المدمج، تصميم وتصنيع الميكاترونكس، الروبوتات وتطبيقات الميكاترونكس، الأنظمة الميكاترونية في الصناعة، الأنظمة الميكاترونية في السيارات.

3. قسم الهندسة الكهربية:

- تخصص هندسة القوى والآلات الكهربائية: أساسيات الهندسة الكهربائية، الآلات الكهربائية، أنظمة القوى الكهربائية، الجهد العالي، إلكترونيات القوى، هندسة القطع و الحماية ، القياسات الكهربائية والاختبار والتحكم في أنظمة الطاقة.
- تخصص هندسة الإلكترونيات والاتصالات الكهربائية: المواد الكهربائية، القياسات الإلكترونية، الهندسة الإلكترونية، الدوائر الإلكترونية، الاتصالات، الموجات الكهرومغناطيسية، الاختبارات الكهربائية، الدوائر المتكاملة.
- تخصص هندسة الحاسبات والنظم: هندسة البرمجيات ، شبكات الحاسوب، الأمن الرقمي، تنظيم الحاسوب، الرقمية، تصميم الدوائر والأنظمة المدمجة والذكاء الاصطناعي والتطبيقات والوسائط المتعددة، المعالجة وهندسة النظم وتطبيقات الكمبيوتر.

4. قسم الهندسة المدنية: التحليل الإنشائي، تصميم الهياكل الخرسانية، تصميم الهياكل الفولاذية، اختبار الخصائص وقوة المواد وضبط الجودة، والهندسة الجيوتقنية والأساسات، و هندسة التشييد وإدارة المشاريع، ميكانيكا الموائع، الهيدروليكا، المساحة والجيوديسيا، هندسة الري و الصرف، المسح التصويري والاستشعار عن بعد ، هندسة النقل المرور ، الصرف الصحي، الهندسة البيئية ، تخطيط النقل ، الطرق والمطارات.

5. قسم الهندسة المعمارية: التصميم المعماري، نظرية العمارة، تاريخ العمارة، تطبيقات الحاسب في الهندسة المعمارية والرسومات التنفيذية وتكنولوجيا البناء والتشريعات وإدارة المشاريع، الحفاظ على المباني وترميم التراث المعماري، التصميم الحضري ، التخطيط الحضري ، تخطيط المدن، الدراسات البيئية، وإعادة تأهيل المواقع التاريخية والتراثية.

ثالثا: لائحة الدراسة بنظام الساعات المعتمدة

مادة(5) نظام الدراسة بالبرامج الأكاديمية

يطبق نظام الساعات المعتمدة فى جميع المقررات الدراسية بالبرامج الأكاديمية وفقاً للقواعد التنفيذية للدراسة و التي يقرّها مجلس الجامعة ولجنة قطاع الدراسات الهندسية والتكنولوجية والصناعية بالمجلس الأعلى للجامعات.

مادة (6) معيار الساعة المعتمدة طبقا للإطار المرجعى (2020)

أولا: بالنسبة للمحاضرات: تحسب ساعة معتمدة واحدة لكل محاضرة مدتها ساعة واحدة أسبوعيا خلال الفصل الدراسى الواحد.

ثانيا : بالنسبة للتمارين التطبيقية والدروس العملية: تحسب ساعة معتمدة واحدة لكل 2-3 ساعة اتصال إسبوعيا خلال الفصل الدراسى الواحد.

ثالثاً : تنقسم ساعة الاتصال الواحدة إلي 50 دقيقة تدريس فعلي و10 دقائق راحة.

مادة(7) رئيس القسم العلمى

يقوم رئيس القسم العلمى بالمهام التالية:

1- تحقيق الأهداف والسياسات العليا في الكلية.
2- الإشراف على إدارة شؤون القسم التعليمية والبحثية والإدارية.
3- تنسيق مع رؤساء الأقسام العلمية الأخرى فى ترشيح السادة أعضاء هيئة التدريس للقيام بأعباء تدريس المقررات كل في مجال تخصصه.
4- .إعداد الخطط التشغيلية للقسم ومتابعة تنفيذها.
5- الإشراف على عملية التطوير الأكاديمي للبرامج بالقسم.
6- الإشراف على التدريب الميدانى.
7- الإشراف على المؤتمر العلمى للبرنامج.
8- الإشراف على تطوير البنية التحتية من مدرجات وقاعات ومعامل.
9- الإشراف على أعمال الجودة بالبرامج.

10- الإشراف على عملية معادلة المقررات الدراسية في القسم.

11- إعداد تقرير سنوي شامل عن سير الدراسة والأداء الأكاديمي والإداري والبحثي في القسم ورفعه إلى عميد الكلية.

مادة (8) منسق البرنامج

يتم اختيار منسق لكل برنامج بقرار من مجلس الكلية بناء على إقتراح من مجلس القسم العلمي المختص أو مجلسي القسمين بالنسبة للبرامج البينية لمدة عامين دراسيين قابلة للتجديد وفق المعايير التالية:

1- أن يكون أحد أعضاء هيئة التدريس العاملين بالقسم ذو كفاءة في مجال تخصصه.
2- أن يتمتع بمهارات القيادة والإدارة والقدرة علي العمل بمهارة مع الفريق.
3- أن يتمتع بمهارات الاتصال الفعال مع الزملاء، والقيادات الأكاديمية، والإدارية.
4- أن يكون لديه رؤية ويطرح حلول مبتكرة
5- أن يكون لديه خبرة في مجال جودة وتطوير التعليم.
6- أن يكون علي دراية بنماذج توصيف و تقارير البرامج والمقررات الدراسية.
7- أن يكون لديه خبرة في كيفية إجراء وصياغة دراسة التقييم الذاتي.
8- أن يشارك في الأنشطة الطلابية.
9- أن يكون لديه سيرة ذاتية تؤهله للتميز في إنجاز المهام المحددة، وسجل وتاريخ وظيفي يشهد له بالنزاهة والالتزام.

ويقوم منسق البرنامج بالمهام التالية :

1- متابعة تنفيذ البرنامج الدراسي من خلال:
   - التحقق من اكتساب الطلبة لمخرجات تعلم البرنامج الدراسي.
   - التحقق من تطبيق استراتيجيات التدريس الموصى بها في توصيف مقررات البرنامج الدراسي.
   - التحقق من تطبيق طرق تقييم الطلبة الموصى بها في توصيف مقررات البرنامج الدراسي.
   - متابعة تفسير النتائج غير الطبيعية لطلبة المقرر الدراسي مع مدرس المقرر.
2- دراسة الصعوبات التي تواجه تنفيذ البرنامج الدراسي، ورفع تقرير بذلك إلى رئيس القسم.
3- رفع المقترحات المتعلقة بتطوير المقررات الدراسية إلى رئيس القسم.
4- الإشراف على عمليات التسجيل الأكاديمى للطلاب و متابعة الخطة الدراسية للطلاب.
5- متابعة الإرشاد الأكاديمى للطلاب.

6- عرض معادلة المقررات للطلاب المحولين من برامج أخرى أو من كليات أخرى على رئيس القسم المختص.

7- متابعة العملية التعليمية ومراجعة التقارير الخاصة بالمقررات من السادة أعضاء هيئة التدريس لتحسين العملية التعليمية.

8- إعداد ومناقشة التقرير السنوي للبرنامج الدراسي مع أعضاء هيئة التدريس بالقسم، ورفع التقرير السنوي للبرنامج والتوصيات المتعلقة به إلى رئيس القسم.

9- عرض خطة المقررات في بداية كل فصل دراسي.

10- جمع البيانات الإحصائية المتعلقة بالبرنامج الدراسي، ورفع تقرير بذلك إلى رئيس القسم.

11- دراسة الاحتياجات التدريبية لأعضاء القسم، ورفع تقرير بذلك إلى رئيس القسم.

12- متابعة انتظام العملية التعليمية والجداول الدراسية.

13- .تطبيق نظم ولوائح الجودة والتقويم والاعتماد الأكاديمي .

14- المتابعة مع لجنة جودة البرنامج لعمل الدراسة الذاتية أو التقريرالسنوي للبرنامج.

مادة (9) لجنة شئون الطلاب

تشكل لجنة شئون التعليم و الطلاب برئاسة وكيل الكلية للتعليم و الطلاب و تختص لجنة شئون الطلاب بدراسة كل الشئون الخاصة بالطلاب طبقا للمادة (28) من قانون تنظيم الجامعات:

1- إبداء الرأي في قبول تحويل الطلاب و نقل ووقف القيد و قبول الأعذار.

2- تنظيم التدريب العملي للطلاب.

3- تتبع نتائج الامتحانات و دراسة الإحصاءات الخاصة بها، و تقارير لجان الامتحان عن مستوياتها، و تقديم التوصيات اللازمة في شأنها إلى مجلس الكلية.

4- تنظيم المكافأت و المنح الدراسية.

5- تتبع النشاط الثقافي و الرياضي و الاجتماعي للطلاب و تقديم الاقتراحات الكفيلة برفع مستواه.

6- تنظيم سياسة علمية للطلاب، بحيث يكون لكل مجموعة من طلاب الفرقة الدراسية رائد من أعضاء هيئة التدريس، يعاونه مدرس مساعد أو معيد للوقوف على مشاكلهم العلمية و توجيههم و العمل على حلها بمعرفة إدارة الكلية و أساتذتها.

يتم عرض جميع توصيات لجنة شئون التعليم والطلاب على مجلس الكلية للاعتماد. و يتم تصعيد الأمور المتعلقة بشؤون الطلاب على مستوى الجامعة في مسارين:

1. مجلس التعليم و الطلاب بجامعة بنها للطلبة الملتحقين بالبرامج التخصصية.
2. مجلس برامج جامعة بنها للطلاب المقيدين بالبرامج متعددة التخصصات.

مادة (10) المنسق العام للتحول الرقمي بالبرامج

يعين بقرار من السيد الأستاذ الدكتور عميد الكلية بعد ترشيح السيد الأستاذ الدكتور وكيل الكلية لشئون التعليم والطلاب بالكلية منسق عام للتحول الرقمى للبرامج من السادة أعضاء هيئة التدريس بالكلية من أصحاب الخبرات فى العمل بنظام الساعات المعتمدة لمدة عامين دراسيين قابلة للتجديد وعليه القيام بالمهام التالية:

1- الإشراف على تجهيز البنية التحتية للتحول الرقمى من شبكات و نقاط اتصال بشبكة الإنترنت.
2- مراجعة أعمال التسجيل للطلاب إلكترونيا.
3- مراجعة تصحيح الاختبارات الإلكترونية.
4- رفع نتائج الطلاب على المنصة الرقمية للجامعة.

مادة (11) مجلس إدارة البرامج

يقوم مجلس القسم العلمي المختص بدور مجلس الإدارة للبرامج التخصصية (المجانية)، أما البرامج متعددة التخصصات (غير المجانية) تشكل مجالس إدارتها طبقا للائحة الموحدة للبرامج بالجامعة. ويختص مجلس إدارة البرامج بالنظر في جميع الاجراءات العلمية والدراسية والإدارية والمالية المتعلقة بالبرامج متعددة التخصصات ، وبالأخص الإجراءات الآتية :

أ. التخطيط الاستراتيجي للبرامج.
ب. الأنشطة التسويقية للبرامج.
ت. إجراء دراسات الجدوى الخاصة بفتح وتجميد البرامج الأكاديمية.
ث. جميع المسائل المالية المتعلقة بتشغيل البرامج.
ج. دراسة الاستثناء من القواعد الواردة في لوائح وأنظمة الكلية.
ح. اقتراح السياسات للمحافظة على جودة التعليم والتعلم في البرامج.
د. مراجعة تقارير اللجان التوجيهية للبرامج وتقارير لجنة شئون التعليم والطلاب.
ذ. التعامل مع تظلمات الطلاب فيما يتعلق بمقررات معينة.
ر. أي مسائل أخرى تتعلق بتشغيل البرامج.

وترفع جميع توصيات مجلس إدارة البرامج إلى مجلس الكلية للاعتماد النهائي.

مادة (12) إجراءات إضافة / تجميد البرامج

- يمكن لأي قسم من أقسام الكلية اقتراح برنامج تخصصي جديد ضمن تخصص هذا القسم. كما يمكن أن يقترح أكثر من قسم برنامجًا جديدًا متعدد التخصصات.
- يجب تقديم مقترح البرنامج متضمنًا جميع معلومات البرنامج كما في هذه اللوائح بالإضافة إلى دراسة جدوى لاحتياجات الصناعة والمجتمع لخريجي البرنامج الجديد. ويجب أن يتضمن الاقتراح أيضًا مراجعة الموارد المتاحة داخل الكلية لتشغيل هذا البرنامج.
- يجب تقديم جميع المقترحات إلى مجلس إدارة البرامج الذي يقوم بدراسة الاقتراح ورفع التوصية إلى مجلس الكلية.
- بعد الموافقة عليها من قبل مجلس الكلية، يتم إحالتها إلى الجامعة لإحالتها إلى المجلس الأعلى للجامعات ومن ثم إضافتها إلى هذه اللوائح.
- يمكن لمجلس الكلية، بناءً على توصية مجلس القسم المختص أو المجالس المختصة، تجميد البرنامج إذا لزم الأمر.

مادة (13) شروط القيد ومتطلبات الإلتحاق

كلية الهندسة ببنها هي مؤسسة تعليمية حكومية تتبع جامعة بنها.و تتبع النظم و اللوائح الصادرة عن المجلس الأعلى للجامعات. كما أنها تقدم التعليم في البرامج المتخصصة مجانًا. و الطلاب الذين يستفيدون من هذا التعليم المجاني هم أولئك الذين أكملوا شهادة الثانوية المصرية (الثانوية العامة) أو ما يعادلها، والتحق بها من خلال مكتب التنسيق في نفس عام الحصول على هذه الشهادة أو ما يعادلها. يحافظ الطالب على تعليمه المجاني طالما أنجز الشروط المنصوص عليها في قانون تنظيم الجامعات و لائحته التنفيذية.

- يتم تقديم جميع البرامج في هذه اللوائح بنظام الساعات المعتمدة.
- تنقسم البرامج في هذه اللوائح إلى فئتين: تخصصية ومتعددة التخصصات.
- تضع الكلية من خلال مجلس الكلية القواعد العامة للالتحاق بالبرامج المختلفة بحيث تكون رغبة الطالب ومبدأ تكافؤ الفرص هي الأساس في قبول الطلاب بنظام الدراسة ببرامج الساعات المعتمدة بناء على القدرة الاستيعابية للكلية.
- يسمح لطلاب التعليم المجاني بالتسجيل في البرامج المتخصصة، بينما تخضع قواعد الالتحاق بالبرامج متعددة التخصصات (المعروفة سابقًا باسم البرامج المميزة) للوائح المنظمة في هذا الشأن طبقا لما تضعه الجامعة من شروط ولها رسوم دراسية منفصلة طبقا للائحة الأكاديمية الموحدة بالجامعة.

- الطلاب غير الملتحقين مباشرة بكلية الهندسة ببنها من خلال مكتب التنسيق ولكنهم حققوا الحد الأدنى للقطاع الهندسي يخضعون لقواعد التحويل الصادرة من المجلس الأعلى للجامعات في هذا الشأن سنة الالتحاق، أما طلاب السنوات السابقة يتم قبولهم شرط أن ينضم إلى البرامج متعددة التخصصات ذات الرسوم الدراسية المنفصلة التي يقررها مجلس الكلية كل عام.
- الطلاب المقيدين مباشرة بكلية الهندسة ببنها من خلال مكتب التنسيق، لهم الحق في الانضمام إلى البرامج متعددة التخصصات التي تدفع رسوم دراسية منفصلة.
- يمكن لمجلس الكلية تقديم منح دراسية إضافية بالبرامج متعددة التخصصات التي تدفع رسوم دراسية منفصلة للطلاب الذين حققوا الحد الأدنى من المعدل التراكمي، أو الطلاب ذوي القدرات المالية المحدودة، وفق القواعد التي يعلنها المجلس كل عام بناء على اقتراح مجلس إدارة البرامج.
- يتم إعفاء أعلى ثلاثون طالب من أوائل الثانوية العامة - القسم العلمي (شعبة الرياضيات إن وجدت) طبقا للترتيب التكراري من رسوم الدراسة عند الالتحاق بالبرامج متعددة التخصصات. ويستمرالإعفاء طيلة مدة الدراسة إذا حافظ الطالب على معدل تراكمي لا يقل عن 3.7 في كل فصل دراسي، وإلا فإن الطالب سيفقد هذا الامتياز وسيتم تطبيق القواعد الأخرى عليه.
- يتم إعفاء الطلاب الخمسة الأوائل في الفرقة الإعدادية في أي كلية هندسة حكومية من الرسوم الدراسية عند الإلتحاق بالبرامج متعددة التخصصات و يستمر الإعفاء إذا حافظ الطالب على معدل تراكمي 3.7 أو أكبر وإلا فإن الطالب سيفقد هذا الامتياز وسيتم تطبيق القواعد الأخرى عليه.
- يتم منح الطلاب المتفوقين دراسيا داخل البرامج متعددة التخصصات تخفيضات في الرسوم الدراسية كالتالي:
  - إذا كان GPA≥ 3.7 تخفيض يصل إلى 20 %
  - إذا كان 3.3≤ GPA≤3.7 تخفيض يصل إلى 10 %
- إذا لم يحقق طالب البرامج المتخصصة معدل تراكمي ≤2.0 لمدة 4 فصول دراسية رئيسية متتالية، يمكن السماح له بتسجيل مقررات لفصلين دراسيين لرفع معدله و في حالة عدم تحقيق ذلك يمكن للطالب الانتقال إلى البرامج متعددة التخصصات مع دفع الرسوم الدراسية المقررة.
- إذا رسب الطالب المسجّل في أي من البرامج المتعددة التخصصات- في مقرر ما مرتين، فيُسمح له بتسجيل هذا المقرر مرة أخرى لمدة 4 مرات أخرى مقابل رسوم إضافية يقررها مجلس الكلية كل عام في سنة تسجيل المقرر.

- يسمح لطلبة البرامج المتخصصة بالتسجيل في المقررات المطلوبة للحصول على الدرجة ضمن متطلبات برنامجه. وأي ساعات معتمدة مسجلة بعد الساعات المعتمدة المطلوبة للبرنامج لأي سبب من الأسباب غير المقبولة يتم تحصيل الرسوم الدراسية المنفصلة التي يقررها مجلس الكلية كل عام في سنة تسجيل المقرر.
- يمكن لطلاب البرامج المتخصصة فقط تسجيل المقررات في الفصول الدراسية الرئيسية. ومع ذلك فإنه يمكنهم ذلك تسجيل الدورات في الفصل الصيفي بدفع الرسوم الدراسية المنفصلة التي يقررها مجلس الكلية كل عام في سنة تسجيل المقرر.
- لكي يكون الطالب منتظما في البرنامج يجب أن يكون مسجلا ل12 ساعة معتمدة على الأقل (مالم يكون الطالب خريجا) بعد موافقة المرشد الأكاديمي ومنسق البرنامج وألا تزيد عدد الساعات المسجلة عن 21 ساعة معتمدة طبقا لقواعد التسجيل و المعدل العام للطالب.
- يمكن لأي طالب غير ملتحق بكلية الهندسة ببنها دراسة أي عدد من المقررات مع سداد الرسوم الدراسية التي يقررها مجلس الكلية كل عام في سنة تسجيل المقرر، و يحصل الطالب على بيان الدرجات طبقا للائحة.

مادة (14): الرسوم الدراسية للبرامج متعددة التخصصات (Inter-Disciplinary Programs)

- يتم تحديد الرسوم الدراسية ، المحددة لكل ساعة معتمدة ، طبقا للائحة الأكاديمية الموحدة بالجامعة. وعلى وكيل الكلية للتعليم و الطلاب الإعلان عن هذه الرسوم قبل بدء الدراسة بالسنة الأكاديمية.
- يتم دفع الرسوم الدراسية في كل فصل دراسي (الفصلين الأول والثاني) على أساس عدد الساعات المعتمدة التي يسجلها الطالب بحد أدنى 12 ساعة معتمدة لكل فصل دراسي ما لم يكن عدد الساعات المعتمدة المتبقي للحصول على الدرجة أقل من ذلك ، وفي هذه الحالة يجب على الطالب دفع مبلغ العدد الفعلي للساعات المعتمدة المسجلة.
- يدفع الطالب الرسوم المقررة كل فصل دراسي رئيسي مقابل الخدمات العامة و التدريب و الأنشطة اللاصفية داخل الحرم الجامعي.
- التسجيل في المقرر لايكون ساريا إلا بعد دفع الرسوم المقررة.

مادة (15) قواعد التحويل (تغيير البرنامج الدراسى) وإعادة القيد داخل الجامعة

- يجوز تحويل الطلاب من برنامج هندسى بنظام الساعات المعتمدة (من داخل الكلية) إلى أي من البرامج المدرجة فى لائحة الكلية وفقا للقواعد التى يحددها مجلس الكلية طالما لم يجتز الطالب 50% من متطلبات التخرج و بعد إجراء المقاصة اللازمة.
- على الطلاب الملتحقين ببرنامج و يرغبون فى الالتحاق للدراسة فى برنامج آخر، يجب عليهم أن يكونوا قد أنهوا مقررات المستوى العام بمتوسط تراكمى لايقل عن 2.0 وطبقا للقواعد التى يحددها مجلس الكلية ويقرها مجلس الجامعة بناء على القدرة الاستيعابية.
- إذا كان التحويل من كلية أخرى داخل الجامعة لايتم التحويل إلا عن طريق مكتب التحويلات المركزى بإدارة الجامعة ومع بداية العام الدراسى وبعد عمل المقاصات اللازمة .
- يستخدم الجدول رقم (3) لحساب التقديرات المكافئة عند تحويل الطالب من النظام الفصلى إلى نظام الساعات المعتمدة.
- يجوز قبول الطلاب الوافدين الحاصلين على الثانوية العامة أو مايعادلها وفقا للترشيحات التى ترد للكلية من الإدارة العامة للوافدين ويتولى مجلس الكلية اقتراح مقابل تكلفة الخدمات التعليمية بخلاف الرسوم الجامعية ويتم القبول طبقا للقواعد المنظمة.

مادة (16) قواعد التحويل من الجامعات الأخرى

يتم تقديم طلبات التحويل من جامعات أخرى طبقا للشروط التالية :

- يتم التحويل عن طريق مكتب التحويلات المركزى بإدارة الجامعة.
- أن يستوفى الطالب قواعد القبول بالكلية والشروط الأخرى التى يحددها المجلس الأعلى للجامعات.
- يجوز لمجلس الكلية قبول طلاب محولين من كليات هندسية حكومية تطبق النظام الفصلى فى بعض البرامج بالكلية بعد عمل المقاصات اللازمة للتحويل من النظام الفصلى إلى نظام الساعات المعتمدة طبقاً للأطر التى تضعها لجنة قطاع الدراسات الهندسية مع الالتزام بما نص عليه البند السابق .
- يجوز تحويل الطلاب من برامج ساعات معتمدة بجامعات أخري إلي البرامج متعددة التخصصات بالكلية بعد عمل المقاصات المطلوبة حيث لايتم احتساب أكثر من 50% من الساعات المعتمدة اللازمة لاجتياز البرنامج المحول إليه من الساعات التي أنهاها الطالب قبل التحويل بشرط عدم مرور أكثر من خمس سنوات دراسية على اجتيازها. و في جميع الأحوال يتم إجراء مقاصة لما درسه ليتم حسابه ضمن متطلبات الحصول على الدرجة دون احتسابها في حساب المعدل التراكمي للطالب.
- عدم احتساب أى ساعات معتمدة لمقررات مضى على دراستها خمس سنوات أكاديمية.
- لا يسمح بنقل الطلاب المفصولين من كليتهم بسبب تجاوزهم الحد الأقصى للفرص الأكاديمية أو الرسوب.

جدول رقم (3) التقديرات المكافئة عند التحويل من النظام الفصلى إلى نظام الساعات المعتمدة

النسبة المئوية	نظام الساعات المعتمدة	
	عدد النقاط	التقدير المناظر
95% فأكثر	4.0	A+
90% الى أقل من 95%		A
85% الى أقل من 90%	3.70	A-
80% الى أقل من 85%	3.30	B+
75% الى أقل من 80%	3.00	B
71% الى أقل من 75%	2.70	B-
68% الى أقل من 71%	2.30	C+
65% الى أقل من 68%	2.00	C
60% الى أقل من 65%	1.70	C-
55% الى أقل من 60%	1.30	D+
50% الى أقل من 55%	1.00	D
أقل من 50%	0.00	F

مادة (17) الدراسة فى جامعات اخرى

يسمح للطالب بدراسة ما لايزيد عن (40%) من الساعات المعتمدة للبرنامج الدراسي المقيد فيه الطالب فى جامعة أخرى معترف بها من المجلس الأعلى للجامعات وتحسب لهم هذه الساعات وفق الشروط التالية:

1- أن يكون الطالب أنهى بنجاح مالايقل عن 36 ساعة معتمدة بالبرنامج فى كلية الهندسة ببنها.
2- أن يحصل الطالب على توصية بالموافقة على المقررات التى سيقوم بدراستها فى الجامعة الأخرى من المرشد الأكاديمى وتعتمد من مجلس الكلية.
3- أن يتوافق المحتوي العلمي للمقرر فى حدود 80%.
4- أن يكون الطالب قد اجتاز كل المقررات المتطلبة للمقرر.

مادة (18) متطلبات الحصول على الدرجة

يشترط لحصول الطالب على درجة بكالوريوس العلوم في الهندسة:

1- اجتياز الساعات المعتمدة المطلوبة (160 ساعة معتمدة) بنجاح في أحد البرامج وفقًا للمتطلبات المنصوص عليها مع معدل تراكمي لا يقل عن 2.0.
2- النجاح فى جميع المقررات الدراسية التى لها (0) ساعة معتمدة .
3- مشروع التخرج هو جزء أساسي من متطلبات البرامج للتخرج. يمكن أن يكتمل مشروع التخرج على مدى فصلين دراسيين متتاليين حسب متطلبات البرنامج، ولن يتخرج الطالب ما لم يستوف متطلبات النجاح في المشروع.

4- يجب أن يقوم الطالب بالتدريب الميدانى مرتين علي الأقل بمدة لا تقل عن 4 أسابيع لكل تدريب خلال فترة دراسته.

5- يجب على الطالب أن يكون قد اجتاز 70% من الساعات المعتمدة على الأقل حتى يمكنه التسجيل فى مشروع التخرج .وإذا كان المشروع ينقسم إلى فصلين دراسيين فعلى الطالب أن يدرسهما وفقا لترتيبهما.ولايجوز التسجيل لمشروع التخرج خلال الفصل الدراسى الصيفى.

على أن يكون توزيع المقررات التى يحتوى عليها البرنامج (جدول 4)على النحو التالى:

جدول (4) توزيع المقررات الدراسية داخل البرنامج

المجموعات التخصصية	الحد الأدنى	الحد الأقصى	المكونات الأساسية
متطلبات الجامعة	%8	--	بناء شخصية الخريجين الثقافية ، وتنمية مهارتهم الشخصية ، والإدراك العام بقضايا المجتمع والتركيز على الهوية والإرتباط بالوطن
متطلبات الكلية	%20	--	الحد الأدنى للعلوم الأساسية والثقافة الهندسية والعلوم الهندسية الأساسية حول كافة التخصصات
متطلبات التخصص العام	%35	--	العلوم الهندسية الأساسية ومبادئ التصميم والتطبيقات فى التخصص العام (معلومات عن جميع التخصصات الدقيقة)
متطلبات التخصص الدقيق	--	%30	المهارات والعلوم الهندسية والتصميمات والتطبيقات الهندسة التخصصية

مع مراعاة أن تحقق الخطط الدراسية لكل برنامج المقررات والنسب الاسترشادية التى وضعتها الهيئة القومية لضمان جودة التعليم وتشمل المقررات التالية

1- العلوم الإجتماعية والإنسانية
2- إدارة الأعمال
3- العلوم الأساسية
4- الثقافة الهندسية
5- العلوم الهندسية الأساسية
6- التطبيقات الهندسية والتصميم
7- مشروع التخرج والتدريب الميدانى

مادة (19) مدة الدراسة

- تمنح الدرجة العلمية متى استوفى الطالب متطلبات الحصول عليها وفقا لما تحدده اللائحة الداخلية للبرنامج.

- يمكن أن يسمح للطالب المتفوق بالتخرج والحصول على درجة البكالوريوس فى الهندسة بنظام الدراسة بالساعات المعتمدة، فى مدة 4 سنوات دراسية، أو (ثمانية فصول دراسية رئيسية)، بعد اجتياز كافة متطلبات التخرج، هذا بالإضافة لمدة الدراسة العادية.
- الحد الأقصى للدراسة ضعف المدة المنصوص عليها والمقترحة فى البرنامج وهو ما لايشمل الفصول الدراسية المجمدة لأسباب مقبولة من مجلس الكلية وبعد هذه المدة يتم فصل الطالب من البرنامج.

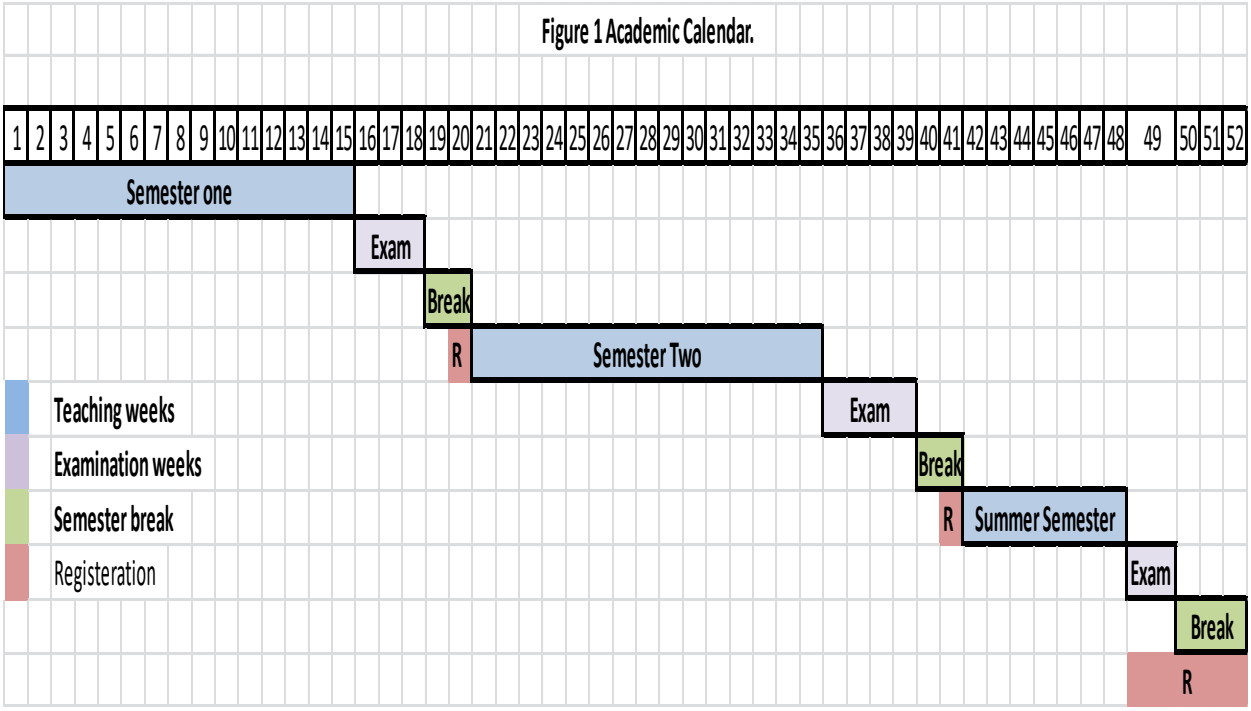
مادة(20) مواعيد الدراسة

تنقسم السنة الأكاديمية إلى ثلاثة فصول كالتالى:

1. **الفصل الدراسى الأول - فصل الخريف** (فصل رئيسى) ويبدأ مع بداية العام الدراسى الجامعى ولمدة 15 أسبوعا تدريسا.
2. **الفصل الدراسى الثانى- فصل الربيع** (فصل رئيسى) ويبدأ بعد إجازة منتصف العام الجامعى ولمدة 15 أسبوعا تدريسا.
3. **الفصل الدراسى الصيفى (فصل اختيارى)** ويبدأ فى شهر يوليو ولمدة 7 اسابيع تدريسية مع مضاعفة ساعات المقررات الدراسية.

يتم القيد والتسجيل قبل بداية كل فصل دراسى طبقا للتقويم الأكاديمي (شكل رقم 1)

Figure 1 Academic Calendar.



مادة (21) الأقسام العلمية المشتركة فى تنفيذ برامج الساعات المعتمدة

يشرف مجلس القسم المختص على تدريس جميع المقررات الدراسية (التخصصية) و القيام بكافة متطلبات الجودة و التقرير السنوي و الاستبيانات المقررة من قبل مجلس الكلية للبرنامج الذى يتبعه ويتم تدريس مقررات العلوم المختلفة من خلال الأقسام التالية كل فى تخصصه:

1- قسم الهندسة الميكانيكية .
2- قسم الهندسة الكهربية .
3- قسم الهندسة المدنية .
4- قسم الهندسة المعمارية.
5- قسم العلوم الهندسية الأساسية.
6- أقسام خارجية من كليات الطب فى برنامج الهندسة الطبية الحيوية.
7- أقسام خارجية من كليات الحقوق فى مجال التشريعات والقوانين والعقود والإنسانيات.
8- أقسام خارجية من كليات التجارة فى مجال اللوجستيات والإدارة .

لغة الدراسة و الاختبارات هى اللغة الإنجليزية ويجوز تدريس بعض المقررات باللغة العربية مثل الإنسانيات.

مادة (22) طرق التدريس والوسائل التعليمية

تعتمد الكلية على طرق التدريس التقليدية والحديثة على النحو التالى:

- **الطرق التقليدية** حيث تقوم على وسيلة يعرض بها المحاضر المادة العلمية وينقلها إلى طلابه بعد تبسيطها وتقوم هذه الطريقة فى الغالب على شرح المحاضر وفاعاليته.
- **الطرق الحديثة** تقوم على التفاعل بين المحاضر والطالب معا ، بمعنى أن يشترك كلاهما فى البحث عن المعلومة والتعلم الذاتى الذى يؤدى إلى إطلاق طاقات الطلاب وإبداعاتهم ويدفعهم للتعلم وتعتبر الوسائل الحديثة عنصرا من عناصر العملية التعليمية وتستخدم الكلية الوسائل التالية :
  - الوسائل البصرية (أجهزة العرض الضوئية المتصلة بالحاسب).
  - وسائل أخرى (الحاسب الألى – السبورات الذكية – المحاضرات عبر الإنترنت والفيديو).
  - دعوة الخبراء والمتخصصين من الصناعة أو ذوى الخبرة لعرض قصص النجاح والتطبيق العملي للدراسة.
  - يجوز لمجلس الكلية بعد أخذ رأى مجلس القسم المختص وحسب طبيعة المقررات الدراسية أن يقرر تدريس مقرر أو أكثر بنمط التعليم الهجين، بحيث تكون الدراسة فى المقرر بنسبة 60-70% وجهاً لوجه و30-40% بنظام التعليم عن بعد، وعلى أن يتم عرض ذلك على مجلس شئون التعليم والطلاب بالجامعة للموافقة عليه ورفعه إلى مجلس الجامعة لاعتماده.

مادة (23) قواعد الإنتظام فى الدراسة

الطلاب المسجلين بالبرامج عليهم الالتزام بالقواعد التالية:

(1) سداد الرسوم الدراسية

يتم دفع رسوم التسجيل والخدمات التعليمية طبقا لما يقرره مجلس الجامعة فى هذا الشأن.

(2) انتظام الحضور

يتولى أستاذ كل مقرر تسجيل حضور وغياب الطلاب عن المحاضرات أوالتمارين التطبيقية أو العملية ويخطر بذلك منسق البرنامج:

- يتم إنذار الطالب إنذارا أوليا عند تجاوزه نسبة غياب 10% من مجموع المحاضرات و التمارين.
- يتم إنذار الطالب إنذارا ثانيا عند تجاوزه نسبة غياب 20% من مجموع المحاضرات و التمارين.
- اذا زادت نسبة غياب الطالب عن 25% من مجموع المحاضرات و التمارين بدون عذر مقبول ومعتمد من مجلس الكلية يتم حرمان الطالب من دخول امتحان المقرر.
- إذا زادت نسبة الغياب للطالب عن 25% وكان غيابه بعذر مقبول يقبله مجلس الكلية يسجل للطالب تقدير غير مكتمل ولا تدخل فى حساب أيا من المعدل الفصلى أو التراكمى للطالب.

(3) إيقاف قيد الطالب

فى حالة قيام ولي أمر الطالب بتقديم طلب بإيقاف قيده فعليه سداد الرسوم الدراسية الإدارية الخاصة بذلك على أن يتم وقف القيد فى المواعيد المحددة من قبل مجلس الكلية.

(4) تغيير عنوان الطالب

على ولي أمر الطالب أن يخطر إدارة البرنامج بأى تغيير يحدث فى محل إقامته حتى تتم المراسلات للطالب على عنوانه الصحيح أو من خلال النظام الإلكتروني أو الإيميل الجامعي.

مادة (24) الفصل من الدراسة والإنذار الأكاديمى

- يحصل الطالب على إنذار أكاديمى إذا كان معدله التراكمى فى أى فصل دراسى رئيسى أقل من 2.0.
- يتم فصل الطالب من الدراسة إذا حصل على ستة إنذارات أكاديمية متتالية.
- إذا تجاوز المعدل الفصلى للطالب 2.0 فى أى فصل دراسى رئيسى ، فإنه يتم إعادة حساب عدد الإنذارات الأكاديمية المتتابعة.
- يتم فصل الطالب إذا لم يحقق متطلبات التخرج خلال المدة القصوى للدراسة (ضعف مدة البرنامج) طبقا للائحة.
- الطالب المعرض للفصل من الدراسة بسبب انخفاض معدله الفصلى إلى عن 2.0 تتاح له فرصة إضافية ونهائية للتسجيل بحد أقصى فصليين دراسيين رئيسيين متتالين بالإضافة إلى فصل الصيف لتحقيق متطلبات التخرج شريطة أن يكون أنجز بنجاح ما لايقل عن 80% من العدد الإجمالى للساعات المعتمدة اللازمة لتخرجه.

مادة (25) شروط تسجيل المقررات الدراسية

- يمكن للطالب أن يسجل مقررات دراسية فى الفصول الدراسية الرئيسية وفقا للقواعد التالية (بعد موافقة المرشد الأكاديمى للطالب)
  - حتى 21 ساعة معتمدة وذلك للطالب الحاصل على معدل تراكمى أكبر من أو يساوى 3.0
  - حتى 18 ساعة معتمدة وذلك عند التسجيل فى أول فصل دراسى للطالب أو للطالب الحاصل على معدل تراكمى أكبر من أو يساوى 2.0 .
  - حتى 14 ساعة معتمدة وذلك للطالب الحاصل على معدل تراكمى أقل من 2.0.
  - الحد الأدني لعدد الساعات المعتمدة المسجلة هو 12 ساعة معتمدة.
- يمكن للطالب تسجيل مقررات فى الفصل الدراسى الصيفى طبقا للقواعد التالية (بعد موافقة المرشد الأكاديمى)
  - حتى 9 ساعات معتمدة وذلك للطالب الحاصل على معدل تراكمى أكبر من أو يساوى 3.0 مالم يكن مسجلاً للتدريب الميداني.
  - حتى 8 ساعات معتمدة وذلك للطالب الحاصل على معدل تراكمى أقل من 3.0 مالم يكن مسجلاً للتدريب الميداني.
  - إذا كان الطالب مسجلاً للتدريب الميداني يمكنه تسجيل مقرر واحد بحد أقصي 3 ساعات معتمدة.
- يمكن للطالب تسجيل مقرر دراسى إضافى واحد عن الحدود المذكورة أعلاه إذا كان ذلك يؤدى إلى تخرجه وذلك بعد موافقة المرشد الأكاديمى.
- يسمح لإدارة البرنامج تحديد المقررات الدراسية التى يتم طرحها كل فصل دراسى عدا المقررات الضرورية للتخرج فيتم إتاحتها للتسجيل كل فصل دراسى.
- يمكن للطلاب التسجيل كمستمعين في بعض المقررات الدراسية وغير مسموح لهم دخول الامتحان النهائي للمقرر إلا بعد موافقة المرشد الأكاديمي و منسق البرنامج.

مادة (26) مستويات الدراسة

كلما استكمل الطالب نسبة محددة من متطلبات البرنامج سوف يتم نقله من مستوى للمستوى التالى ويوضح الجدول رقم (5) حالة الطالب استنادا إلى نسبة عدد الساعات المعتمدة التى تم اجتيازها بنجاح

جدول رقم (5) حالة الطالب استنادا إلى عدد الساعات المعتمدة المجتازة

المستوى الدراسى	تعريف موقع الطالب	نسبة عدد الساعات المعتمدة التى اجتازها الطالب بنجاح
الأول	المستوى العام (Freshman)	من 0 الى أقل من 25%
الثانى	المستوى الأول(sophomore)	من 25 الى أقل من 50%
الثالث	المستوى الثانى (Junior)	من 50 الى أقل من 75%
الرابع	المستوى الثالث(Senior)	من 75 الى 100%

مادة (27) التدريب الميداني

- يشمل كل برنامج تدريب ميداني لمدة لاتقل عن ثمانية أسابيع داخل القطاعات المتخصصة تحت إشراف أعضاء هيئة التدريس.
- يتولى متابعة التدريب مشرف معين من قبل إدارة البرنامج و يمنح بدل انتقال مرة واحدة أسبوعيا.

- يتم تحديد مسؤول الاتصال بجهة التدريب.
- يجب على الطالب تقديم تقرير فني إلى المشرف الأكاديمي في نهاية فترة التدريب.
- يجب على المنشأة تقديم تقييم للطالب إلى المشرف الأكاديمي في نهاية فترة التدريب.
- ينقسم التدريب إلى فترتين كل فترة 4 أسابيع على الأقل و يشترط اجتياز الطالب 65 ساعة للتدريب الأول، و 96 ساعة من الساعات المعتمدة للتدريب الثاني على الترتيب.
- يتم تقييم التدريب الميداني على أساس النجاح / الرسوب ولا يتم احتسابه في حساب المعدل التراكمي.

مادة(28) إضافة وحذف المقررات الدراسية

- يسمح للطالب أن يضيف مقرر دراسى فى الأسبوع الأول من الفصول الدراسية الرئيسية أو فى الأيام الثلاثة الأولى من الفصل الدراسى الصيفى .
- يمكن للطالب أن يحذف المقررات الدراسية المسجل بها حتى نهاية الأسبوع الثانى من الفصول الدراسية الرئيسية أو نهاية الأسبوع الأول من الفصل الدراسى الصيفى .
- لايجب أن يؤدى إضافة أو حذف المقررات الدراسية إلى مخالفة الحد الأدنى أو الحد الأقصى لعدد الساعات المعتمدة لكل فصل دراسى .

مادة(29) الانسحاب من المقررات الدراسية

- يمكن للطالب الانسحاب من المقرر الدراسى خلال الأسابيع العشرة الأولى من الفصول الدراسية الرئيسية أو خلال الأسابيع الخمسة الأولى للفصل الدراسى الصيفى .
- لايرسب الطالب فى المقرر المنسحب منه ، شريطة أن يتم الانتهاء من طلب الانسحاب والموافقة عليه خلال المدة الزمنية المحددة.
- يحصل الطالب على تقدير (W) للمقرر المنسحب منه ويسمح له بتسجيل هذا المقرر (الحضور الكامل وأداء جميع الأنشطة بما فى ذلك الامتحانات) فى الفصول الدراسية اللاحقة .
- بالنسبة للمقرر الاختيارى ، يسمح للطالب بتغييره فى الفصول الدراسية اللاحقة إذا رسب فى اجتيازه أو قام بالانسحاب منه . وهذا يخضع لموافقة المرشد الأكاديمى للطالب ومتطلبات تخرجه.

مادة(30) المقررات الدراسية غير المكتملة

- إذا لم يحضر الطالب الامتحان النهائى للمقرر الدراسى بعذر مقبول من قبل اللجنة المختصة بشئون البرنامج المسجل به ووافق عليه مجلس الكلية ، فإن المقرر يعتبر غير مكتمل (I) .
- يحصل الطالب على تقدير (I) فى المقرر غير المكتمل ولن يدخل فى حساب المعدل التراكمى للطالب، وذلك حتى يتم إجراء الامتحان فى هذا المقرر فى الموعد التالى المتاح لامتحان هذا المقرر.
- إذا لم يقم الطالب بإجراء الامتحان النهائى للمقرر غير المكتمل فى الموعد التالى المتاح لامتحان هذا المقرر فإنه يحصل على تقدير (F) فى المقرر الدراسى .
- إذا قام الطالب بإجراء الامتحان النهائى للمقرر غير المكتمل فى الموعد التالى المتاح لامتحان هذا المقرر تضاف درجات هذا الامتحان النهائى إلى درجات أعمال الفصل الدراسى وذلك لحساب التقدير الكلى لهذا المقرر الدراسى.

مادة(31) إعادة المقررات الدراسية

- يمكن للطالب إعادة مقرر دراسى دراسة وامتحانا لمرة واحدة بهدف التحسين إذا كان تقديره فى هذا المقرر يستوفى شرط الحد الأدنى من النجاح وفقا للقواعد التالية.
  - يحصل الطالب على التقدير الأعلى فى المقرر الدراسى بعد الإعادة . وهذا التقدير هو الذى سيتم احتسابه فى المعدل التراكمى للطالب . شريطه أن تظهر الإعادة فى شهادة الطالب.

- الحد الأقصى لعدد المرات التى يمكن للطالب تكرارها بهدف التحسين هو خمس مرات خلال مدة دراسته . ويستثنى من ذلك المقررات الدرسية التى يتم التحسين فيها تلبية لمتطلبات التخرج.
- فى حالة رسوب الطالب فى الإعادة إذا كان بغرض تحسين التقدير، فيلغى تقديره السابق للمقرر ولايعتد به بعد ذلك ويعتبر راسبا ويحصل على تقدير (F).
- إذا رسب الطالب فى مقرر دراسى (حاصل على تقدير F)، فإنه يطلب منه إعادة جميع متطلبات المقرر (الحضور الكامل وأداء جميع الأنشطة بما فى ذلك الامتحانات) وفقا للقواعد التالية:
  1- أقصى تقدير للمقرر الدراسى المعاد هو B^+ .
  2- يحصل الطالب على تقدير المقرر الدراسى بعد الإعادة وهذا التقدير هو الذى سيتم احتسابه فى المعدل التراكمى للطالب شريطة أن تظهر الإعادة فى شهادة الطالب.
- إذا قام الطالب بإعادة مقرر دراسى، فإنه يطلب منه أن يعيد جميع متطلبات تقييم المقرر الدراسى حتى يعاد تقييمه بالكامل. حيث يعاد احتساب تقدير المقرر الدراسى.
- يجوز السماح للطالب إذا رسب فى مقرر دراسى (حصل على تقديرF)، بإعادة الامتحان النهائى (فى ذات الفصل الدراسى) خلال المدة التى تقرها اللائحة، ولمقرر دراسى واحد فقط للطالب، ووفقا للقواعد الأتية :
  - ألا تقل درجة الطالب فى الامتحان النهائى للمقرر عن 50% من درجة الامتحان، وألا تقل نتيجة الطالب فى المقرر عن 55% من إجمالى درجات المقرر.
  - ألا يزيد تقدير الطالب فى المقرر بعد الإعادة عن C^-.
  - فى حالة رسوب الطالب فى الامتحان التكميلى عليه إعادة المقرر دراسة وامتحان طبقا لقواعد الإعادة .
  - فى حالة الضرورة (عدم اكتمال عدد الساعات المعتمدة المصرح بها فى الفصل الدراسى) يجوز للطالب الراسب فى متطلب سابق، بتوصية المرشد الأكاديمى وموافقة لجنة التعليم بالكلية، التسجيل فى مقرر بالتزامن مع المتطلب السابق، ويعلق نجاح الطالب فى المقرر حتى يجتاز الطالب المتطلب السابق بنجاح.

مادة(32) الامتحانات والتقييم للمقررات الدراسية

- تحسب الدرجة لكل مقرر من مائة درجة.
- الدرجة الكلية لكل مقرر هى مجموع درجات الامتحان النهائى ودرجات الأعمال الفصلية موزعة طبقاً للجدول رقم (6) المرفق بالنسبة للبرامج التخصصية أما البرامج متعددة التخصصات فيتبع توزيع الدرجات الجدول رقم (7)، ويكون الامتحان النهائى تحريرياً ويستثنى من ذلك مشروع التخرج والمقررات التى يحدد وصف المقرر باللائحة (Course syllabus) أن الامتحان النهائى يكون شفهيا أو باستخدام الحاسب الآلى أو بأى طريقة أخرى.

جدول رقم (6) توزيع درجات المقرر للبرامج التخصصية

نوع الإمتحان	المقرر نظري/عملي	المقرر نظري فقط	المقرر عملي فقط	المشروع
الامتحان النهائي	%40	%40	%40	%50
امتحان فصلي	%30	%30	%30	–
امتحان شفوى/عملى	%20	-	-	
أعمال فصلية و خلافه	%10	%30	%30	%50

جدول رقم (7) توزيع درجات المقرر للبرامج متعددة التخصصات

نوع الامتحان	المقرر نظرى / عملى	المقرر نظري	المقرر عملي	المشروع
امتحان فصلى	30%	%30	%30	---
امتحان فصلى ثانى	--	%20	%20	---
أعمال السنة	%10	%10	%10	% 50
الامتحان العملي/الشفهي	%20	--	40%	--
الامتحان النهائى	%40	%40	--	%50

يعتبر الطالب راسبا ويحصل على تقدير (F) إذا حصل على أقل من 40% من درجات الاختبار النهائى وبغض النظر عن مجموع درجاته بالمقرر.

- يعتبر الطالب راسبا ويحصل على تقدير (F) إذا حصل على أقل من 60% من الدرجات الكلية للمقرر، أو تم حرمانه من حضور الامتحان النهائى بسبب تجاوز نسبة الغياب أو الغش..إلخ، أو لم يحضر الامتحان النهائى دون تقديم عذر مقبول من قبل مجلس الكلية .
- المقررات الدراسية التى لها (0) ساعة معتمدة يكون التقدير فيها راسب أو ناجح ويجب على الطالب الحصول على 60% من درجات المقرر ليعتبر ناجحا ولايدخل هذا المقرر فى حساب المعدل الفصلى، أو المعدل التراكمى.
- يكون الامتحان الفصلي للمقرر امتحانا واحدا على أن يعقد فى الأسبوع السابع من بداية كل من الفصليين الدراسيين الرئيسيين (الخريف والربيع) وفى الفصل الصيفى يعقد فى الأسبوع الرابع . وقد تشمل الأعمال الفصلية تقاريرا، أو بحوثا، أو مشاريع مصغرة .. إلخ طبقا لما هو موضح فى وصف المقرر (Course syllabus).
- يكون منسق المقرر(يحدده منسق البرنامج) من أحد المحاضرين القائمين بتدريس المقرر على أن يكون عضوا بلجنة تصحيح المقرر فى مراجعة التوزيع الإحصائى لتقديرات الطلاب بناء على الآليات التى يضعها مجلس الكلية . وبالنسبة لمقررات العلوم الإنسانية والاجتماعية ومقررات إدارة الأعمال ومقررات الثقافة الهندسية التى لاترتبط ببرنامج معين فيكون وكيل الكلية لشئون التعليم والطلاب، أو من يفوضه منسقا عليها.
- المقررات العملية أو المقررات التي لها شق عملي سيكون الامتحان النهائى لها هو امتحان عملي و يقسم الطلاب إلى مجموعات و كل مجموعة 5 طلاب و تكون لجنة الامتحان مكونة من 4 أعضاء هيئة تدريس.
- بالنسبة لمشروع التخرج-1 سيكون الامتحان النهائى له عبارة عن امتحان شفوى فى نهاية الفصل.
- بالنسبة لمشروع التخرج-2 يتم اقتراح تشكيل لجان من قبل منسق البرنامج لمناقشة المشاريع بنهاية الفصل و يفضل وجود عضو من خارج الكلية ضمن تشكيل اللجنة و يعتمد من مجلس إدارة البرامج.
- يحدد مجلس الكلية آلية تقديم ودراسة التظلمات والفترة الزمنية اللازمة لذلك.
- تحدد مدة الامتحان النهائى بساعتين لجميع المقررات ، ماعدا مقررات الرسم والتصميم والمقررات المشابهة لها فيجوز زيادتها إلى أكثر من ذلك ويصدر قرارا من مجلس الكلية بذلك لتحديد هذه المقررات.

- يجب أن ينص توصيف المقرر على توزيع الدرجات لطرق التقييم المختلفة. ويجوز لمجلس الكلية أن يعدل توزيع الدرجات لمقرر ما وذلك بناء على اقتراح مجلس القسم بعد التنسيق مع منسق البرنامج وإعلان ذلك التوزيع للطلاب قبل بدء الفصل الدراسى .
- يجوز لمجلس الكلية بعد أخذ رأى مجلس القسم المختص وحسب طبيعة المقررات الدراسية أن يقرر عقد الامتحانات إلكترونيا فى مقرر أو أكثر، كما يجوز عقد الامتحان فى كل المقرر أو جزء منه بما يسمح بتصحيحه إلكترونيا وعلى أن يتم عرض ذلك على مجلس شئون التعليم والطلاب بالجامعة للموافقة عليه ورفعه إلى مجلس الجامعة لاعتماده.

مادة(33) تقديرات المقررات الدراسية

- بالنسبة للمقررات التى يسجل الطالب فيها كمستمع أو أن يطلب منه فقط اجتياز المقرر (المقررات الدراسية ذات عدد الساعات المعتمدة الصفرية ، المقررت الدراسية غير المدرجة فى حساب المعدل التراكمى) ستكون تقديرات الطالب طبقا للجدول رقم (8).

جدول رقم (8) تقديرات المقررات الدراسية ذات عدد الساعات المعتمدة الصفرية

التقدير	المدلول	التفاصيل
Au	مستمع (Audience)	يرصد للطالب المسجل مستمع
P	ناجح (Pass)	يرصد للطالب الناجح
F	راسب (Fail)	يرصد للطالب الراسب
W	منسحب (Withdraw)	يرصد للطالب المنسحب من مقرر بناءً علي طلبه
I	مقرر غير مكتمل (Incomplete)	يرصد للطالب الذي تعذر عليه إستكمال متطلبات المقرر وتغيب في الإمتحان النهائي بعذر مقبول وقدم طلباً بذلك وتم قبوله طبقاً للقواعد.

- يتم حساب عدد النقاط لكل مقرر على أساس الدرجات التى يحصل عليها الطالب خلال دراسته لهذا المقرر (الأنشطة- امتحانات منتصف الفصل الدراسى – الامتحان العملى- الامتحان النهائى) ويوضح الجدول رقم (9) كيفية حساب عدد النقاط والتقدير من خلال الدرجات .
- يجب على الطالب الحصول على الحد الأدنى (D) لاجتياز أى مقرر دراسى والتى يتم استخدامه فى حساب المعدل التراكمى للطالب .

مادة (34) المرشد الأكاديمى

- يعين منسق البرنامج مرشد أكاديمى لكل طالب يتابع الطالب ويساعده فى اختيار المقررات الدراسية بكل فصل دراسى.
- المرشد الأكاديمى مسئول عن :
  - مساعدة الطالب فى تسجيل المقررات طبقا لمعدل الطالب.
  - مساعدة الطالب فى اختيار مساره الأكاديمى وكذلك فى اختيار المقررات بكل فصل دراسى .
  - مساعدة الطالب فى اختيار التدريب الميدانى.
  - مساعدة الطالب فى اختيار التخصص ومشروع التخرج

- يجوز للمرشد الأكاديمى أن يطلب من الطالب إعادة مقررات دراسية نجح فيها الطالب بالفعل أو أن يطلب منه التسجيل فى مقررات دراسية إضافية ، وذلك بهدف رفع المعدل التراكمى المطلوب لكى يحقق الطالب متطلبات التخرج.

مادة (35) حساب المعدل التراكمى (GPA)

- تحسب نقاط المقررات الدراسية التى حققها الطالب على أنها عدد الساعات المعتمدة لهذا المقرر مضروبة فى نقاط التقدير وفقا لجدول رقم (7)
- يتم احتساب إجمالى النقاط التى حققها الطالب فى أى فصل دراسى على أنها مجموع نقاط المقررات التى اجتازها الطالب فى هذا الفصل الدراسى

يحسب المعدل التراكمى للطالب فى نهاية أى فصل دراسى باعتباره إجمالى عدد النقاط التى حققها الطالب فى جميع المقررات الدراسية التى تمت دراستها مقسوما على العدد الإجمالى للساعات المعتمدة لهذه المقررات ، مع مراعاة القواعد المتعلقة بإعادة القيد وتحسين المقررات .

$$Cumulative\ GPA = \frac{\sum_{Courses} Grade\ points * Credit\ Hours}{\sum_{Courses} Credit\ Hours}$$

- يحسب متوسط النقاط فى الفصل الدراسى باعتبار إجمالى النقاط التى حققها الطالب فى المقررات الدراسية فى هذا الفصل الدراسى مقسوما على العدد الإجمالى للساعات المعتمدة لهذه المقررات.
- المعدل التراكمى للتخرج هو المعدل التراكمى عند التخرج وذلك بعد اجتياز جميع متطلبات التخرج ولايمكن للطالب الحصول على درجة البكالوريوس إلا إذا حقق معدل تراكمى 2.0 على الأقل.
- يتحدد ترتيب الخريجين على أساس المعدل التراكمى للتخرج . فى حالة التساوى فى المعدل التراكمي يتم الترتيب طبقا للمجموع التراكمى للدرجات.

يجب أن تتضمن شهادة الطالب جميع المقررات الدراسية التى تم تسجيلها خلال مدة الدراسة ، بما فى ذلك المقررات الدراسية التى رسب فيها أو انسحب منها أو تم تحسينها.

مادة (36) مرتبة الشرف لطلبة البكالوريوس

لكى يحصل الطالب على مرتبة الشرف فإن عليه أن يستوفى الشروط التالية:

1. الحفاظ على معدل تراكمى لايقل عن 3.3 خلال فترة دراسته فى البرنامج مع تحقيق هذا المعدل على الأقل خلال جميع فصول الدراسة .
2. ألا يكون قد حصل على تقدير(F) فى أى مقرر دراسى خلال فترة دراسته.
3. ألا يكون قد تم توقيع أى عقوبات تأديبية عليه خلال فترة دراسته فى الكلية .

مادة (37) تكليف خريجى البرامج فى وظيفة معيد

يتم تكليف المعيدين من خريجى البرامج بقرار من رئيس الجامعة بناء على طلب من مجلس الكلية طبقا للمادة (133) من قانون تنظيم الجامعات وبما لايخل بتطبيق المادتين 135،136 من ذات القانون ويشترط ألا يقل معدله التراكمي عند التخرج عن B^{+}.

جدول رقم (9) تقدير المقررات وعدد النقاط المناظر

النسبة المئوية	نظام الساعات المعتمدة	
	عدد النقاط	التقدير المناظر
أكثر من 97%	4.0	A+
93% الى أقل من 97%		A
89% الى أقل من 93%	3.70	A-
84% الى أقل من 89%	3.30	B+
80% الى أقل من 84%	3.00	B
76% الى أقل من 80%	2.70	B-
73% الى أقل من 76%	2.30	C+
70% الى أقل من 73%	2.00	C
67% الى أقل من 70%	1.70	C-
64% الى أقل من 67%	1.30	D+
60% الى أقل من 64%	1.00	D
أقل من 60%	0.00	F

مادة (38) الإدارة الإلكترونية

تقوم الكلية بتصميم برنامج لإدارة نظم المعلومات للبرامج أو تتعاقد عليه وذلك لميكنة العمل بالبرامج بنظام الساعات المعتمدة و يشرف عليها منسق التحول الرقمي ويشتمل هذا البرنامج على البنود التالية :

1- تسجيل المقررات الدراسية .
2- إضافة وحذف المقررات الدراسية.
3- أعمال الإرشاد الأكاديمى.
4- أعمال إدارة البرنامج فى تحقيق القواعد المنظمة للبرنامج.
5- أعمال الكنترولات.
6- أعمال الدراسة والامتحانات .
7- الأعمال الخاصة بشئون الطلاب.
8- بيانات الحالة.
9- تقارير عن أداء الطلاب.
10- تسجيل غياب الطلاب.
11- التواصل مع الطلاب.
12- الإمتحانات الإلكترونية.
13- أعمال الجودة.

ويجب مراعاة الحفاظ على سرية البيانات واستدعائها، وسهولة الاستخدام للطالب وعضو هيئة التدريس والفريق الإدارى وإتاحة الدعم الفنى.

رابعا: تفاصيل البرامج المقدمة

تمنح جامعة بنها بناءً على طلب مجلس كلية الهندسة ببنها درجة بكالوريوس العلوم في أحد البرامج التي تقدمها كلية الهندسة ببنها، و التي تنقسم إلى برامج متخصصة (Disciplinary programs) ومتعددة التخصصات (Inter-Disciplinary Programs).

وفقًا للشروط المرجعية لنظام الدراسة بنظام الساعات المعتمدة بكليات الهندسة (2020) - المجلس الأعلى للجامعات، تنقسم المقررات الدراسية في أي برنامج إلى المتطلبات التالية:

1. متطلبات الجامعة.
2. متطلبات الكلية.
3. متطلبات التخصص.
4. متطلبات البرنامج.

يوضح الجدول (10) توزيع الساعات المعتمدة بين المتطلبات المختلفة لكل من البرامج المتخصصة ومتعددة التخصصات. بالنسبة للبرامج متعددة التخصصات، يتم تقسيم **114** ساعة معتمدة بين التخصصات المختلفة التي يتكون منها هذا البرنامج.

يوضح الشكل (2) المستويات المختلفة للجدارات كما تم نشرها في المعايير المرجعية الأكاديمية الوطنية (NARS-2018). تحدد هذه الجدارات توزيع المقررات في مستويات الجدارات المختلفة وفقا و متطلبات المستوى الدراسي.

جدول (10) تقسيم الساعات المعتمدة بين المتطلبات الأربعة.

		متطلبات الجامعة	متطلبات الكلية	متطلبات التخصص	متطلبات البرنامج
البرامج التخصصية (Specialized Programs)	الهندسة الميكانيكية	14 CH 8.75%	32 CH 20%	66 41.25%	48 30%
	الهندسة الكهربية			67 41.88%	47 29.37%
	الهندسة المدنية			114 CH 71.25%	
	الهندسة المعمارية			114 CH 71.25%	
البرامج متعددة التخصصات (Inter-Disciplinary Programs)				114 CH 71.25%	

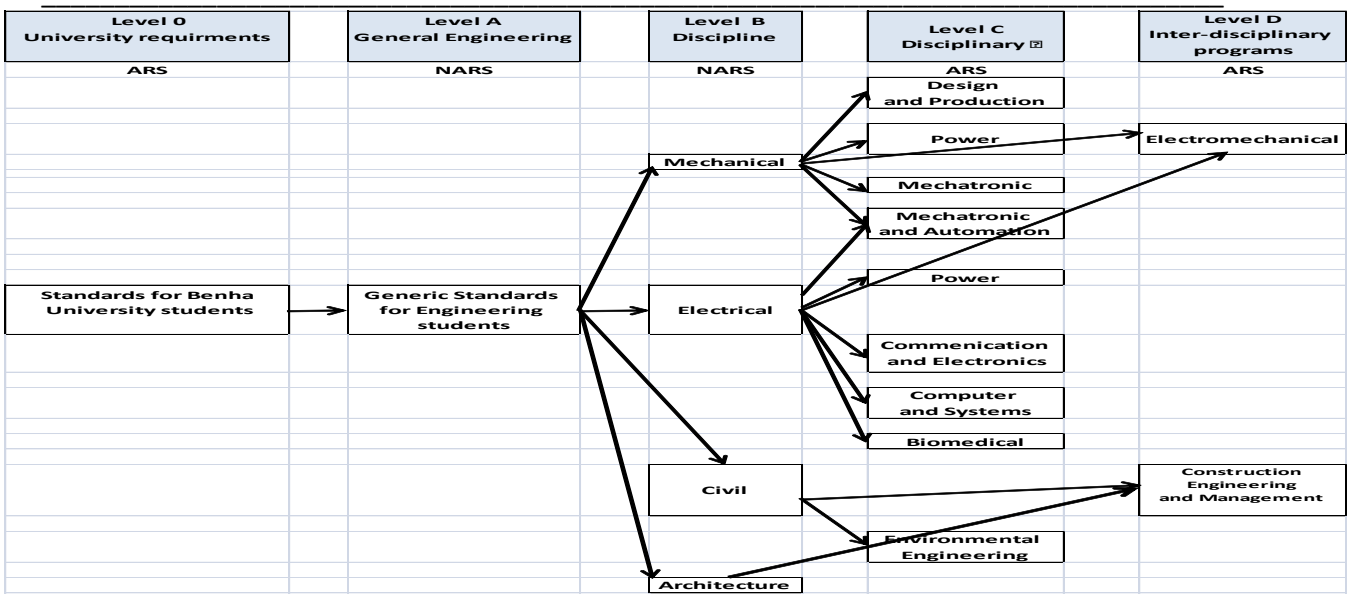


Figure 2 Different Levels of Competencies as per NARS 2018, as published by NAQAAE

ملخص البرامج الدراسية:

Table 11 List of overall data about the programs.

#	Program	NC	Credits and SWL			Total Contact Hours				4 Requirements %				BS %
			CH	ECTS	SWL	Lec	Tut	Lab	TT	UR	FR	DR	PR	
Specialized Programs														
1	Design and Production Engineering	**61**	160	267	6750	104	55	76	235	8.75	20	39.37	31.87	22.5
2	Mechanical Power Engineering	**61**	160	267	6750	106	55	74	235	8.75	20	41.25	30	18.75
3	Mechatronics Engineering Program	61	160	267	6750	104	55	76	235	8.75	20	39.375	31.875	22.5
4	Electrical Power and Machines Engineering	61	160	270	6750	110	102	73	285	8.75	20	41.87	29.4	18.125
5	Computer and Control Systems Engineering	58	160	270	6750	108	56	75	239	8.75	20	41.88	29.38	20.63
6	Electronics and Communications	58	160	270	6750	107	65	72	244	8.75	20	42.5	28.75	18.75
7	Biomedical Engineering	58	160	270	6750	108	89	97	294	8.75	20	41.7	29	18.75
8	Civil Engineering	62	160	270	6750	113	51	61	225	8.75	20	63.75	0	18.75
9	Architectural Engineering	**61**	160	267	6750	108	98	26	232	8.75	20	71.25	0	11.25
Interdisciplinary Programs														
10	Infrastructures and Utilities Engineering	62	160	267	6667	110	70	50	230	8.75	20	0	71.75	18.75
11	Construction Engineering and Management	62	160	267	6667	111	71	50	232	8.75	20	0	71.75	18.75
12	Elctromechanical Engineering	61	160	234	5850	113	82	31	226	9	20	0	71	21
13	Mechatronics and Automation Program	**61**	160	279.6	6990	106	56	71	233	8.75	27.5	0	63.75	22.5

NC	Total number of Courses	UR	University Requirement
CH	Credit Hour	FR	Faculty Requirement
ECTS	European Credit Transfer System	DR	Discipline Requirement
SWL	Student Workload	PR	Program Requirement
Lec	Lectures	TT	Total
Tut	Tutorials	BS	Basic Sciences Percentage
Lab	Laboratory		

Checklist for each program:

- The total number of credit hours should be between 144 and 165
- The percentage of the 4 requirements is calculated by credit hours and should follow the percentages in the Terms of Reference.
- The percentage of Basic Sciences is calculated by credit hours and should follow the percentages in the Terms of Reference.
- **The maximum number of courses is 60**
- The maximum number of weekly contact hours is 280 Contact Hours. The maximum number of Lecture Contact hours is 50% of total contact hours or 130 contact hours, whichever is less.

متطلبات االجامعة

تهتم جامعة بنها ببناء التفكير البشري ليكون في أعلى مستوياته ليكون مصدر مهم لتنمية الموارد البشرية، يهتم بالنهوض بالحضارة العربية و التراث التاريخي للمجتمع المصري وتقاليده. كما أنها تهتم بتعاليم الدين والأخلاق والقومية العربية. و من الأهمية بمكان الاهتمام بدراسة المشاكل المجتمعية المعاصرة و كيفية مواجهتها. لذلك يجب أن يكون خريج جامعة بنها مدرك تماما للقضايا الوطنية والإقليمية والدولية المعاصرة ، ليكون شخصية واعية و مؤهلة فكريا للتفاعل الفعال في المجتمع من خلال مختلف مهارات التواصل.

و لتحقيق هذا، صممت جامعة بنها عددًا من المقررات لبناء شخصية الطالب وتنمية مهاراته وتزيد من وعيه بالموضوعات المختلفة. هذه المقررات تسمى متطلبات الجامعة. اختارت كلية الهندسة ببنها بعض من هذه المقررات ضمن البرامج الهندسية. هذه المقررات تشتمل على:

جدول (11) قائمة مقررات متطلبات الجامعة

الكود	المقرر	الساعات المعتمدة	ساعات الإتصال			
			محاضرة	معمل	درس نظري	الإجمالي
UHS 101	لغة أجنبية	2	2	--	--	2
UHS 102	تكنولوجيا المعلومات و الإتصالات	2	2	--	--	2
UHS 103	القضايا المجتمعية	2	2	--	--	2
UHS 104	أخلاقيات المهنة	2	2	--	--	2
UHS XXX	مقرر إختياري 1	2	2	--	--	2
UHS XXX	مقرر إختياري 2	2	2	--	--	2
UHS XXX	مقرر إختياري 3	2	2	--	--	2
الإجمالي		14	14	--	--	14

Table 11 List of University Requirements Courses

Code	Course Title	Cr. Hrs.	Ct. Hr.			
			Lect.	Lab.	Tut.	Tot.
UHS 101	Foreign Language	2	2	0	0	2
UHS 102	Information and Communication Technology	2	2	0	0	2
UHS 103	Societal Issues	2	2	0	0	2
UHS 104	Professional Ethics	2	2	0	0	2
UHS XXX	Humanities Elective I	2	2	0	0	2
UHS XXX	Humanities Elective II	2	2	0	0	2
UHS XXX	Humanities Elective III	2	2	0	0	2
Total		14	14	0	0	14

جدول (12) قائمة المقررات الإختيارية لمتطلبات الجامعة

الكود	المقرر	الساعات المعتمدة	ساعات الإتصال			
			محاضرة	معمل	درس نظري	الإجمالي
مقررات ريادة الأعمال						
UHS 201	مبادىء ريادة الأعمال وإدارة المشروعات	2	2	--	--	2
UHS 203	إدارة الموارد البشرية	2	2	--	--	2
مقررات المهارات الشخصية والمكتسبة						
UHS 301	مهارات الإتصال والعرض	2	2	--	--	2
UHS 302	مهارات القيادة	2	2	--	--	2
مقررات البحث والتحليل العلمي						
UHS 801	مناهج البحث	2	2	--	--	2
UHS 803	مهارات التفكير	2	2	--	--	2

Table 12 List of Humanities Elective Courses

Humanities Elective	Code	Course Title	Cr. Hrs.
Entrepreneurship Courses	UHS 201	Principles of Entrepreneurship and Project Management	2
	UHS 203	Human Resources Management	2
Personal and acquired skills courses	UHS 301	Communication and Presentation Skills	2
	UHS 302	Leadership Skills	2
Scientific research and analysis courses	UHS 801	Research Methodologies	2
	UHS 803	Thinking Skills	2

University Requirements Compulsory Courses

Code	Course Title	Pre-req.	CH	Ct. Hr.				Assessment			
				Lec.	Lab.	Tut.	Sum	SA	MT	PE/OE	Final
UHS 101	Foreign Language	-	2	2	-	-	2	30%	30%	-	40%
Course Contents	خصائص اللغة الانجليزية، أو الألمانية، أو الفرنسية، أو أي لغة أخري يتم إقرارها من قبل مجلس القسم العلمي واعتمادها من مجلس الكلية والجامعة، مراجعه قواعد اللغة، بعض قواعد الاسلوب والجمل الفعالة وخصائصها، التعرف على بعض الأخطاء الشائعة في كتابه الجملة الفنية، بناء الفقرات الاساسية: أنواع الفقرات، قراءة وتحليل مقتطفات من الكتب في مختلف الفروع لتنمية مهارات الاتصال. The characteristics of the foreign language (English, Deutsch, French, or any foreign language approved by the academic department council and both the faculty and university councils) - Revision of the language grammar – grammar style and effective sentences and their characteristics – Identification of common errors in writing technical sentences – Building basic paragraphs: types of paragraphs, reading and analysing of excerpts from books in varies disciplines to develop communication skills.										
References	EManuel Alvarez-Sandoval, “The Importance of Learning a Foreign Language in a Changing Society”, 2005, Universe										

Code	Course Title	Pre-req.	CH	Ct. Hr.				Assessment			
				Lec.	Lab.	Tut.	Sum	SA	MT	PE/OE	Final
UHS 102	Information and Communication Technology	-	2	2	-	-	2	30%	30%	-	40%
Course Contents	مفاهيم ومصطلحات تكنولوجيا المعلومات، أنماط الاتصال في التعليم والتعلم، شبكة الانترنت والتعلم، نظم الوسائل المتعددة، قواعد البيانات، الواقع الافتراضي، الواقع المعزز، انترنت الأشياء، الروبوتات وتصنيفها، الذكاء الاصطناعي، البيانات الضخمة، الحوسبة السحابية. Concepts and terminologies of information technology – Communication styles in teaching and learning – The internet and learning – multimedia systems – databases – Virtual Reality – Augmented reality – Internet of Things – Robotics and its classification – Artificial Intelligence – Big data – Cloud Computing.										
References	ITL Limited ITL Education Solutions Limited, "Introduction to Information Technology", 2nd edition, 2012, Pearson Education, ISBN: 9789332525146 Floyd Fuller, Brain Larson, Lisa Bucki, Faithe Wempen, "Computers: Understanding Technology Comprehensive ", 6th edition, 2016, Kendall Hunt Publishing, ISBN-13 : 978-0763870089										

Code	Course Title	Pre-req.	CH	Ct. Hr.				Assessment			
				Lec.	Lab.	Tut.	Sum	SA	MT	PE/OE	Final
UHS 103	Societal Issues	-	2	2	-	-	2	30%	30%	-	40%
Course Contents	توعية الطلاب بالعديد من القضايا الاجتماعية والبيئية والاقتصادية وغ ريه ا ي مصر مثل من القضايا المعاصرة ف قضايا الزيادة السكانية في مصر وأثره ا على الفرد والمجتمع، وقضايا مكافحة الفساد وأثره على الحقوق الاقتصادية والتنمية المستدامة، وقضايا حقوق الإنسان، وقضايا العنف ضد المرأة، وقضايا الصحة العامة والتلوث البيئي والتصحر وتغيير المناخ والمياه، قضايا الطاقة وغيرها من القضايا الهامة في مجتمعنا. The awareness of students on many social, environmental, economic, and other contemporary issues in Egypt such as issues of overpopulation in Egypt and its impact on the individual and society - issues of combatting venality and its impact on economic rights and sustainable development – human rights issues – issues of violence against women – public health issues – environmental pollution and desertification -Climate change, water and energy issues – Other important issues in our society.										
References	Enid Hill, "Discourses in Contemporary Egypt: Politics and Social Issues", 2000, American University in Cairo Press.										

Code	Course Title	Pre-req.	CH	Ct. Hr.				Assessment			
				Lec.	Lab.	Tut.	Sum	SA	MT	PE/ OE	Final
UHS 104	Professional Ethics	-	2	2	-	-	2	30%	30%	-	40%

Course Contents	يقدم المقرر الخلفية اللازمة لمناقشة المواضيع الأساسية للأخلاقيات المهنية مع التركيز على الموضوعات الأخلاقية التي تواجه الخريجيين في مجال العمل. ويحتوي المقرر على التعريف بالمقومات العامة لأخلاقيات المهنة ومراعاة المصلحة العامة واللوائح والانظمة، الالتزامات تجاه المجتمع والحقوق والواجبات مع دراسة أمثلة من مجال عمل الخريج في كل كلية. The course offers the background necessary to discuss the core issues of professional ethics facing graduates in their field of work. The course contains the definition of the general ingredients of professional ethics, and taking into account the public interest, rules and regulations, obligation towards society, rights and duties, with a study of example from the graduate's field of work in each college.
References	John Rowan & Samuel Zinaich, Jnr., "Ethics for the Professions", 1st edition, 2002, ISBN-13 : 978-0155069992

University Requirements Elective Courses

Code	Course Title	Pre-req	CH	Ct. Hr.				Assessment			
				Lec.	Lab	Tut	Sum	SA	MT	PE/O E	Final
UHS 201	Principles of Entrepreneurship and Project Management	-	2	2	-	-	2	30	30	-	40

Course Content	مفاهيم في ريادة الأعمال، ريادة الأعمال والمنشآت الصغيرة، توليد الأفكار للمشاريع الريادية، الجامعة وريادة الأعمال فرص وتحديات، الخطة التسويقية، الخطة التشغيلية، الخطة المالية، كتابة خطة العمل، البيئة التكنولوجية للمشروع الريادي، بيئة الاعمال الخارجية للمشروعات الريادية، برامج دعم المشاريع الرائدة في الاقتصاد المصري، مهارات عرض المشروع الريادي، مقدمة في إدارة المشروعات، الهيكل التنظيمي للمشروعات، تقييم النجاح، التخطيط، قراءة البيانات، مخطط الشبكات، تحليل المسار الحرج للشبكات، تخصيص المصادر والقيود، إدارة التكلفة، إدارة المخاطر، قياس ومراقبة أداء المشروعات. Concepts in entrepreneurship – entrepreneurship and small enterprises – Idea generation of entrepreneurial projects – The university and entrepreneurship opportunities and challenges – Marketing plan – operational plan – financial plan – Writing the business plan – The technological environment for entrepreneurship projects – External business environment for pioneering projects – Egyptian economy programs to support leading projects – entrepreneurial project presentation skills – Introduction to project management – The organizational structure – Success assessment – Planning – data reading – network planning – critical path analysis of networks – resource allocation and constraints – cost management – risk management – measurement and control of project performance.
References	• Alexander Osterwalder, Yves Pigneur, "Business model generation: A handbook for visionaries, game changers, and challengers", 1st edition, 2010, ISBN-13 : 978-0470876411 • Eric Ries, "The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses", 1st edition, 2011, ISBN-13 : 978-0307887894 • https://designthinking.ideo.com/

Code	Course Title	Pre-req	CH	Ct. Hr.				Assessment			
				Lec.	Lab	Tut	Sum	SA	MT	PE/OE	Final
UHS 203	Human Resources Management		2	2	-	-	2	30	30	-	40
Course Content	مفهوم إدارة الموارد البشرية، التطور التاريخي لإدارة الموارد البشرية، الوظائف الرئيسية لإدارة الموارد البشرية، التخطيط للموارد البشرية، الحصول على الموارد البشرية، تدريب وتطوير الموارد البشرية، تعويض الموارد البشرية، الحفاظ على الموارد البشرية واستدامتها. The concept of human resources management – The historical development of human resource management – the main jobs of human resource management – planning for human resources – obtaining human resources – training and developing human resources – compensation for human resources – maintaining and sustaining human resources.										
References	• Dessler, G., Chhinzer, N., & Gannon, G., « Management of human resources: The essentials", 5th ed., 2019, Pearson Education, ISBN: 9780134882963. • A. DeNisi, R. Griffin, HR, "Human Resource Management", 3rd edition, 2007, ISBN-13 : 978-0618794195										

Code	Course Title	Pre-req.	CH	Ct. Hr.				Assessment			
				Lec.	Lab.	Tut.	Sum	SA	MT	PE/OE	Final
UHS 301	Communication & Presentation Skills	-	2	2	-	-	2	30%	30%	-	40%
Course Contents	مدخل عام الى الاتصال، اهمية الاتصال، ا نواع الاتصال، معوقات الاتصال، مهارات الاتصال، سمات واساليب العرض الفعال، الاتصال اللفظي: مهارات التحدث، الاتصال غير اللفظي، مهارات الحوار واستراتيجيات الاقناع، الاتصال في بيئة العمل، كتابة السيرة الذاتية والتقارير والرسائل الرسمية. A general introduction to communication, the importance of communication, types of communication, communication obstacles, communication skills, features and methods of effective presentation, verbal communication: speaking skills – non-verbal communication – dialogue skills and persuasion strategies – communication in the work environment – writing resume – writing formal reports and letters.										
References	Mike Markel; Stuart A. Selber, "Practical Strategies for Technical Communication", Macmillan Learning, 3rd edition, 2019 Mike Markel; Stuart Selber, "Technical Communication", Macmillan Learning, 13th edition, 2021										

Code	Course Title	Pre-req.	CH	Ct. Hr.				Assessment			
				Lec.	Lab.	Tut.	Sum	SA	MT	PE/OE	Final
UHS 302	Leadership Skills	-	2	2	-	-	2	30%	30%	-	40%
Course Contents	يهدف المقرر الى تنمية المهارات القيادية والإدارية لدى الطلاب، وتنمية فرص التم ر ي لديهم، من خلال تعريفهم بسمات الشخصية القيادية والإدارية، وأهم طرق وأساليب التحول من التعبئة الى القيادة، وتعريفهم بأهم استراتيجيات التميز والتفاعل القيادي، اضافة الى تنمية بعض المهارات وأخلاقيات القيادة والإدارة المتعلقة بالتخطيط وإدارة الذات والأخرين، وطرق وأساليب اتخاذ القرارات الفعالة، وأساليب التحف ر ي، ومهارة قيادة التغيير، وأخلاقيات الإدارة والقيادة. The course aims to develop the students' leadership and management skills – Develop their opportunities for excellence, by introducing the leadership and administrative personality traits – The most important ways of transformation from mobility to leadership – The most important strategies of excellence and leadership interaction – developing some skills and ethics of leadership and management related to planning self and other management – Effective decision-making methods and techniques – motivational methods – the skill of change leadership – management and leadership ethics.									
References	Primal Leadership, "Unleashing the power of Emotional Intelligence", Daniel Goleman, Harvard Business Review Press										

Code	Course Name	Pre-req.	CH	Ct. Hr.				Assessment			
				Lec.	Lab.	Tut.	Sum	SA	MT	PE/OE	Final
UHS 801	Research Methodology	-	2	2	-	-	2	30%	30%	-	40%
Course Contents	التفكير العلمي وخصائصه، تعريف البحث العلمي وخصائصه، خطوات البحث العلمي وتصميم أدوات البحث وضبطها واختيار العينات (اختيار موضوع البحث، تحديد مشكلة البحث وعوامل اختيارها، تحديد إطار البحث، تحديد منهج البحث، تحليل البيانات). أنواع الدراسات العلمية: الدراسات الاستطلاعية، الدراسات الوصفية، الدراسات التجريبية. مناهج وطرق البحث العلمي: المنهج الوصفي، المسح الاجتماعي، دراسة المضمون، تحليل المضمون، أنواع التصميمات التجريبية، الأساليب الوصفية، الأساليب الاستنتاجية. Scientific thinking and its specifications, definition of scientific research and its specifications, steps of scientific research and designing research tools and sample selection (choosing a research subject, defining the research problem and the principles of choice, setting the research frame and methodology and data analysis). Types of scientific studies: Descriptive, survey and experimental studies. Scientific research methods: Descriptive method, social screening, content study, content analysis, types of experimental designs, descriptive methods, analytical methods.									
References	Ann Sloan Devlin, "The Research Experience: Planning, Conducting and Reporting Research", SAGE, 2nd Edition, 2020 C.R. Kothari, "Research Methodology: Methods and Techniques", New Age, 2nd Edition, 2004, ISBN (13) : 978-81-224-2488-1										

Code	Course Title	Pre-req.	CH	Ct. Hr.				Assessment			
				Lec.	Lab.	Tut.	Sum	SA	MT	PE/OE	Final
UHS 803	Thinking Skills	-	2	2	-	-	2	30%	30%	-	40%
Course Contents	مفاهيم نظرية (الذاكرة -التفكير- الإبداع)، مدخل إلى تعليم مهارات التفكير، طبيعة التفكير (تعريفه – خصائصه – مستوياته)، أنواع التفكير (الإبداعي- الناقد- العلمي)، مهارات التفكير المعرفية، مهارات التفكير الميتا معرفية، أدوات قياس التفكير، أنماط التفكير المختلفة ومها راتها، الاستراتيجيات المستخدمة في تنمية مهارات التفكير، برامج تعليم مهارات التفكير، طرق تعليم مهارات التفكير. Theoretical concepts (memory – thinking – creativity), an introduction to teaching thinking skills, the nature of thinking (definition – characteristics – levels) types of thinking (creative – critical – scientific), cognitive thinking skills, metacognitive thinking skills, thinking measurement tools, different thinking patterns, and skills, strategies used to develop thinking skills, thinking skills programs, ways to teach thinking skills									
References	John Butterworth, Geoff Thwaites, “Thinking Skills: Critical Thinking and Problem Solving”, 2nd edition, 2016, ISBN-13 : 978-1107606302										

Faculty Requirements for Desplinary Programs متطلبات الكلية

All programs offered at Benha Faculty of Engineering, Benha University are Engineering Programs. The graduates have the opportunity of being Engineers and are registered in the Egyptian Engineering Syndicate.

According to the National Academic Reference Standards (NARS-2018), The Engineering Graduate must be able to (A-Level):

A1. Identify, formulate, and solve complex engineering problems by applying engineering fundamentals, basic science and mathematics.

A2. Develop and conduct appropriate experimentation and/or simulation, analyse and interpret data, assess and evaluate findings, and use statistical analyses and objective engineering judgment to draw conclusions.

A3. Apply engineering design processes to produce cost-effective solutions that meet specified needs with consideration for global, cultural, social, economic, environmental, ethical and other aspects as appropriate to the discipline and within the principles and contexts of sustainable design and development.

A4. Utilize contemporary technologies, codes of practice and standards, quality guidelines, health and safety requirements, environmental issues and risk management principles.

A5. Practice research techniques and methods of investigation as an inherent part of learning.

A6. Plan, supervise and monitor implementation of engineering projects.

A7. Function efficiently as an individual and as a member of multi-disciplinary and multi-cultural teams.

A8. Communicate effectively – graphically, verbally and in writing – with a range of audiences using contemporary tools.

A9. Use creative, innovative and flexible thinking and acquire entrepreneurial and leadership skills to anticipate and respond to new situations.

A10. Acquire and apply new knowledge; and practice self, lifelong and other learning strategies.

To achieve these Learning Outcomes, a set of courses has to be completed as a Faculty Requirement. These courses are divided into Basic Science Courses and Basic Engineering Courses.

Table 12 List of Faculty requirements courses.

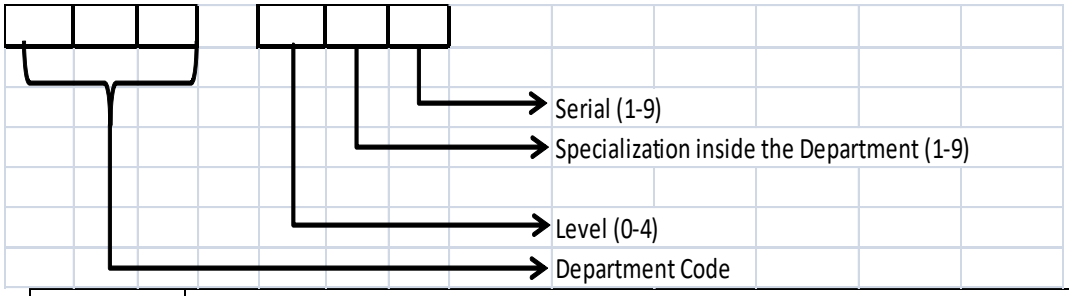
Code	Course	Pre-requisites	Cr. Hrs.	Ct. Hr.			
				Lec	Lab	Tut	Sum
BES 011	Mathematics I	-----	3	2	0	2	4
BES 021	Mechanics I	-----	3	2	0	2	4
BES 031	Physics I	-----	3	2	2	1	5
BES 041	General Chemistry	-----	4	3	2	1	6
MEC 011	Engineering Graphics	-----	2	0	0	4	4
BES 012	Mathematics II	BES 011	3	2	0	2	4
BES 022	Mechanics II	BES 021	3	2	0	2	4
BES 032	Physics II	-----	3	2	2	1	5
MEC 012	Production Engineering	-----	2	1	3	0	4
MEC 014	Computer Aided Drafting	MEC 011	2	1	2	0	3
ELE 042	Computer Programming Fundamentals	-----	2	0	2	2	4
BES 141*	Pollution and Industrial Safety	BES 041	2	2	1	0	3
FTR 103	Field Training I	Completion of 65 Cr.Hrs	0	0	0	0	0
FTR 203	Field Training II	Completion of 96 Cr.Hrs	0	0	0	0	0
Total			32	19	14	17	50

* Course teaching is shared between the Basic Engineering Science Department and Displine Department.

Faculty Requirement Courses

The course coding is divided into two parts and follows the following convention:

1. Three Letters which are the Department code.
2. Three Numbers indicating the Level, the Specialization inside the department, and a counter inside the specialization.



BES x1x	Mathematics Courses offered by Basic Engineering Science Department
BES x2x	Mechanics Courses offered by Basic Engineering Science Department
BES x3x	Physics Courses offered by Basic Engineering Science Department
BES x4x	Chemistry Courses offered by Basic Engineering Science Department
MEC xxx	Course offered by Mechanical Engineering Department for Faculty Requirement
ELE xxx	Course offered by Electrical Engineering Department for Faculty Requirements

The following abbreviations are the legend for the courses:

CH Credit Hour
Ct. Hr. Contact Hour
Lec Lectures
Tut Tutorials
Lab Laboratory
Tot Total
MT Mid-Term Exam
SA Student Activity
PE Practical Exam

Code	Course Title	Pre-req	CH	Ct. Hrs.				Assessment			
BES 011	Mathematics I	-	3	Lec.	Lab	Tut	Tot	SA	MT	PE/OE	Final
				2	0	2	4	30	30	0	40
Course Content	**Differential Calculus:** Real functions and their graphs (Algebraic functions, trigonometric functions and their inverses, exponential, hyperbolic and logarithmic functions). Limits and continuity. Differentiation of real functions of one variable. Applications of differentiation (maxima, minima and inflection points, curve tracing, optimization problems). The first mean value theorem and first order approximation of functions. Taylor's and Maclaurin's expansions of functions. **Algebra:** Elements of mathematical logic with applications, Matrix algebra and systems of linear equations (Gauss elimination, Gauss – Jordan elimination, LU factorization, matrix inversion). Applications (codes, matrix games). Eigenvalues and eigenvectors. Complex numbers.										
References	• Howard Anton, "Calculus with analytical geometry", John Wiley & Sons, Last Edition. • Gilbert Strang, "Introduction to Linear Algebra", Wellesley-Cambridge Press, Last Edition.										

Code	Course Title	Pre-req	CH	Ct. Hrs				Assessment			
				Lec.	Lab	Tut	Tot	SA	MT	PE/OE	Final
BES 012	Mathematics II	BES 011	3	2	0	2	4	30	30	-	40
Course Content	**Integral Calculus:** Indefinite integrals with applications. Methods of integration. Definite integrals with applications (areas, volumes of revolution, lengths of curves and surface area). **Multivariable Calculus (A):** Surfaces and curves in three dimensions. Vector functions of one variable. Scalar functions of several variables, partial derivatives. Directional derivatives, total derivatives. Applications (tangent planes and normal lines. Taylor expansions, maxima and minima, Lagrange's multipliers).										
References	• Howard Anton, "Calculus with analytical geometry", John Wiley & Sons, Last Edition. • George B. Thomas, Jr., Maurice D. Weir, Joel Hass, THOMAS' CALCULUS Multivariable (Twelfth Edition), 2010. .										

Code	Course Title	Pre-req	CH	Ct. Hrs.				Assessment			
				Lec.	Lab	Tut	Tot	SA	MT	PE/OE	Final
BES 021	Mechanics I	-	3	2	-	2	4	30	30	-	40
Course Content	Fundamentals of statics, Types of supports, Vector algebra and applications to mechanics, Statics of particles, Moments of forces and couples, Equivalent systems of forces and moments. Equilibrium of rigid bodies, Centroides and centers of gravity, Analysis of structures (trusses and machines), Friction and its applications. Virtual Work for a System of Connected Rigid Bodies, Stability of Equilibrium Configuration.										
References	• F. P. Beer, E. R. Johnston, D. F. Mazurek, P. J. Cornwell, Vector Mechanics for Engineers: Statics and Dynamics, 10th edition (2013). • Hibbeler, R. C. Engineering Mechanics: Statics and Dynamics, 10th Edition. Upper Saddle River, New Jersey: Prentice Hall, (2003).										

Code	Course Title	Pre-req	CH	Ct Hrs				Assessment			
				Lec.	Lab	Tut	Tot	SA	MT	PE/OE	Final
BES 022	Mechanics II	BES 021	3	2	0	2	4	30	30	0	40
Course Content	Kinematics of particles (rectilinear and curvilinear motion), Kinetics of particles (force and acceleration method – work and energy method – impulse and momentum method), Planar Kinematics of rigid bodies (translation – rotation about a fixed axis – general plane motion), planar kinetics of rigid bodies (force and acceleration method – work and energy method. – impulse and momentum method). Moment of area, mass moments of inertia for single body, product of inertia and principal moments of inertia.										
References	• F. P. Beer, E. R. Johnston, D. F. Mazurek, P. J. Cornwell, Vector Mechanics for Engineers: Statics and Dynamics, 10th edition (2013). • Hibbeler, R. C. Engineering Mechanics: Statics and Dynamics, 10th Edition. Upper Saddle River, New Jersey: Prentice Hall, (2003).										

Code	Course Title	Pre-req	CH	Ct. Hrs.				Assessment			
BES 031	Physics I	-	3	Lec.	Lab	Tut	Tot	SA	MT	PE/OE	Final
				2	2	1	5	10	30	20	40
Course Content	Wave motion, Sound waves, Doppler effect, Superposition of waves: interference, standing waves and beats, Interference of light waves, Diffraction of light, Polarization of light, First law of thermodynamics, Kinetic theory of gases, specific heats of gases, thermodynamic processes: isochoric, isobaric, isothermal and adiabatic, Heat transfer: conduction, convection and radiation, Elasticity, Hooke's law, Hydrostatics and surface tension, Hydrodynamics and Viscosity.										
References	• R. A. Serway and J. W. Jewett, Physics for scientists and engineers: Cengage learning, 2018. • Tarek M. Abdolkader, Mohamed Elfaham, Mina Asham, Ibrahim Sayed, Walid Selmy, *"Engineering Physics, Part I, Waves, Heat and Optics"*, 1st edition, 2022. • D. Halliday, et al., Fundamentals of physics: John Wiley & Sons, 2013. • D. Giancoli, Physics for Scientists & Engineers with Modern Physics, 4th Edition ed. Pearson, 2008.										
Laboratory	• Simple harmonic motion • Waves in stretched string, • Sound waves, • Interference and diffraction of light, • Polarization of light, • Specific heat, Thermistor and thermal conductivity.										

Code	Course Title	Pre-req	CH	Ct. Hrs				Assessment			
BES 032	Physics II	-	3	Lec.	Lab	Tut	Tot	SA	MT	PE/OE	Final
				2	2	1	5	10	30	20	40
Course Content	Electric force and electric field, Motion of charge in electric field, Electric dipole, Gauss law and applications, Electric potential, Capacitors and dielectrics, Current and resistance, Magnetic field and magnetic force, Sources of magnetic field, Bio-Savart law and Ampere's laws, Electromagnetic induction and Faraday's law, Self-induction and magnetic energy.										
References	• R. A. Serway and J. W. Jewett, Physics for scientists and engineers: Cengage learning, 2018. • Tarek M. Abdolkader, Mohamed Elfaham, Mina Asham, Ibrahim Sayed, Walid Selmy, *"Engineering Physics, Part II, Waves, Heat and Optics"*, 1st edition, 2022. • D. Halliday, et al., Fundamentals of physics: John Wiley & Sons, 2013. • D. Giancoli, Physics for Scientists & Engineers with Modern Physics, 4th Edition ed. Pearson, 2008.										
Laboratory	• Ohm's Law • Wheatstone bridge & Metric bridge • Electric Field Mapping • Capacitor Charging and Discharging • The Electric Transformer • Faraday's Law										

Code	Course Title	Pre-req	CH	Ct. Hrs.				Assessment			
BES 041	General Chemistry	-	4	Lec.	Lab	Tut	Tot	SA	MT	PE/OE	Final
				3	2	1	6	10	30	20	40
Course Content	Gases: ideal & real gas laws, kinetic molecular theory- Liquids and solutions - Solids: arrangement of atoms, metallic solids, alloys - Chemical kinetics: reaction rates & order, catalysis – Electrochemistry: electrochemical cells, corrosion– Cements – Polymers – lubricants.										
References	- J. Brady, "General Chemistry, Principles and structures", Wiley Inc., Fifth Edition, 1990. - L. W. Fine, H. Beall, J. Stuehr, "Chemistry for Scientists and Engineering, Preliminary Edition, Brooks Cole; 1st edition, 1999. -Steven S. Zumdahl, "Chemistry Principles", Third Edition, Houghton Mifflin, 1998. -Prof. Elsayed Fouad, Engineering Chemistry I, II. -Steven S. Zumdahl, Susan A. Zumdahl "Chemistry" Seventh Edition, Houghton Mifflin, 2007. -P. Barnes, J. Bensted, Structure and Performance of Cements, CRC Press, 2nd Edition, 2019.										
Laboratory	-Neutralization Reactions -Oxidation-Reduction Reactions -W/C Ratio -Precipitation Reactions										

Code	Course Title	Pre-req	CH	Ct Hrs				Assessment			
BES 141	Pollution and Industrial Safety	BES 041	2	Lec.	Lab	Tut	Tot	SA	MT	PE/OE	Final
				2	1	-	3	10	30	20	40
Course Content	- Air pollution-sources and types of pollutants-Adverse effects -ozone depletion – green house effects- Acid rain and global warming -measurement and control methods. - Water pollution- sources and types- constituents of wastewater- primary treatment: various pre-treatment methods - Advanced Treatment: chemical oxidation, precipitation, air stripping, - heavy metals removal. **Civil and Architecture Engineering students:** Plan and manage construction health and safety, maintain safety issues for construction to introduce the foundations on which appropriate health and safety systems may be built. Occupation and health and safety affect all aspects of work. Legal framework for health and safety. **Mechanical Engineering students:** Hazards analysis-Hazards of pressure , uses of over pressure-hazards of temperature-HAZOP study regarding pressure, temperature & flow -static electricity & its control purging and inerting -relief valves and rupture disks-venting – flame arrester -flare system-alarms and types of alarms and its application-trips d interlock system-hot work permit , confined space vessel work permit & height work permit - personnel protective equipment-On-site &Off-site emergency plan. **Electrical Engineering students:** Electric shock and burns from live wire contact, Fires from faulty wiring, overloading circuits, leaving electrical parts exposed, Electrocution or burns from lack of PPE, Explosions and fires from explosive and flammable substances, Contact with overhead power lines Electrical exposure to water.										
References	• Handbook of "Industrial Safety and Health, Trade and Technical Press Ltd. Morden, U.K.1980. • S.P. Mahajan, "Pollution Control in Process Industries" Tata McGraw Hill, NewDelhi1985.										
Laboratory	• Air sampling • Water sampling • Adsorption • Precipitation										

Code	Course Title	Pre-req	CH	Ct. Hr.				Assessment Criteria			
				Lec.	Lab	Tut	Sum	SA	MT	PE/OE	Final
MEC 011	Engineering Graphics	-	2	0	0	4	4	30	30	-	40
Course Content	Engineering drawing techniques and skills. Conventional lettering and dimensioning. Geometric constructions. Theories of view derivation. Orthographic projection of engineering bodies. Derivation of views from isometric drawings and deducing of missing views. Sectioning views: (full, half, offset, partial, revolved, removed, and partial sectioning). Steel construction, Symbols of electrical circuits										
References	William Chalk, Goetsch, "Technical Drawing", Delmar technical graphics series, 6th edition, 2010. Allbert W. Boundy, "Engineering Drawing", McGraw-Hill Australia, 2012										
Laboratory	Student's engineering sketches and drawings carried out in the engineering drawing Labs.										

Code	Course Title	Pre-req	CH	Ct. Hr.				Assessment Criteria			
				Lec.	Lab	Tut	Sum	SA	MT	PE/OE	Final
MEC 012	Production Engineering	-	2	1	3	0	4	10	30	20	40
Course Content	Introduction, Types of industries, Casting processes: Main steps of sand casting, Pattern design, melting of metals, Cleaning and inspection of casting, Metal forming processes: Forging, Rolling, Extrusion, Drawing, Bending, Joining Processes: Temporary and permanent joints, welding techniques, Cutting Processes: Principles and elements of cutting processes, Basic cutting, and machining (Turning, Drilling, Milling, etc.,). Principles of production planning and control, Introduction to quality control.										
References	• Jiangshan Li, Semyon M. Meerkov, 2008, “Production Systems Engineering”, Springer; 1st ed. 2009 edition, 2008 • M. P. Groover, 2011, "Principles of Modern Manufacturing", 4th Ed., john Wiley & Sons, Inc.										
Laboratory	• Practicing the workshop measuring operations and tools • Practicing the sand-casting workshop • Practicing the welding workshop; electric arc welding, gas welding and cutting, and electric resistance welding • Practicing the machining workshop; turning, shaping, drilling, milling, and grinding • Practicing the metal forming workshop; rolling, bending, drawing, and extrusion • Practicing the carpentry workshop • Practicing the forging workshop										

Code	Course Title	Pre-req	CH	Ct. Hr.				Assessment Criteria			
				Lec.	Lab	Tut	Sum	SA	MT	PE/OE	Final
MEC 014	Computer Aided Drafting	MEC 011	2	1	2	0	3	10	30	20	40
Course Content	Introduction to Computer Aided Drafting, history, advantages, and limitation. Graphics/CAD involves the visualization, sketching, and geometric construction of mechanical components. Layout and creation 2D working industrial drawings that adhere to industry standards. Illustrate CAD drawing construction techniques, implementation of graphical communication through the use of the alphabet of lines, orthographic projection, section views, auxiliary views and the creation of assembly and detail mechanical components										
References	• William Chalk, Goetsch, "Technical Drawing", Delmar technical graphics series, 6th edition, 2010. • Allbert W. Boundy, "Engineering Drawing", McGraw-Hill Australia, 2012										
Laboratory	Student's engineering sketches and drawings carried out in the engineering Computer Labs										

Code	Course Name	Pre-req.	CH	Ct Hrs				Assessment			
				Lec.	Lab.	Tut.	Tot	SA	MT	PE/OE	Final
FTR 103	Field Training I	Completion of 65 CH	0	0	0	0	0	-	-	-	-
Course Contents	For 4 weeks interval as a minimum. Field training conducted under the supervision of a faculty member and field mentor in the actual field practice. The student must submit a detailed technical report by the end of training period, explain what he learned during this training. By the end of the training the student will be able to: Apply the principles knowledge to execute practical engineering field works. The students will have the opportunity to work with multidisciplinary teams during the training period.										

Code	Course Name	Pre-req.	CH	Ct Hrs				Assessment			
				Lec.	Lab.	Tut.	Tot	SA	MT	PE/OE	Final
FTR 203	Field Training II	Completion of 96 CR	0	0	0	0	0	-	-	-	-
Course Contents	For 4 week interval as a minimum. Field training conducted under the supervision of a faculty member and field mentor in the actual field practice. The student must submit a detailed technical report by the end of training period, explain what he learned during this training. By the end of the training the student will be able to: Apply the principles knowledge to execute practical engineering field works. The students will have the opportunity to work with multidisciplinary teams during the training period.										

Code	Course Title	Pre-req	CH	Ct. Hr.				Assessment			
				Lec.	Lab	Tut	Sum	SA	MT	PE/OE	Final
ELE 042	Computer Programming Fundamentals	-	2	0	2	2	4	10	30	20	40
Course Content	Computer System: Hardware, Software - Introduction to software design - evolution and comparison of programming languages - types and characteristics of translators - Program Design Process - Software Life Cycle - structured programming - Variables, Constants - Input and Output - Data Types and Representation - Simple Flow - Flow of Control (Conditioning, Iteration) - Array - Functions (Predefined - Programmer Defined) - Pointers- Strings - program maintenance & testing – documentation. Course topics are explained using a high-level language (as C, or C++).										
References	• W. Savitch, "Problem Solving with C++", 10th Edition, Pearson, 2018, ISBN-13: 978-0134448282 • Jery Hanly, Elliot Koffman, “Problem Solving and Program Design in C”, 8th edition, Pearson, 2015, ISBN-13: 978-0134014890 • C.R. Severance, S. Blumenburg, "Python for Everybody: Exploring Data in Python 3", CreateSpace Independent Publishing Platform, 2016, ISBN-13: 978-1530051120 • R. Sedgweck, K. Wayne, "Introduction to Programming in Java: An Interdisciplinary Approach”, 2nd Edition, Addison-Wesley Professional, 2017, ISBN-13: 978-0672337840										
Laboratory	Problem solving labs using high level language (C, or C++) to apply explained topics in each lecture including: • Flowcharts • Data Types, Variable, Constant declaration. Input and Output • Sequence Flow program • Conditioning Statements (if, nested if and switch case) • Iteration Statements (for, while do while, Do Until, and nested loops) • Arrays (1D and 2D arrays) • Functions (predefined and user defined) • Pointers • Strings and string functions * Project: At the end of the course the student must provide a project emphasizing the course content										

Program # 4 Electrical Power and Machines Engineering Program

Program Description

The Electrical Power and Machines Engineering Program is designed to qualify its graduates for both fundamental and modern trends in electrical power systems, design, operation and control. The program is structured in a hierarchical manner based on strong mathematical and physics background while moving gradually up to the fundamental electrical engineering subjects. Then, reaching to the major specialty courses of power systems design, operation, installation, control and economics. The program pays significant attention to the renewable electrical energy resources as well as the smart grid operation and control with the objective of environmental conservation and economical aspects. The program adapts the updated approaches and methodology in teaching and learning activities and assessment with focus on achieving balance between academic background and professional skills of the graduates. Students in the program are centered of focus by implanting self-learning attitude, peer discussions, and courses embedded engineering skills. The assessment techniques are devised in a way to avoid passing the courses unless the student gets the intended learning outcomes.

Basic Information

Program Mission

The program seeks to achieve a high level of competitiveness through the preparation of a distinguished and innovative engineer in the field of electrical power engineering and its applications, be able to use advanced scientific knowledge and communication skills and its tools while adhering to the ethics of the profession by keeping pace with the needs of the market and achieve sustainable economic development and community service, and armed with the skills of performing scientific research. The program also urges students to engage in fundamentals of entrepreneurship

Program Objectives

Electrical Power and Machines Engineering Program is planned to: -

1. Qualify graduates for fundamental and modern trends in electrical power systems, design, operation, and control.
2. Prepare graduates to compete for the best jobs in several electrical power and machines engineering areas.
3. Qualify graduates to design a system, experiment, component, and process to meet the required needs of energy generation, transmission and distribution within realistic constraints, and data analysis and interpretation.
4. Prepare graduates to implement science, mathematics, and computational technology knowledge to investigate and solve problems encountered in the electrical power industry.
5. Qualify graduates to follow lifelong learning and continuously improve their knowledge in the electrical power engineering practice and contribute to the advancement of the engineering profession.
6. Prepare graduates to communicate effectively through speaking, writing, and using graphics, functioning collaboratively within multi-disciplinary problem-solving teams.

Graduate Attributes

The general engineering graduates' attributes as NARS 2018, the graduate would be able to:

Graduate attributes are the academic abilities, personal qualities, and skills which electronics and electrical communications engineering graduates should have. In addition to all engineering graduate attributes defined by NARS 2018, Electronics and Electrical Communications Engineering graduate should be able to:

1. Master a wide spectrum of engineering knowledge and specialized skills and can apply acquired knowledge using theories and abstract thinking in real life situations
2. Apply analytic critical and systemic thinking to identify, diagnose and solve engineering problems with a wide range of complexity and variation.
3. Behave professionally and adhere to engineering ethics and standards.
4. Work in and lead a heterogeneous team of professionals from different engineering specialties and assume responsibility for own and team performance.
5. Recognize his/her role in promoting the engineering field and contribute to the development of the profession and the community.
6. Value the importance of the environment, both physical and natural, and work to promote sustainability principles.
7. Use techniques, skills, and modern engineering tools necessary for engineering practice.
8. Assume full responsibility for own learning and self-development, engage in lifelong learning and demonstrate the capacity to engage in post- graduate and research studies.
9. Communicate effectively using different modes, tools, and languages with various audiences; to deal with academic/professional challenges in a critical and creative manner.
10. Demonstrate leadership qualities, business administration and entrepreneurial skills.
11. Design, operate, analyze, and maintain different electric power and electrical machines engineering systems.
12. Use modern software tools to design, simulate, and implement different parts of electric power and machines engineering systems.

Program Learning Outcomes

The program courses fulfill the NARS 2018

Level A

The Engineering Graduate must be able to:

PLO1. Identify, formulate, and solve complex engineering problems by applying engineering fundamentals, basic science and mathematics.

PLO2. Develop and conduct appropriate experimentation and/or simulation, analyze and interpret data, assess and evaluate findings, and use statistical analyses and objective engineering judgment to draw conclusions.

PLO3. Apply engineering design processes to produce cost-effective solutions that meet specified needs with consideration for global, cultural, social, economic, environmental, ethical and other aspects as appropriate to the discipline and within the principles and contexts of sustainable design and development.

PLO4. Utilize contemporary technologies, codes of practice and standards, quality guidelines, health and safety requirements, environmental issues and risk management principles.

PLO5. Practice research techniques and methods of investigation as an inherent part of learning.

PLO6. Plan, supervise and monitor implementation of engineering projects, taking into consideration other trades requirements.

PLO7. Function efficiently as an individual and as a member of multi-disciplinary and multi-cultural teams.

PLO8. Communicate effectively – graphically, verbally and in writing – with a range of audiences using contemporary tools.

PLO9. Use creative, innovative and flexible thinking and acquire entrepreneurial and leadership skills to anticipate and respond to new situations.

PLO10. Acquire and apply new knowledge, and practice self, lifelong and other learning strategies.

Level B

In addition to the program learning outcomes for All Engineering Programs the BASIC ELECTRICAL Engineering graduate and similar programs must be able to:

PLO11. Select, model, and analyze electrical power systems applicable to the specific discipline by applying the concepts of generation, transmission, distribution, protection, control, and high voltage of electrical power systems.

PLO12. Design, model, and analyze an electrical system or component for a specific application; and identify the tools required to optimize this design.

PLO13. Design and implement elements, modules, sub-systems or systems in electrical engineering using technological and professional tools.

PLO14. Estimate and measure the performance of an electrical power system under specific input excitation and evaluate its suitability for a particular application.

PLO15. Adopt suitable national and international standards and codes to: design, build, operate, inspect and maintain electrical/electronic/digital equipment, systems and services.

Level C

In addition to program learning outcomes for all engineering programs (Level A, NARS 2018), and Electric Engineering program learning outcomes (Level B, NARS 2018), the Electrical Power and Machines Engineering Program graduate must be able to (C-Level):

PLO16. Analyze the performance of electric power generation, control and distribution systems.

PLO17. Design and perform experiments, as well as analyses and interpret experimental results related to electrical power and machines system.

PLO18. Test and examine components, equipment and systems of electrical power and machines.

PLO19. Integrate electrical, electronic and mechanical components and equipment with transducers, actuators and controllers in creatively computer-controlled systems.

PLO20. Apply modern techniques, skills and engineering tools to electrical power and machines engineering systems.

Faculty Mission vs. Program Mission Matrix

Faculty Mission		Program Mission		
		The Electrical Power and Machines Engineering program at Benha Faculty of Engineering aims focuses on both the theoretical and practical aspects of electrical power and machines engineering. This is achieved by addressing the fundamental concepts of engineering mathematics, physical sciences, electrical machines and drives, power electronics, energy conversion, high voltage engineering, power system analysis, distribution, control, and protection. The program study plan aims at qualifying the graduates to have the ability to apply engineering principles needed for solving problems that arise in the field of electrical power engineering, and it qualifies them to compete for the best jobs in Egypt and the advanced countries. Also, the program is committed to providing continuing education, outreach activities, consulting, and scientific research.		
		Qualify the graduates to have the ability to apply engineering principles needed for solving problems that arise in the field of electrical power engineering	Qualify the graduates to compete for the best jobs in Egypt and the advanced countries. Also, the program is committed to providing continuing education, outreach activities, consulting, and scientific research	Participate effectively and ethically in serving their professional and societal communities
Benha University is committed to graduate well prepared engineers equipped with knowledge and skills necessary to compete in labor market, and capable of using and developing modern technology, and providing research in engineering fields to serve society and community.	graduate well prepared engineers equipped with knowledge and skills	√		
	compete in labor market capable of using and developing modern technology, and providing research in engineering fields		√	
	serve society and community.			√

Program Mission vs. Program Objectives Matrix

Program Mission		Program Objectives					
		PO1	PO2	PO3	PO4	PO5	PO6
The Electrical Power and Machines Engineering program at Benha Faculty of Engineering aims focuses on both the theoretical and practical aspects of electrical power and machines engineering. This is achieved by addressing the fundamental concepts of engineering mathematics, physical sciences, electrical machines and drives, power electronics, energy conversion, high voltage engineering, power system analysis, distribution, control, and protection. The program study plan aims at qualifying the graduates to have the ability to apply engineering principles needed for solving problems that arise in the field of electrical power engineering, and it qualifies them to compete for the best jobs in Egypt and the advanced countries. Also, the program is committed to providing continuing education, outreach activities, consulting, and scientific research.	Qualify the graduates to have the ability to apply engineering principles needed for solving problems that arise in the field of electrical power engineering	√	√	√	√		√
	Qualify the graduates to compete for the best jobs in Egypt and the advanced countries. Also, the program is committed to providing continuing education, outreach activities, consulting, and scientific research		√	√	√	√	
	Participate effectively and ethically in serving their professional and societal communities		√		√		√

Program Objectives vs. Graduate Attributes Matrix

Program Objectives	Graduate Attributes											
	GA 1	GA 2	GA 3	GA 4	GA 5	GA 6	GA 7	GA 8	GA 9	GA 10	GA 11	GA 12
PO1	√											
PO2		√	√									
PO3							√				√	
PO4								√	√			
PO5					√	√					√	√
PO6				√						√		√

Program Competencies vs. Program Objectives Matrix

Program Objectives	Program Competencies																			
	Level A										Level B					Level C				
	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	B1	B2	B3	B4	B5	C1	C2	C3	C4	C5
PO1	√		√								√	√	√							
PO2										√						√				
PO3		√	√							√	√	√	√			√	√	√		
PO4				√	√	√							√		√					√
PO5									√	√				√					√	
PO6					√	√	√	√						√	√				√	√

Career Prospects

The prospect market of the Electrical Power and Machines Engineering Program graduate is widespread. Electrical power networks planning, design, and installation in urban areas, hospitals, touristic, educational and administrative buildings is a sizable market for the graduates in engineering contracting, and manufacturing firms. Industrial control and maintenance of electrical motors, traction, escalators, and elevators are covered within the program profession. Electrical power utilities; distribution, transmission, and generation are as well as major market labour for the graduals.

List of Electrical Power and Machines Engineering Program Requirement Courses

Requirement	Cr. Hrs.	Ct. Hr			
		Lec	Lab	Tut	Tot
Benha University Requirements	14	14	0	0	14
Benha Faculty of Engineering Requirements	32	20	37	43	50
Discipline Requirements	67	45	22	35	102
Major Power and Machines Engineering Program Requirements	29	19	14	12	45
Concentration of Power and Machines Engineering Requirements	18	12	6	12	30
Total	160	110	78	102	241

Basic Science Requirements of Electrical Power and Machines Program

Basic Science Requirements of Electrical Power and Machines Program

Code	Course	Pre-Req	Cr. Hrs.	Ct. Hr.			
				Lec	Lab	Tut	Sum
BES 011	Mathematics I		3	2	0	2	4
BES 041	General Chemistry		4	3	1	2	6
BES 031	Physics I		3	2	2	1	5
BES 012	Mathematics II	BES 011	3	2	0	2	4
BES 032	Physics II		3	2	2	1	5
BES 111	Differential Equations	BES 012	3	2	0	2	4
BES 113	Mathematics III	BES 012	3	2	0	2	4
BES 112	Numerical Analysis	BES 111	3	2	2	0	4
BES 141	Pollution and Industrial Safety	BES 041	2	2	1	0	3
BES 131	Modern Physics	BES 031 BES 032	2	2	0	2	4
Total			29	21	8	14	43

One credit Hour Has been added to the Basic Science Courses from ELE 371
One credit Hour Has been added to the Basic Science Courses from ELE 271

Discipline Requirements of Electrical Power and Machines Program

Code	Course	Pre-Req	Cr. Hrs.	Ct. Hr.			
				Lec	Lab	Tut	Sum
BES 111	Differential Equations	BES 012	3	2	0	2	4
BES 113	Mathematics III	BES 012	3	2	0	2	4
ELE 111	Electric Circuits I	BES 032	3	2	1	2	5
ELE 112	Electric Circuits II	ELE 111	3	2	1	2	5
ELE 141	Digital Logic Circuits		3	2	1	2	5
ELE 213	Electronic Circuits I	BES 131	3	2	1	2	5
MEC 128	Thermal Power Engineering		2	2	0	1	3
BES 131	Modern Physics	BES 031 BES 032	3	2	0	2	4
ELE 173	Electrical Applications		2	1	3	0	4
BES 112	Numerical Analysis	BES 111	3	2	2	0	4
ELE 132	Measurements and Instrumentations I	ELE 111 or ELE 179	3	2	2	1	5
ELE 237	Measurements and Instrumentations II	ELE 132	3	2	1	2	5
ELE 216	Electromagnetic Field	BES 113	3	2	0	2	4
ELE 231	Control Theory	BES 111	3	2	1	2	5
ELE 245	Computer Applications	ELE 042	3	2	2	0	4
MEC 228	Power Station	MEC 128	3	2	0	2	4
*ELE 271	Electrical Power System I	ELE 112	3	2	0	2	4
ELE 273	Power Electronics I	ELE 213	3	2	1	2	5
ELE 277	Electrical Machine I	ELE 112	3	2	1	2	5
ELE 232	Modern Control System	ELE 231	3	2	2	1	5
ELE 373	Renewable Energy	ELE 278	3	2	0	2	4
ELE 335	Industrial Automation Systems	ELE 232& ELE 132	3	2	2	1	5
ELE 347	Microcontroller Embedded Systems	ELE 141	3	2	2	0	4
Total			67	45	22	35	102

Major Requirements of Electrical Power and Machines Program

Code	Course	Pre-Req	Cr. Hrs.	Ct. Hr.			
				Lec	Lab	Tut	Sum
*ELE 371	Power System Analysis	ELE 272	3	2	0	2	4
ELE 372	Power System Protection	ELE 371	3	2	0	2	4
ELE 375	Electrical Drive	ELE 278	3	2	0	2	4
ELE 377	Special Machines	ELE 278	2	2	1	0	3
ELE 376	Power Systems Distribution	ELE 272	2	2	1	0	3
ELE 471	High Voltage Engineering	ELE 272	3	2	0	2	4
ELE 272	Electrical Power System II	ELE 271	3	2	0	2	4
ELE 274	Power Electronics II	ELE 273	3	2	1	2	5
ELE 278	Electrical Machine II	ELE 277	3	2	1	2	5
ELE 392	Senior Design Project I	70 % of Total Hrs.	2	0	4	0	4
ELE 491	Senior Design Project II	ELE 392	3	1	4	0	5
ELE 4xx	Elective I		3	2	0	2	4
ELE 4xx	Elective II		3	2	0	2	4
ELE 4xx	Elective III		3	2	0	2	4
ELE 4xx	Elective V		3	2	0	2	4
ELE 4xx	Elective IV		3	2	0	2	4
ELE 4xx	Elective VI		3	2	0	2	4
Total			47	31	14	24	69

*One credit Hour Has been added to the Basic Science Courses

Concentration Requirements of Electrical Power and Machines Program

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hr.			
				Lec	Lab	Tut	Sum
Pool Courses for Elective I, Elective II, Elective III							
ELE 472	Advanced Power Electronics	ELE 274	3	2	0	2	4
ELE 474	Power System Control	ELE 272	3	2	0	2	4
ELE 476	Power System Operation	ELE 371	3	2	0	2	4
ELE 478	Smart Grid Technology	ELE 373	3	2	0	2	4
ELE 480	Grid Integration of Renewable Energy Systems	ELE 373	3	2	0	2	4
ELE 482	Advanced Electric Machines	ELE 278	2	2	0	2	4
Pool Courses for Elective IV, Elective V, Elective VI							
ELE 473	Electrical Power Quality	ELE 272	3	2	0	2	4
ELE 475	Industrial Instrumentation	ELE 132	3	2	0	2	4
ELE 477	Advanced Power Systems	ELE 272	3	2	0	2	4
ELE 479	HVDC and Flexible AC Transmission Systems	ELE 274	3	2	0	2	4
ELE 481	Switchgear Engineering and substation	ELE 372	3	2	0	2	4
ELE 485	Electrical Installations and Energy Utilization	ELE 376	3	2	0	2	4

Proposed Study Plan for Electrical Power and Machines Program

Level 0-1													
Code	Course	Pre-Req	Cr. Hrs.	Ct. Hr.				Final Exam Time	Assessment				
				Lec	Lab	Tut	Sum		SA	MT	PE/ OE	Final Exam	Sum
BES 011	Mathematics I		3	2	0	2	4	2	30	30	-	40	100
BES 021	Mechanics I		3	2	0	2	4	2	30	30	-	40	100
BES 041	General Chemistry		4	3	2	1	6	2	10	30	20	40	100
BES 031	Physics I		3	2	2	1	5	2	10	30	20	40	100
MEC 011	Engineering Graphics		2	0	0	4	4	2	30	30	-	40	100
UHS 101	Foreign Language		2	2	0	0	2	2	30	30	-	40	100
UHS 102	Information and Communication Technology		2	2	0	0	2	2	30	30	-	40	100
Total			19	13	4	10	27						700

Level 0-2													
Code	Course	Pre-Req	Cr. Hrs.	Ct. Hr.				Final Exam Time	Assessment				
				Lec	Lab	Tut	Sum		SA	MT	PE/ OE	Final Exam	Sum
BES 012	Mathematics II	BES 011	3	2	0	2	4	2	30	30	-	40	100
BES 022	Mechanics II	BES 021	3	2	0	2	4	2	30	30	-	40	100
MEC 012	Production Engineering		2	1	3	0	4	2	10	30	20	40	100
BES 032	Physics II		3	2	2	1	5	2	10	30	20	40	100
MEC 014	Computer Aided Drafting	MEC 011	2	1	2	0	3	2	10	30	20	40	100
ELE 042	Computer Programming Fundamentals		2	0	2	2	4	2	10	30	20	40	100
UHS 103	Societal Issues		2	2	0	0	2	2	30	30	-	40	100
Total			17	10	9	7	26						700

Level 1-1													
Code	Course Name	Pre-Req.	Cr, Hr.	Ct. Hr.				Final Exam Time	Assessment				
				Lec	Lab	Tut	Sum		SA	MT	PE/ OE	Final Exam	Sum
BES 111	Differential Equations	BES 012	3	2	0	2	4	2	30	30	-	40	100
ELE 111	Electric Circuits I	BES 032	3	2	1	2	5	2	10	30	20	40	100
ELE 141	Digital Logic Circuits		3	2	1	2	5	2	10	30	20	40	100
BES 131	Modern Physics	BES 031 BES 032	3	2	0	2	4	2	30	30	-	40	100
ELE 173	Electrical Application		2	1	3	0	4	2	10	30	20	40	100
BES 113	Mathematics III	BES 012	3	2	0	2	4	2	30	30	-	40	100
UHS XXX	Humanities – Elective I		2	2	0	0	2	2	30	30	-	40	100
Total			19										700

Level 1-2													
Code	Course Name	Pre - Req.	Cr. Hr.	Ct. Hr.				Final Exam Time	Assessment				
				Lec	Lab	Tut			SA	MT	PE/ OE	Final Exam	Sum
BES 112	Numerical Analysis	BES 111	3	2	2	0	4	2	10	30	20	40	100
ELE 112	Electric Circuits II	ELE 111	3	2	1	2	5	2	10	30	20	40	100
ELE 213	Electronic Circuit I	BES 131	3	2	1	2	5	2	10	30	20	40	100
ELE 132	Measurments and Instrumentation I	ELE 111 or ELE 179	3	2	2	1	5	2	10	30	20	40	100
MEC 128	Thermal Power Engineering		2	2	0	1	3	2	30	30	-	40	100
UHS104	Professional Ethics		2	2	0	0	2	2	30	30	-	40	100
UHS XXX	Humanities Elective II		2	2	0	0	2	2	30	30	-	40	100
Total			18										700

Field Training I													
Code	Course	Pre-Req	Cr. Hrs.	Ct. Hr.				Final Exam time	Assessment				
				Lec	Lab	Tut	Sum		SA	MT	PE/OE	Final Exam	Sum
FTR 103	Field Training I	Completion of 65 Cr. Hr	0	0	0	0	0	Oral	-	-	-	Pass or Fail	-

Level 2-1													
Code	Course Name	Pre - Req.	Cr. Hr.	Ct. Hr.				**Final Exam Time**	**Assessment**				
				Lec	Lab	Tut			SA	MT	**PE/ OE**	**Final Exam**	**Sum**
ELE 271	Electrical Power System I	ELE 112	3	2	0	2	4	**2**	**30**	**30**	**-**	**40**	**100**
ELE 273	Power Electronics I	ELE 213	3	2	1	2	5	**2**	**10**	**30**	**20**	**40**	**100**
ELE 216	Electromagnetic Field	BES 113	3	2	0	2	4	**2**	**30**	**30**	**-**	**40**	**100**
ELE 277	Electrical Machine I	ELE 112	3	2	1	2	5	**2**	**10**	**30**	**20**	**40**	**100**
ELE 231	Control Theory	BES 111	3	2	1	2	4	**2**	**10**	**30**	**20**	**40**	**100**
ELE 237	Measurements and Instruments II	ELE 132	3	2	1	2	5	**2**	**10**	**30**	**20**	**40**	**100**
Total			18										**600**

Level 2-2													
Code	Course Name	Pre - Req.	Cr. Hr.	Ct. Hr.				Final Exam Time	Assessment				
				Lec.	Lab	Tut	Sum		SA	MT	PE/ OE	Final Exam	Sum
ELE 272	Electrical Power System II	ELE 271	3	2	0	2	4	**2**	**30**	**30**	**-**	**40**	**100**
ELE 274	Power Electronics II	ELE 273	3	2	1	2	5	**2**	**10**	**30**	**20**	**40**	**100**
MEC 228	Power Station	MEC 128	3	2	0	2	4	**2**	**30**	**30**	**-**	**40**	**100**
ELE 278	Electrical Machine II	ELE 277	3	2	1	2	5	**2**	**10**	**30**	**20**	**40**	**100**
ELE 232	Modern Control Systems	ELE 231	3	2	2	1	5	**2**	**10**	**30**	**20**	**40**	**100**
ELE 245	Computer Applications	ELE 042	3	2	2	0	4	**2**	**10**	**30**	**20**	**40**	**100**
Total			18										**600**

Field Training II													
Code	Course	Pre-Req	Cr. Hrs.	Ct. Hr.				Final Exam time	Assessment				
				Lec	Lab	Tut	Sum		SA	MT	PE/OE	Final Exam	Sum
FTR 203	Field Training I	Completion of 96 Cr. Hr	0	0	0	0	0	Oral	-	-	-	Pass or Fail	-

Level 3-1													
Code	Course Name	Pre-Req.	Cr. Hr.	Ct. Hr.				Final Exam Time	Assessment				
				Lec	Lab	Tut	Sum		SA	MT	PE/ OE	Final Exam	Sum
ELE 373	Renewable Energy	ELE 278	3	2	0	2	4	2	30	30	-	40	100
ELE 371	Power System Analysis	ELE 272	3	2	0	2	4	2	30	30	-	40	100
ELE 376	Power Systems Distribution	ELE 272	2	2	1	0	3	2	10	30	20	40	100
ELE 347	Microcontroller Embedded Systems	ELE 141	3	2	2	0	4	2	10	30	20	40	100
ELE 375	Electrical Drive	ELE 278	3	2	0	2	4	2	30	30	-	40	100
ELE 377	Special Machines	ELE 278	2	2	1	0	3	2	10	30	20	40	100
UHS 4XX	Humanities – Elective III		2	2	0	0	2	2	30	30	-	40	100
Total			18										700

Level 3-2													
Code	Course Name	Pre - Req.	Cr. Hr.	Ct. Hr.				Final Exam Time	Assessment				
				Lec	Lab	Tut	Sum		SA	MT	PE/ OE	Final Exam	Sum
ELE 372	Power System Protection	ELE 371	3	2	0	2	4	2	30	30	-	40	100
ELE 4XX	Elective I		3	2	0	2	4	2	30	30	-	40	100
ELE 4XX	Elective II		3	2	0	2	4	2	30	30	-	40	100
ELE 335	Industrial Automation Systems	ELE232 & ELE132	3	2	2	1	5	2	10	30	20	40	100
ELE 392	Senior Design Project I	70% of total CH	2	0	4	0	4	2	50	-	50	--	100
ELE 4XX	Elective III		3	2	0	2	4	2	30	30	-	40	100
Total			17										600

Level 4-1													
Code	Course Name	Pre - Req.	Cr. Hr.	Ct. Hr.				Final Exam Time	Assessment				
				Lec	Lab	Tut	Sum		SA	MT	PE/ OE	Final Exam	Sum
BES 141	Pollution and Industrial Safety	BES 041	2	2	1	0	3	**2**	**10**	**30**	**20**	**40**	**100**
ELE 4XX	Elective IV		3	2	0	2	5	**2**	**10**	**30**	**-**	**40**	**100**
ELE 471	High Voltage Engineering	ELE 272	3	2	0	2	4	**2**	**30**	**30**	**-**	**40**	**100**
ELE 491	Senior Design Project II	ELE 392	3	1	4	0	5	2	**50**	**-**	**50**	**--**	**100**
ELE 4XX	Elective V		3	2	0	2	4	**2**	**10**	**30**	**20**	**40**	**100**
ELE 4XX	Elective VI		3	2	0	2	4	**2**	**10**	**30**	**20**	**40**	**100**
Total			17										**600**

Matching Electrical power and machines engineering Program Courses with ABET Requirements

ABET Program Criteria for Electrical power and machines engineering Program and Similarly Named Engineering Programs Lead Society: American Society of Electrical Engineers.

ABET Criteria		Electrical power and machines engineering Program Courses Required to Cover ABET Criteria		
		CODE	Course Name	Cr. Hrs.
A minimum of 30 semester Cr. Hrs. (or equivalent) of a combination of college-level mathematics and basic sciences with experimental experience appropriate to the program.	The curriculum must prepare graduates to apply knowledge of mathematics through differential equations.	BES 011	Mathematics I	3
		BES 012	Mathematics II	3
		BES 111	Differential Equations	3
		BES 113	Mathematics III	3
		BES 112	Numerical Analysis	3
	Chemistry	BES 041	General Chemistry	4
		BES 141	Pollution and Industrial Safety	2
	Calculus-based physics	BES 031	Physics I	3
		BES 131	Modern Physics	3
		BES 032	Physics II	3
Total				**30**
A minimum of 45 semester Cr. Hrs. (or equivalent) of engineering topics appropriate to the program, consisting of engineering and computer sciences and engineering design and utilizing modern engineering tools.	The basic Courses of electrical power and machines engineering program.	ELE 111	Electric Circuits I	3
		ELE 112	Electric Circuits II	3
		ELE 141	Digital Logic Circuits	3
		ELE 213	Electronic Circuits I	3
		BES 131	Modern Physics	3
		ELE 173	Electrical Applications	2
		ELE 216	Electromagnetic Field	3
	Discuss the principle of control and automation system	ELE 131	Control Systems	3
		ELE 335	Industrial Automation Systems	3

		ELE 232	Modern Control System	3
A minimum of 45 semester Cr. Hrs. (or equivalent) of engineering topics appropriate to the program, consisting of engineering and computer sciences and engineering design and utilizing modern engineering tools.	Discuss the basic concepts of measurement and instrumentation	ELE 132	Measurements and Instrumentations I	3
		ELE 237	Measurements and Instrumentations II	3
	Discuss the principle of power electronics engineering	ELE 273	Power Electronics I	3
		ELE 274	Power Electronics II	3
		ELE 375	Electrical Drive	3
	Discuss the principle of electrical machines	ELE 277	Electrical Machine I	3
		ELE 278	Electrical Machine II	3
		ELE 377	Special Machines	2
	Considers the systems or processes from other electrical power and machines engineering curricular areas	ELE 392	Senior Design Project I	2
		ELE 491	Senior Design Project II	3
	Includes communication and collaboration with other design or construction team members	UHS 103	Societal Issues	2
		UHS 102	Information and Communication Technology	2
		UHS 104	Professional Ethics	2
	Include principles of electrical power system	ELE 271	Electrical Power System I	3
		ELE 272	Electrical Power System II	3
		ELE 371	Power System Analysis	3
		ELE 373	Renewable Energy	3
		ELE 372	Power System Protection	3
		ELE 379	Power Systems Distribution	2

		ELE 471	High Voltage Engineering	3
	Includes computer-based technology and considers applicable codes and standards.	ELE 042	Computer Programming Fundamentals	2
		ELE 245	Computer Applications	3
		ELE 347	Microcontroller Embedded Systems	3
Total				**91**

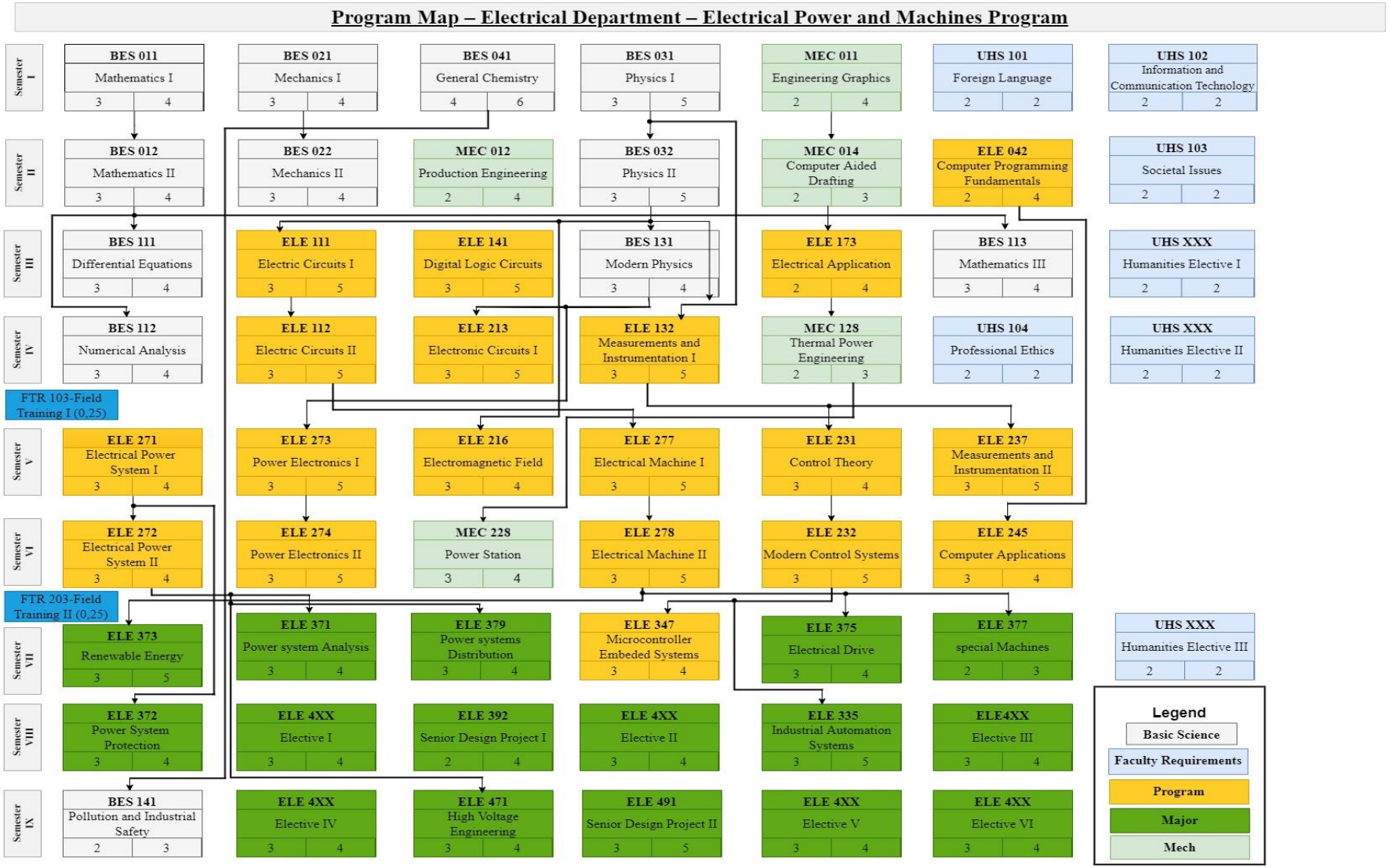
Courses Plan and Matrix

Program Map - Electrical Dept - Electrical Power & Machines

Level 1	BES 011 Mathematics I 3 4	BES 021 Mechanics I 3 4	BES 041 General Chemistry 4 6	BES 031 Physics I 3 5	MEC 011 Engineering Graphics I 2 4	UHS 101 English Language 2 2	UHS 102 Information and 2 2	19 27
	BES 012 Mathematics II 3 4	BES 022 Mechanics II 3 4	MEC 012 Production Engineering 2 4	BES 032 Physics II 3 5	MEC 014 Computer Aided Drafting 2 3	ELE 042 Computer Programming 2 4	UHS 103 Societal Issues 2 2	17 26
Level 2	BES 111 Diferential Equations 3 4	ELE 111 Electric Circuits I 3 5	ELE 141 Digital Logic Circuits 3 5	BES 131 Modern Physics 3 4	ELE 173 Electrical Application 2 4	BES 113 Mathematics III 2 4	UHS XXX Humanities - Elective I 2 2	18 28
	BES 112 Numerical Analysis 3 4	ELE 112 Electric Circuits II 3 5	ELE 213 Electronic Circuits I 3 5	ELE 132 Measurments and Instrumentation I 3 5	MEC 128 Thermal Power Engineering 2 3	UHS 104 Professional Ethics 2 2	UHS XXX Humanities Elective II 2 2	18 26
	FTR 103 - Field Traning I [0,25]							
Level 3	ELE 271 Electrical Power System I 3 4	ELE 273 Power Electronics I 3 5	ELE 216 Electromagnetic Field 3 4	ELE 277 Electrical Machine I 3 5	ELE 231 Control Theory 3 5	ELE 237 Measurments and Instrumentation II 3 5		18 28
	ELE 272 Electrical Power System II 3 4	ELE 274 Power Electronics II 3 5	MEC 228 Power Station 3 4	ELE 278 Electrical Machine II 3 5	ELE 232 Modern Control Systems 3 5	ELE 245 Computer Applications 3 4		18 27
	FTR 203 - Field Traning II [0,25]							
Level 4	ELE 371 Power System Analysis 3 4	ELE 373 Renewable Energy 3 4	ELE 375 Electrical Drive 3 4	ELE 377 Special Machines 2 3	ELE 379 Power Systems Distribution 2 3	ELE 347 Microcontroller Embedded 3 4	UHS XXX Humanities - Elective III 2 2	18 24
	ELE 372 Power System Protection 3 4	ELE 335 Industrial Automation 3 5	ELE 392 Senior Design Project I 2 4	ELE 4xx Elective I 3 4	ELE 4xx Elective II 3 4	ELE 4xx Elective III 3 4		17 25
Level 5	BES 141 Pollution and Industrial Safty 2 3	ELE 471 High Voltage Engineering 3 4	ELE 491 Senior Design Project II 3 5	ELE 4xx Elective IV 3 4	ELE 4xx Elective V 3 4	ELE 4xx Elective VI 3 4		17 24
								160 235

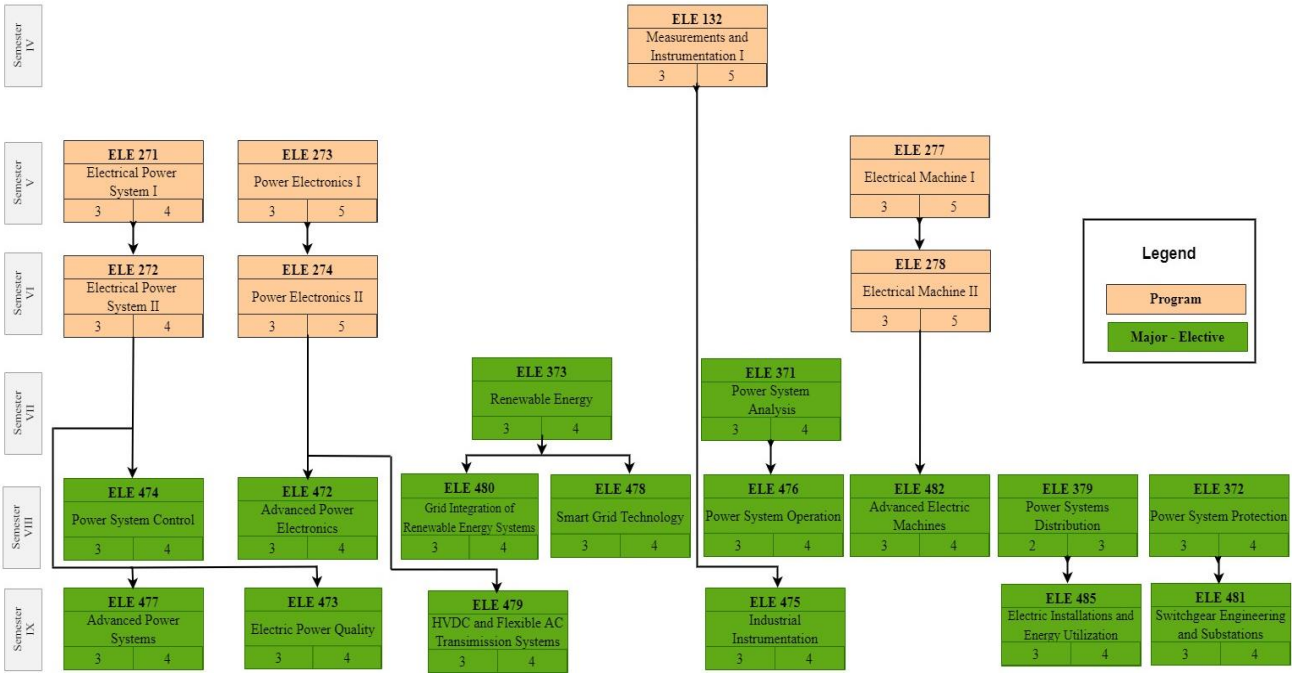
	University Req.	Faculty Req.	Discipline Req.	Major Req.
Min. Requirements	Min 8%	Min 20%	Min 41%	Min 30%
	CR CT	CR CT	CR CT	CR CT
Min. Hours	12.80 23.76	32.00 59.40	65.60 121.77	48.00 89.10
Satisfied Hours	14 14	32 99	66 104	48 80

Curriculum Plan for Electrical Power and Machines Program



Map of Elective Courses

Flowchart of Elective Map



Program Learning Outcomes to Courses Matrix

	Course		PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12	PLO13	PLO14	PLO15	PLO16	PLO17	PLO18	PLO19	PLO20
	Code	Name																				
Semester I	BES 011	Mathematics I	√		√																	
	BES 021	Mechanics I	√	√																		
	BES 041	General Chemistry	√	√																		
	BES 031	Physics I	√	√																		
	MEC 011	Engineering Graphics						√		√												
	UHS 101	Foreign Language								√		√										
	UHS 102	Information and Communication Technology				√						√										
Semester II	BES 012	Mathematics II	√		√																	
	BES 022	Mechanics II	√	√																		
	MEC 012	Production Engineering				√		√														
	BES 032	Physics II	√	√																		
	MEC 014	Computer Aided Drafting				√				√												
	ELE 042	Computer Programming Fundamentals	√		√																	
	UHS 103	Societal Issues							√			√										
Semester III	BES 111	Differential Equations	√	√																		
	ELE 111	Electric Circuits I		√										√	√							
	ELE 141	Digital Logic Circuits	√	√	√									√								
	BES 113	Mathematics III	√	√																		

	Course		PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12	PLO13	PLO14	PLO15	PLO16	PLO17	PLO18	PLO19	PLO20
	Code	Name																				
	ELE 173	Electrical Application				√	√										√					
	BES 131	Modern Physics	√	√																		
	UHS 2xx	Humanities - Elective I			√	√																
Semester IV	BES 112	Numerical Analysis	√	√																		
	ELE 112	Electric Circuits II			√	√	√							√	√							
	ELE 213	Electronic Circuits I		√										√	√							
	ELE 132	Measurements and Instrumentation I		√										√		√						
	MEC 128	Thermal Power Engineering	√						√													
	UHS 104	Professional Ethics				√	√															
	UHS 4xx	Humanities - Elective II					√					√	√									
	FTR 103	Field Training I							√			√										
	ELE 271	Electrical Power System I								√			√	√				√				
	ELE 273	Power Electronics I							√				√		√	√						
	ELE 216	Electromagnetic Field	√											√	√							
	ELE 277	Electrical Machine I											√				√					
	ELE 231	Control Theory													√	√		√	√			
	ELE 237	Measurements and Instrumentation II		√							√					√						
te	ELE 272	Electrical Power System II			√								√	√	√			√	√			

	Course		PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12	PLO13	PLO14	PLO15	PLO16	PLO17	PLO18	PLO19	PLO20
	Code	Name																				
	ELE 274	Power Electronics II						√						√	√							
	MEC 228	Power Station	√							√					√	√		√	√			√
	ELE 278	Electrical Machine II									√		√							√		√
	ELE 232	Modern Control Systems															√	√			√	
	ELE 245	Computer Applications		√										√		√						
	FTR 203	Field Training II							√			√										
	ELE 371	Power System Analysis			√									√	√		√	√	√			√
	ELE 373	Renewable Energy															√				√	
	ELE 375	Electrical Drive						√													√	√
	ELE 377	Special Machines								√								√		√		
	ELE 379	Power Systems Distribution							√									√	√			√
	ELE 347	Microcontroller Embedded												√	√	√						
	UHS 5xx	Humanities - Elective III					√					√										
Semester VIII	ELE 4xx	Elective I	Refer to electrical power and machines engineering electives																			
	ELE 4xx	Elective II																				
	ELE 4xx	Elective III																				
	ELE 372	Power System Protection																	√	√		
	ELE 335	Industrial Automation Systems															√				√	√
	ELE 392	Senior Design Project I					√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	

	Course		PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12	PLO13	PLO14	PLO15	PLO16	PLO17	PLO18	PLO19	PLO20
	Code	Name																				
Semester IX	BES 141	Pollution and Industrial Safety				√		√														
	ELE 471	High Voltage Engineering																		√	√	√
	ELE 491	Senior Design Project II					√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
	ELE 4xx	Elective IV	Refer to electrical power and machines engineering electives																			
	ELE 4xx	Elective V																				
	ELE 4xx	Elective VI																				
Electrical Power and Machines Engineering Electives	ELE 473	Electric Power Quality								√						√		√	√		√	
	ELE 475	Industrial Instrumentation							√		√	√	√					√		√		
	ELE 472	Advanced Power Electronics			√			√							√		√					√
	ELE 474	Power System Control										√			√		√	√	√			
	ELE 477	Advanced Power Systems							√		√					√		√		√	√	
	ELE 479	HVAC and Flexible AC Transmission Systems								√			√			√			√	√		
	ELE 476	Power System Operation			√						√							√			√	√
	ELE 478	Smart Grid Technology								√					√		√		√			
	ELE 480	Grid Integration of Renewable Energy Systems						√					√			√				√	√	
	ELE 481	Switchgear Engineering and Substations			√		√									√				√	√	√
	ELE 482	Advanced Electric Machines						√							√		√		√			
	ELE 485	Electrical Installations and Energy Utilization							√		√		√			√		√			√	√

Program # 5 Computer and Control Systems Engineering Program

Program Description

Computer and control systems engineering is a discipline that integrates the science and technology of design, implementation, controlling and maintenance of software and hardware components of computing systems, computer-controlled equipment, and networks of intelligent devices. Generally, computer and control systems engineering is some combination of both electrical engineering and computer science.

Because of the breadth of the computer and control systems engineering field, computer-related coursework typically comes from computer organization and architecture, networks, algorithms, programming, databases, software engineering, automation, and intelligent systems. Electrical engineering related coursework typically comes from circuits, digital logic, microelectronics, signal processing, control systems, and integrated circuit design. Foundational areas typically include basic sciences, mathematics for both discrete and continuous domains, and applications of probability and statistics.

Basic Information

Program Mission

The mission of Computer and control systems is to provide students with the competencies and skills for successful featured careers, characterized by creativity, innovation, research and lifelong learning, to participate effectively and ethically in serving their professional and societal communities.

Program Objectives

Computer and Control Systems Engineering program is planned to:

1- Qualify graduates to apply principles, knowledge, skills, and current techniques of computer and control systems in their careers
2- Prepare graduates to be contributors and responsible in making professional and personal decisions
3- Enable graduates to synthesize and analyze the efficacy solutions to complex problems
4- Prepare graduates engage successfully and productively in their careers
5- Qualify graduates to work in areas across the breadth and depth of the discipline and diverse career paths including leadership and entrepreneurship
6- Program graduates would communicate and act in a creative, responsible, respectful, and ethical manner to serve their career and society
7- Program graduates would continue improve and develop professionally by learning new techniques, directions, and other creative pursuits in the field of computer and control systems
8- Stimulate the graduate scientific curiosity, and passion for continuous research, to be able to participate in the evolution of the promising computer and control systems field.

Graduate Attributes

Graduate attributes are the academic abilities, personal qualities, and skills which computer and control systems Engineering graduates should have.

With the ubiquity of computers, computer-based systems, and networks in the world today, computer engineers must be versatile in the knowledge drawn from standard study areas in computer science and electrical engineering as well as the foundations in mathematics and sciences. The rapid pace of change in the computing field requires that computer engineers be lifelong learners to maintain their knowledge and skills within their chosen discipline.

According to NARS 2018 all engineering graduates must:

1. Master a wide spectrum of engineering knowledge and specialized skills and can apply acquired knowledge using theories and abstract thinking in real life situations.
2. Apply analytic critical and systemic thinking to identify, diagnose and solve engineering problems with a wide range of complexity and variation.
3. Behave professionally and adhere to engineering ethics and standards.
4. Work in and lead a heterogeneous team of professionals from different engineering specialties and assume responsibility for own and team performance.
5. Recognize his/her role in promoting the engineering field and contribute to the development of the profession and the community.
6. Value the importance of the environment, both physical and natural, and work to promote sustainability principles.
7. Use techniques, skills and modern engineering tools necessary for engineering practice.
8. Assume full responsibility for own learning and self-development, engage in lifelong learning and demonstrate the capacity to engage in post- graduate and research studies.
9. Communicate effectively using different modes, tools and languages with various audiences; to deal with academic/professional challenges in a critical and creative manner.
10. Demonstrate leadership qualities, business administration and entrepreneurial skills.

In addition to all engineering graduate attributes defined by NARS 2018, Computer and Control Systems Engineering graduate should be able to:

1. Use the existing computing tools professionally and can develop neoteric tools
2. Develop and manage projects related to computer and control systems in diverse fields of applications
3. Design and manage computer, computer-based systems, networks, and control and intelligent systems to solve novel problems including both hardware and software designs and extend their applications to diversity of real-life systems
4. Demonstrate the breadth and depth competencies of the computer and control systems engineering

Program Learning Outcomes

- **Level A Competencies**

According to NARS 2018, the competencies of the Engineering Graduate must be able to:

PLO1. Identify, formulate, and solve complex engineering problems by applying engineering fundamentals, basic science and mathematics.

PLO2. Develop and conduct appropriate experimentation and/or simulation, analyze and interpret data, assess and evaluate findings, and use statistical analyses and objective engineering judgment to draw conclusions.

PLO3. Apply engineering design processes to produce cost-effective solutions that meet specified needs with consideration for global, cultural, social, economic, environmental, ethical and other aspects as appropriate to the discipline and within the principles and contexts of sustainable design and development.

PLO4. Utilize contemporary technologies, codes of practice and standards, quality guidelines, health and safety requirements, environmental issues and risk management principles.

PLO5. Practice research techniques and methods of investigation as an inherent part of learning.

PLO6. Plan, supervise and monitor implementation of engineering projects, taking into consideration other trades requirements.
PLO7. Function efficiently as an individual and as a member of multi-disciplinary and multi-cultural teams.
PLO8. Communicate effectively – graphically, verbally and in writing – with a range of audiences using contemporary tools.
PLO9. Use creative, innovative and flexible thinking and acquire entrepreneurial and leadership skills to anticipate and respond to new situations.
PLO10. Acquire and apply new knowledge, and practice self, lifelong and other learning strategies.

- **Level B Competencies**

In addition to the Program learning outcomes for All Engineering Programs the BASIC ELECTRICAL Engineering graduate and similar programs must be able to:
PLO11. Design, model and analyze an electrical/electronic/digital system or component for a specific application; and identify the tools required to optimize this design.
PLO12. Design and implement elements, modules, sub-systems or systems in electrical/electronic/digital engineering using technological and professional tools.
PLO13. Estimate and measure the performance of an electrical/electronic/digital system and circuit under specific input excitation and evaluate its suitability for a specific application.
PLO14. Adopt suitable national and international standards and codes to design, build, operate, inspect and maintain electrical/electronic/digital equipment, systems and services.

- **Level C Competencies**

In addition to the previous program learning outcomes for all engineering programs (Level A, NARS 2018), and Electric Engineering program learning outcomes (Level B, NARS 2018), computer and control systems engineers must be able to:
PLO15. Determine the characteristics of a given problem, choose the appropriate method to solve, analyze, design, and apply programming paradigm in Algorithm design/software design problems/intelligent systems design/ software engineering and testing
PLO16. Design and Implement Embedded Systems/ Image and Signal Processing Systems/ Systems Using Programmable Devices/Systems Using ASIC Design, taking into account relevant system design constraints (time, interrupts, reliability, reducing failure, bridging the analog and digital domains,…)
PLO17. Develop, deploy, manage, maintain, and evaluate the performance and security of wireless and wired networking principles in the context of relevant standards.
PLO18. Analyze, design, model, and evaluate basic control systems, multivariable systems, and dynamic nonlinear systems for real-world systems
PLO19. Formulate and describe different types of Industrial robots: structure and applications, robot kinematics, dynamics, and control systems, apply robot software tools, formulate solutions to solve problems related to robotics, industry, and automation, apply principles and techniques in varied application domains related to industry and artificial intelligence.
PLO20. Consolidate electrical, electronic, and digital components and equipment, and apply modern techniques, skills, and engineering tools to electrical, power, machines, and intelligent engineering systems.

Faculty Mission vs. Program Mission Matrix

Faculty Mission		Program Mission		
		The mission of Computer and control systems is to provide students with the competencies and skills for successful featured careers, characterized by creativity, innovation, research, and lifelong learning, to participate effectively and ethically in serving their professional and societal communities		
		provide students with the competencies and skills for successful featured careers	characterized by creativity, innovation, research, and lifelong learning	to participate effectively and ethically in serving their professional and societal communities
Benha Faculty of Engineering - Benha University is committed to graduate well prepared engineers equipped with knowledge and skills necessary to compete in labor market, and capable of using and developing modern technology, and providing research in engineering fields to serve society and community.	graduate well prepared engineers equipped with knowledge and skills necessary to compete in labor market, and capable of using and developing modern technology	√		
	providing research in engineering fields		√	
	to serve society and community			√

Program Objectives Vs Graduate Attributes

Program Objectives	Graduate Attribute													
	GA1	GA2	GA3	GA4	GA5	GA6	GA7	GA8	GA9	GA10	GA11	GA12	GA13	GA14
PO1	√										√			
PO2			√		√									
PO3		√											√	
PO4				√			√					√		
PO5										√				√
PO6						√			√					
PO7								√						
PO8								√						

Program Competencies vs. Program Objectives Matrix

Program Objectives	Program Competencies																			
	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	B1	B2	B3	B14	C1	C2	C3	C4	C5	C6
PO1	√		√	√																
PO2		√				√			√											
PO3	√	√	√	√		√														
PO4							√	√	√	√										
PO5						√			√		√	√	√	√	√	√	√	√	√	√
PO6			√				√	√												
PO7					√				√	√	√	√	√	√	√	√	√	√	√	√
PO8					√					√										

Career Prospects

Computer and control systems engineers work in most industries, including the computer, automobile, aerospace, telecommunications, power production, manufacturing, defense, and electronics industries. They design high-tech devices ranging from tiny microelectronic integrated-circuit chips to powerful systems that utilize those chips and efficient telecommunication systems that interconnect those systems. Computer and control systems engineers also work on distributed computing environments—local and wide area networks, wireless networks, internets, intranets—and embedded computer systems—such as in aircraft, spacecraft, and automobile control systems where they perform various functions. A wide array of complex technological systems, such as power generation and distribution systems and modern processing and manufacturing plants, rely on computer systems developed and designed by computer and control systems engineers

Program Concentrations

The graduate of the program can be specialized in one of the following two concentrations:

1. Computer Engineering
2. Control Systems Engineering

The concentration focus is achieved by 23 Cr. Hrs. including 18 Cr. Hrs. of elective courses and 5 Cr. Hrs. as the graduation project, all related to the specific concentration.

List of Computer and Control Systems Engineering Requirement Courses

Requirement	Cr. Hrs.	Ct. Hr.			
		Lec	Lab	Tut	Sum
Benha University Requirements	14	14	0	0	14
Benha Faculty of Engineering Requirements	32	19	34	47	50
Discipline Requirements	67	45	31	25	101
Program Computer and Control Systems Program Requirements	29	18	18	8	44
Concentration of Computer Engineering Requirements	18	12	12	6	30
Concentration of Control Systems Engineering Requirements					
Total	160	108	95	86	239

Basic Science Requirements of Computer and Control Systems Engineering

Code	Course Title	Pre-Req	Cr. Hrs.	Contact Hrs			
				Lec	Lab	Tut	Tot
BES 011	Mathematics I		3	2	0	2	4
BES 041	General Chemistry		4	3	2	1	6
BES 031	Physics I		3	2	2	1	5
BES 012	Mathematics II	BES 011	3	2	0	2	4
BES 032	Physics II		3	2	2	1	5
BES 111	Differential Equations	BES 012	3	2	0	2	4
BES 113	Mathematics III	BES 012	3	2	0	2	4
BES 112	Numerical Analysis	BES 111	3	2	2	0	4
BES 114	Discrete Mathematics and Linear Programming	BES 012	3	2	0	2	4
*BES 141	Pollution and Industrial Safety	BES 041	2	2	1	0	3
BES 211	Engineering Statistics and Probability	BES 012	3	2	1	1	4
Total			33	23	11	13	47

* Course teaching is shared between the Basic Engineering Science Department and Electrical Engineering Department.

Discipline Requirements of Computer and Control Systems Engineering

Code	Course Title	Pre-Req	Cr. Hrs.	Ct. Hr.			
				Lec	Lab	Tut	Sum
BES 111	Differential Equations	BES 012	3	2	0	2	4
BES 113	Mathematics III	BES 012	3	2	0	2	4
ELE 179	Electric Circuits Analysis	BES 032	3	2	1	2	5
ELE 141	Digital Logic Circuits		3	2	1	2	5
ELE 143	Object Oriented Programming	ELE 042	3	2	2	0	4
ELE 173	Electrical Applications		2	1	3	0	4
BES 112	Numerical Analysis	BES 111	3	2	2	0	4
ELE 132	Measurements and Instrumentations I	ELE 179 or ELE 111	3	2	2	1	5
ELE 142	Digital System Design	ELE 141	3	2	2	1	5
ELE 144	Data Structures and Algorithms	ELE 143	3	2	2	0	4
ELE 211	Signals and Systems	BES 111	3	2	0	2	4
ELE 213	Electronic Circuits I	BES 131 or ELE 114	3	2	1	2	5
ELE 231	Control Theory	BES 111	3	2	1	2	4
ELE 241	Computer Architecture	ELE 142	3	2	2	1	5
ELE 245	Computer Applications	ELE 042	3	2	2	0	4
BES 211	Engineering Statistics and Probability	BES 012	3	2	1	1	4
ELE 276	Electric Machines	ELE 179	3	2	1	1	4
ELE 232	Modern Control Systems	ELE 231	3	2	2	1	5
ELE 242	Computer Organization	ELE 241	3	2	2	1	5
ELE 246	Computer Network		3	2	2	1	5
ELE 341	Microprocessor Based Systems	ELE 242	3	2	1	2	5
Total			67	44	33	25	102

Program Requirements of Computer and Control Systems Engineering

Code	Course	Pre-Req	Cr. Hrs.	Ct. Hr.			
				Lec	Lab	Tut	Sum
BES 114	Discrete Mathematics and Linear Programming	BES 012	3	2	0	2	4
ELE 243	Algorithms Analysis and Design	BES 114, ELE 144	3	2	1	1	4
ELE 244	Operating Systems	ELE 241	3	2	1	1	4
ELE 343	Database Systems	ELE 144	3	2	2	1	5
ELE 331	Machine Learning	ELE 243, BES 211	3	2	2	1	5
ELE 333	Digital Control	ELE 211, ELE 232	3	2	1	1	4
ELE 335	Industrial Automation Systems	ELE 132, ELE 232	3	2	2	1	5
ELE 342	Embedded Systems	ELE 141	3	2	2	0	4
ELE 3XX	Elective I		3	2	2	1	5
ELE 3XX	Elective II		3	2	2	1	5
ELE 3XX	Elective III		3	2	2	1	5
ELE 4XX	Elective IV		3	2	2	1	5
ELE 4XX	Elective V		3	2	2	1	5
ELE 4XX	Elective VI		3	2	2	1	5
*ELE 392	Senior Design Project I	70% of total CH	2	0	4	0	4
ELE 491	Senior Design Project II	ELE 392	3	1	4	0	5
Total			47	30	30	14	74

*The student can register the Senior design Project course after passing 70% of the program cr. hrs., i.e., 112 Cr. Hr.

Concentration Requirements of Control Systems Engineering

Code	Course	Pre-Req	Cr. Hrs.	Ct. Hr.			
				Lec	Lab	Tut	Sum
Pool Courses for Elective I, Elective II, Elective III							
ELE 3302	Robotics	ELE 232, ELE 245	3	2	2	1	5
ELE 3304	Intelligent Control	ELE 232	3	2	2	1	5
ELE 484	Special Electric Machines	ELE 276	3	2	2	1	5
ELE 3306	Modelling and Simulation	ELE 245	3	2	2	1	5
ELE 3308	System Identification and Parameter Estimation	ELE 231	3	2	2	1	5
ELE 483	Power Electronics	ELE 213	3	2	2	1	5
Pool Courses for Elective IV, Elective V, Elective VI							
ELE 4301	Advanced Robotics	ELE 3302	3	2	2	1	5
ELE 4303	Autonomous Systems	ELE 3302	3	2	2	1	5
ELE 4305	Advanced Control Systems	ELE 333	3	2	2	1	5
ELE 4307	Advanced Industrial Automation Systems	ELE 331	3	2	2	1	5
ELE 4409	Internet of Things	ELE 342	3	2	2	1	5
*ELE 4309	Selected Topics in Control Systems		3	2	2	1	5

* The course content must be approved by Electric Engineering Department Council before any student can register it.

Concentration Requirements of Computer Engineering

Code	Course	Pre-Req	Cr. Hrs.	Ct. Hr.			
				Lec	Lab	Tut	Sum
Pool Courses for Elective I, Elective II, Elective III							
ELE 3402	Advanced Topics in Computer Networks	ELE 246	3	2	2	1	5
ELE 3404	Computer and Network Security	ELE 246	3	2	2	1	5
ELE 3406	Software Engineering	ELE 144	3	2	2	1	5
ELE 3408	Data Analytics	BES 211	3	2	2	1	5
ELE 3118	Digital Electronics	ELE 213	3	2	2	1	5
ELE 3410	Web Engineering	ELE 143	3	2	2	1	5
ELE 3412	Fault-Tolerant Computing	ELE 242, BES 211	3	2	2	1	5
ELE 3414	Cloud Computing	ELE 246	3	2	2	1	5
Pool Courses for Elective IV, Elective V, Elective VI							
ELE 441	Image Processing	ELE 211, ELE 245	3	2	2	1	5
ELE 4401	Parallel and Distributed Systems	ELE 3402	3	2	2	1	5
ELE 4403	Digital Forensics	ELE 3404	3	2	2	1	5
ELE 4405	Software Project Management	ELE 3406	3	2	2	1	5
ELE 4407	Compilers	ELE 144	3	2	2	1	5
ELE 4409	Internet of Things	ELE 342	3	2	2	1	5
ELE 4411	RTL Design	ELE 242	3	2	2	1	5
*ELE 4413	Selected Topics in Computer Engineering		3	2	2	1	5

* The course content must be approved by Electric Engineering Department Council before any student can register it.

Proposed Study Plan for Computer and Control Systems Engineering

Level 0-1													
Code	Course	Pre-Req	Cr. Hrs.	Ct. Hr.				Final Exam Time	Assessment				
				Lec	Lab	Tut	Sum		SA	MT	PE/ OE	Final Exam	Sum
BES 011	Mathematics I		3	2	0	2	4	2	30	30	-	40	100
BES 021	Mechanics I		3	2	0	2	4	2	30	30	-	40	100
BES 041	General Chemistry		4	3	2	1	6	2	10	30	20	40	100
BES 031	Physics I		3	2	2	1	5	2	10	30	20	40	100
MEC 011	Engineering Graphics		2	0	0	4	4	2	30	30	-	40	100
UHS 101	Foreign Language		2	2	0	0	2	2	30	30	-	40	100
UHS 102	Information and Communication Technology		2	2	0	0	2	2	30	30	-	40	100
Total			19	13	4	10	27						700

Level 0-2													
Code	Course	Pre-Req	Cr. Hrs.	Ct. Hr.				Final Exam Time	Assessment				
				Lec	Lab	Tut	Sum		SA	MT	PE/ OE	Final Exam	Sum
BES 012	Mathematics II	BES 011	3	2	0	2	4	2	30	30	-	40	100
BES 022	Mechanics II	BES 021	3	2	0	2	4	2	30	30	-	40	100
MEC 012	Production Engineering		2	1	3	0	4	2	10	30	20	40	100
BES 032	Physics II		3	2	2	1	5	2	10	30	20	40	100
MEC 014	Computer Aided Drafting	MEC 011	2	1	2	0	3	2	10	30	20	40	100
ELE 042	Computer Programming Fundamentals		2	0	2	2	4	2	10	30	20	40	100
UHS 103	Societal Issues		2	2	0	0	2	2	30	30	-	40	100
Total			17	10	9	7	26						700

Level 1-1													
Code	Course	Pre-Req	Cr. Hrs.	Ct. Hr.				Final Exam Time	Assessment				
				Lec	Lab	Tut	Sum		SA	MT	PE/ OE	Final Exam	Sum
BES 111	Differential Equations	BES 012	3	2	0	2	4	2	30	30	-	40	100
BES 113	Mathematics III	BES 012	3	2	0	2	4	2	30	30	-	40	100
ELE 179	Electric Circuits Analysis	BES 032	3	2	1	2	5	2	10	30	20	40	100
ELE 141	Digital Logic Circuits		3	2	1	2	5	2	10	30	20	40	100
ELE 143	Object Oriented Programming	ELE 042	3	2	2	0	4	2	10	30	20	40	100
ELE 173	Electrical Applications		2	1	3	0	4	2	10	30	20	40	100
UHS XXX	Humanities Elective I		2	2	0	0	2	2	30	30	-	40	100
Total			19	13	7	8	28						700

Level 1-2													
Code	Course	Pre-Req	Cr. Hrs.	Ct. Hr.				Final Exam Time	Assessment				
				Lec	Lab	Tut	Sum		SA	MT	PE/ OE	Final Exam	Sum
BES 112	Numerical Analysis	BES 111	3	2	2	0	4	2	10	30	20	40	100
BES 114	Discrete Mathematics and Linear Programming	BES 012	3	2	0	2	4	2	30	30	-	40	100
ELE 132	Measurements and Instrumentations I	ELE 179 or ELE 111	3	2	2	1	5	2	10	30	20	40	100
ELE 142	Digital System Design	ELE 141	3	2	2	1	5	2	10	30	20	40	100
ELE 144	Data Structure and Algorithms	ELE 143	3	2	2	0	4	2	10	30	20	40	100
ELE 114	Semiconductor Physics	BES 032	3	2	0	2	4	2	30	30	-	40	100
Total			18	12	8	6	26						600

1st Field Training													
Code	Course	Pre-Req	Cr. Hrs.	Ct. Hr.				Final Exam Time	Assessment				
				Lec	Lab	Tut	Sum		SA	MT	PE/ OE	Final Exam	Sum
FTR 103	Field Training, I	Completed 65 CH	0	0	0	0	0	-	-	-	-	Pass/ Fail	-

Level 2-1													
Code	Course	Pre-Req	Cr. Hrs.	Ct. Hr.				Final Exam Time	Assessment				
				Lec	Lab	Tut	Sum		SA	MT	PE/ OE	Final Exam	Sum
ELE 211	Signals and Systems	BES 111	3	2	0	2	4	2	30	30	-	40	100
ELE 213	Electronic Circuits I	ELE 114	3	2	1	2	5	2	10	30	20	40	100
ELE 231	Control Theory	BES 111	3	2	1	2	5	2	10	30	20	40	100
ELE 241	Computer Architecture	ELE 142	3	2	2	1	5	2	10	30	20	40	100
ELE 243	Algorithms Analysis and Design	BES 114, ELE 144	3	2	1	1	4	2	10	30	20	40	100
ELE 245	Computer Applications	ELE 042	3	2	2	0	4	2	10	30	20	40	100
Total			18	12	7	8	27						600

Level 2-2													
Code	Course	Pre-Req	Cr. Hrs.	Ct. Hr.				Final Exam Time	Assessment				
				Lec	Lab	Tut	Sum		SA	MT	PE/ OE	Final Exam	Sum
BES 211	Engineering Statistics and Probability	BES 012	3	2	1	1	4	2	10	30	20	40	100
ELE 276	Electric Machines	ELE 179	3	2	1	1	4	2	10	30	20	40	100
ELE 232	Modern Control Systems	ELE 231	3	2	2	1	5	2	10	30	20	40	100
ELE 242	Computer Organization	ELE 241	3	2	2	1	5	2	10	30	20	40	100
ELE 244	Operating Systems	ELE 241	3	2	1	1	4	2	10	30	20	40	100
ELE 246	Computer Network		3	2	2	1	5	2	10	30	20	40	100
Total			18	12	10	5	27						600

2nd Field Training													
Code	Course	Pre-Req	Cr. Hrs.	Ct. Hr.				Final Exam Time	Assessment				
				Lec	Lab	Tut	Sum		SA	MT	PE/ OE	Final Exam	Sum
FTR 203	Field Training, II	Completed 96CH	0	0	0	0	0	-	-	-	-	Pass/Fail	-

Level 3-1													
Code	Course	Pre-Req	Cr. Hrs.	Ct. Hr.				Final Exam Time	Assessment				
				Lec	Lab	Tut	Sum		SA	MT	PE/ OE	Final Exam	Sum
ELE 341	Microprocessor Based Systems	ELE 242	3	2	1	2	5	2	10	30	20	40	100
ELE 331	Machine Learning	ELE 243, BES 211	3	2	2	1	5	2	10	30	20	40	100
ELE 333	Digital Control	ELE 211, ELE 232	3	2	1	1	4	2	10	30	20	40	100
ELE 335	Industrial Automation Systems	ELE 132, ELE 232	3	2	2	1	5	2	10	30	20	40	100
ELE 343	Database Systems	ELE 144	3	2	2	1	5	2	10	30	20	40	100
UHS XXX	Humanities - Elective II		2	2	0	0	2	2	30	30	-	40	100
Total			17	12	8	6	26						600

Level 3-2													
Code	Course	Pre-Req	Cr. Hrs.	Ct. Hr.				Final Exam Time	Assessment				
				Lec	Lab	Tut	Sum		SA	MT	PE/ OE	Final Exam	Sum
ELE 342	Embedded Systems	ELE 141	3	2	2	0	4	2	10	30	20	40	100
ELE 3XX	Elective I		3	2	2	1	5	2	10	30	20	40	100
ELE 3XX	Elective II		3	2	2	1	5	2	10	30	20	40	100
ELE 3XX	Elective III		3	2	2	1	5	2	10	30	20	40	100
ELE 332	Innovation Management and Entrepreneurship		2	2	0	0	2	2	30	30	-	40	100
ELE 392	Senior Design Project I	70% of total CH	2	0	4	0	4	2	50	-	50	--	100
UHS XXX	Humanities - Elective III		2	2	0	0	2	2	30	30	-	40	100
Total			18	13	11	3	27						700

Level 4-1

Code	Course	Pre-Req	Cr. Hrs.	Ct. Hr.				Final Exam Time	Assessment				
				Lec	Lab	Tut	Sum		SA	MT	PE/ OE	Final Exam	Sum
BES 141	Pollution and Industrial Safety	BES 041	2	2	1	0	3	2	10	30	20	40	100
ELE 4XX	Elective IV		3	2	2	1	5	2	10	30	20	40	100
ELE 4XX	Elective V		3	2	2	1	5	2	10	30	20	40	100
ELE 4XX	Elective VI		3	2	2	1	5	2	10	30	20	40	100
ELE 491	Senior Design Project II	ELE 392	3	1	4	0	5	2	50	-	50	--	100
UHS 104	Professional Ethics		2	2	0	0	2	2	30	30	-	40	100
Total			16	11	11	3	25						600

Courses Plan and Matrix

Curriculum Plan for Computer and Control Systems Engineering

Program Map – Electrical Department – Computer and Control Systems Program

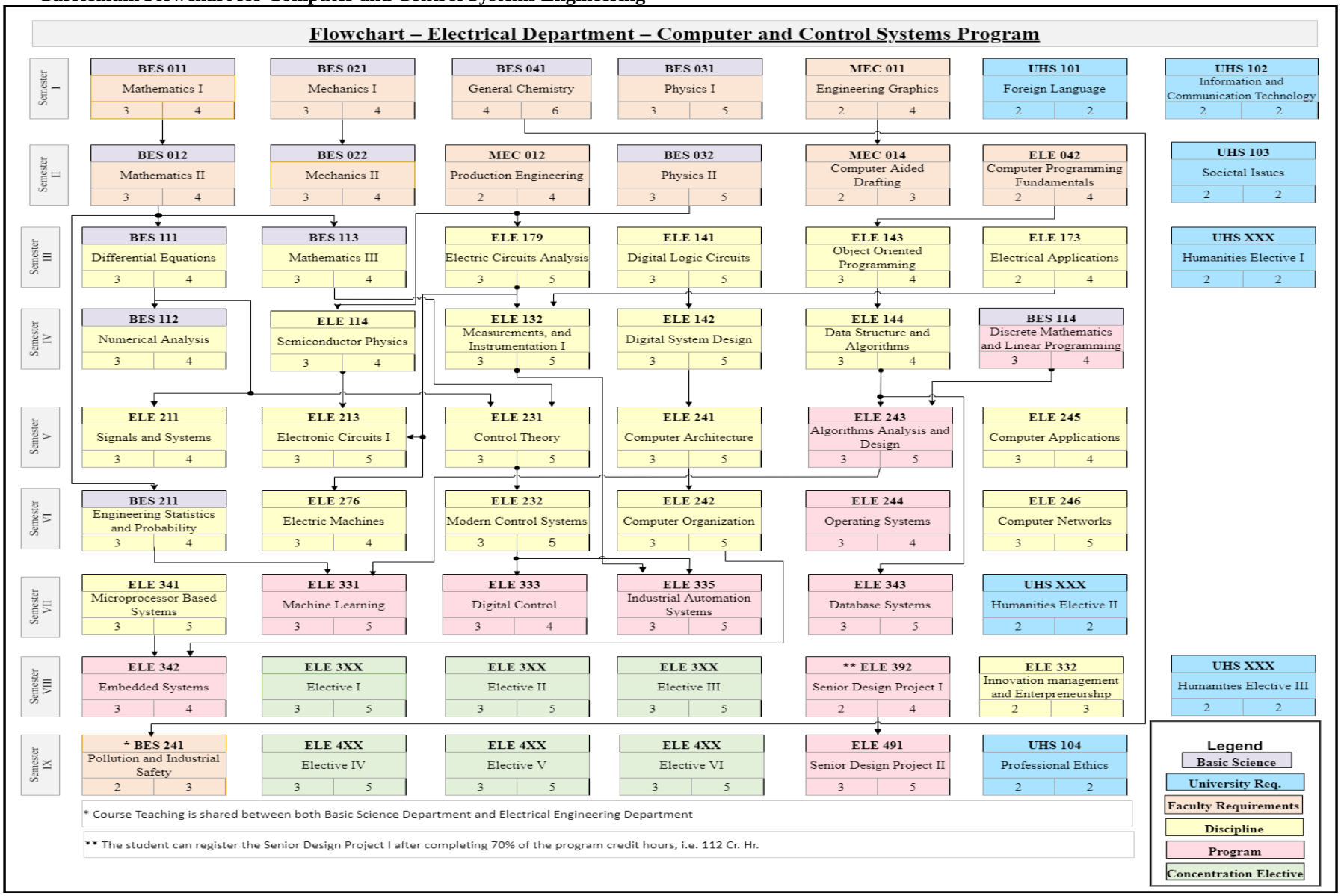
Semester I	BES 011 Mathematics I (3, 4)	BES 021 Mechanics I (3, 4)	BES 041 General Chemistry (4, 6)	BES 031 Physics I (3, 5)	MEC 011 Engineering Graphics (2, 4)	UHS 101 Foreign Language (2, 2)	UHS 102 Information and Communication Technology (2, 2)
Semester II	BES 012 Mathematics II (3, 4)	BES 022 Mechanics II (3, 4)	MEC 012 Production Engineering (2, 4)	BES 032 Physics II (3, 5)	MEC 014 Computer Aided Drafting (2, 3)	ELE 042 Computer Programming Fundamentals (2, 4)	UHS 103 Societal Issues (2, 2)
Semester III	BES 111 Differential Equations (3, 4)	BES 113 Mathematics III (3, 4)	ELE 179 Electric Circuits Analysis (3, 5)	ELE 141 Digital Logic Circuits (3, 5)	ELE 143 Object Oriented Programming (3, 4)	ELE 173 Electrical Applications (2, 4)	UHS XXX Humanities Elective I (2, 2)
Semester IV	BES 112 Numerical Analysis (3, 4)	ELE 114 Semiconductor Physics (3, 4)	ELE 132 Measurements, and Instrumentation I (3, 5)	ELE 142 Digital System Design (3, 5)	ELE 144 Data Structure and Algorithms (3, 4)	BES 114 Discrete Mathematics and Linear Programming (3, 4)	
Semester V	ELE 211 Signals and Systems (3, 4)	ELE 213 Electronic Circuits I (3, 5)	ELE 231 Control Theory (3, 5)	ELE 241 Computer Architecture (3, 5)	ELE 243 Algorithms Analysis and Design (3, 5)	ELE 245 Computer Applications (3, 4)	
Semester VI	BES 211 Engineering Statistics and Probability (3, 4)	ELE 276 Electric Machines (3, 4)	ELE 232 Modern Control Systems (3, 5)	ELE 242 Computer Organization (3, 5)	ELE 244 Operating Systems (3, 4)	ELE 246 Computer Networks (3, 5)	
Semester VII	ELE 341 Microprocessor Based Systems (3, 5)	ELE 331 Machine Learning (3, 5)	ELE 333 Digital Control (3, 4)	ELE 335 Industrial Automation Systems (3, 5)	ELE 343 Database Systems (3, 5)	UHS XXX Humanities Elective II (2, 2)	
Semester VIII	ELE 342 Embedded Systems (3, 4)	ELE 3XX Elective I (3, 5)	ELE 3XX Elective II (3, 5)	ELE 3XX Elective III (3, 5)	** ELE 392 Senior Design Project I (2, 4)	ELE 332 Innovation Management and Enterpreneurship (2, 2)	UHS XXX Humanities Elective III (2, 2)
Semester IX	* BES 241 Pollution and Industrial Safety (2, 3)	ELE 4XX Elective IV (3, 5)	ELE 4XX Elective V (3, 5)	ELE 4XX Elective VI (3, 5)	ELE 491 Senior Design Project II (3, 5)	UHS 104 Professional Ethics (2, 2)	

Legend: Basic Science; University Req.; Faculty Requirements; Discipline; Program; Concentration Elective

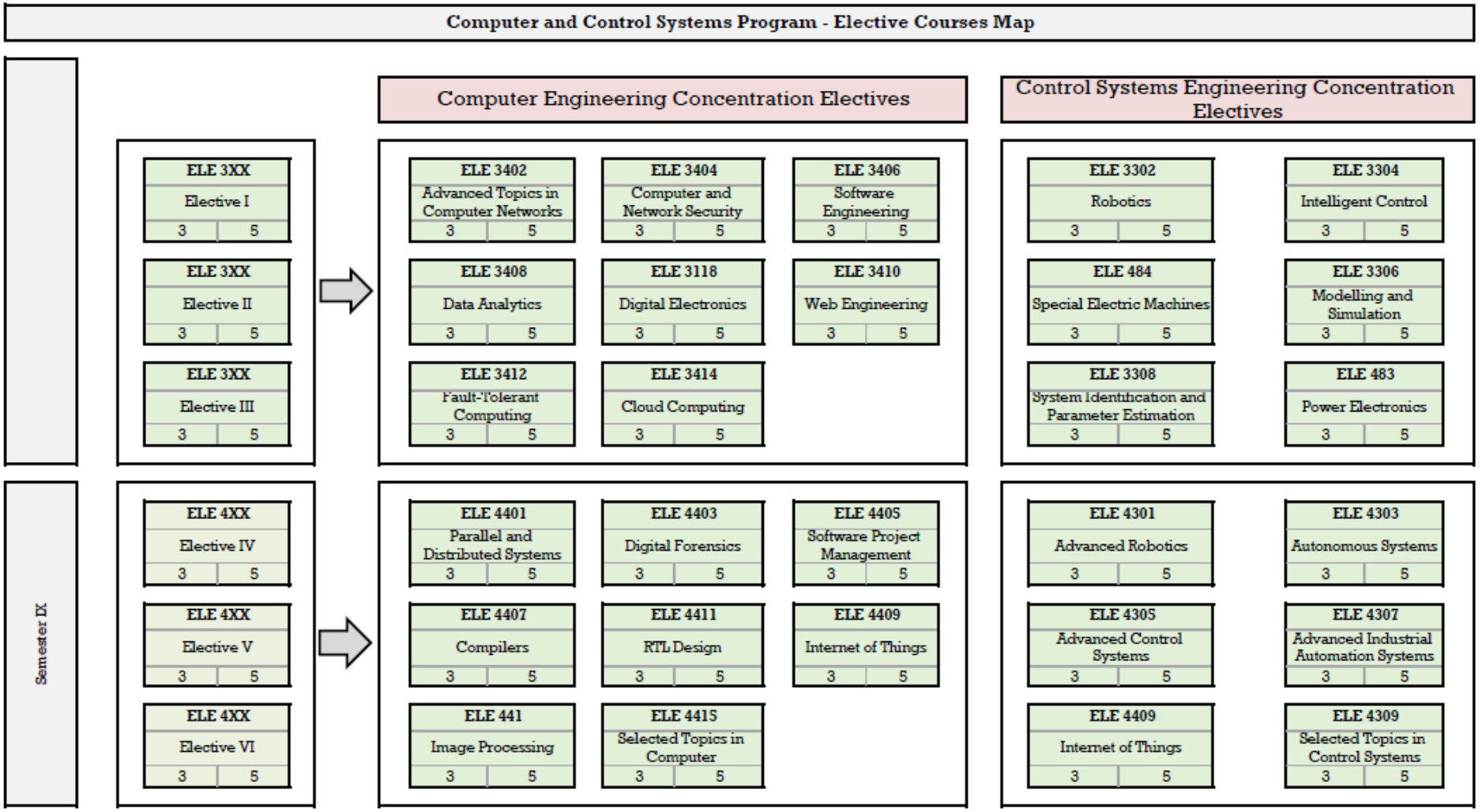
* Course Teaching is shared between both Basic Science Department and Electrical Engineering Department

** The student can register the Senior Design Project I after completing 70% of the program credit hours, i.e. 112 Cr. Hr.

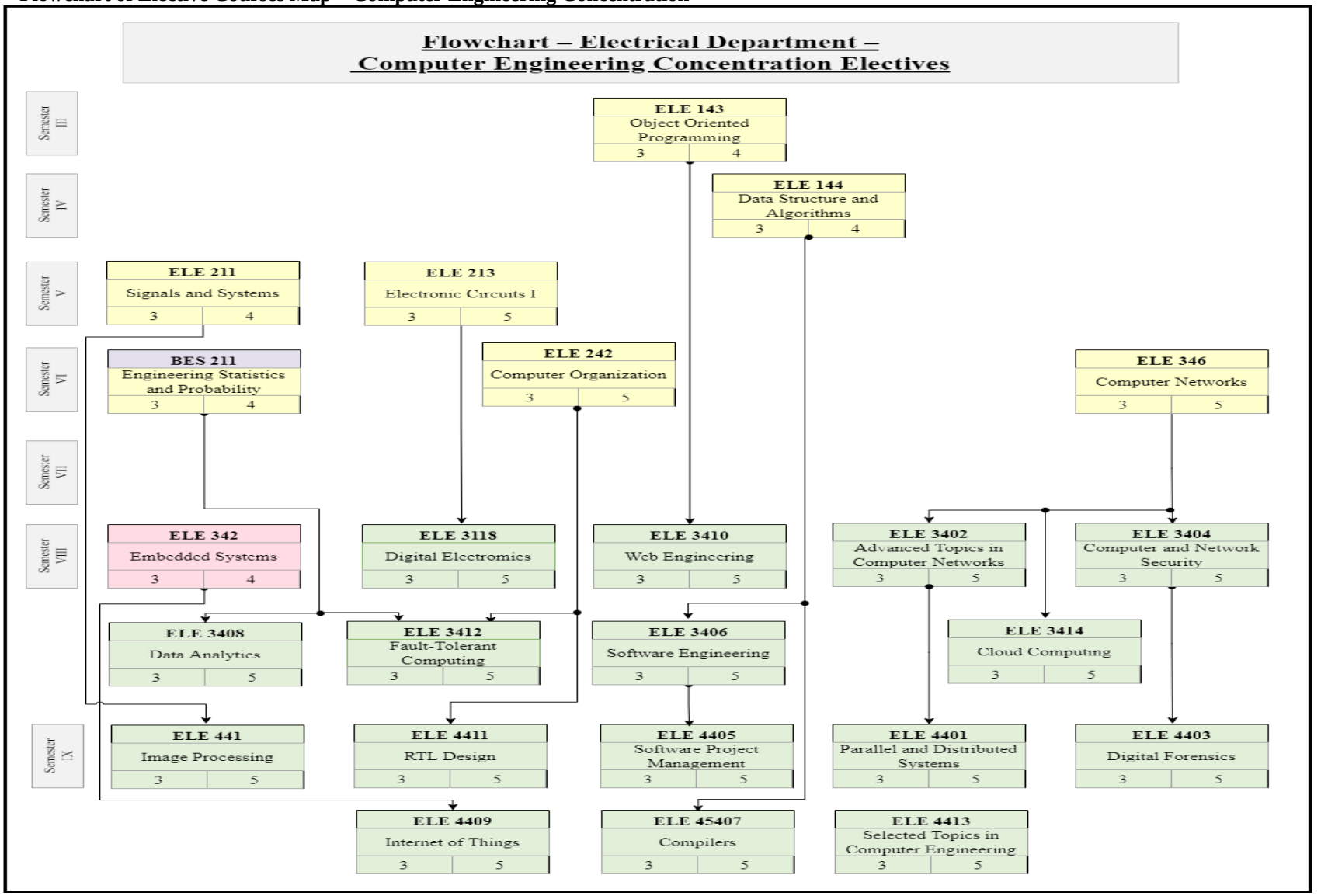
Curriculum Flowchart for Computer and Control Systems Engineering



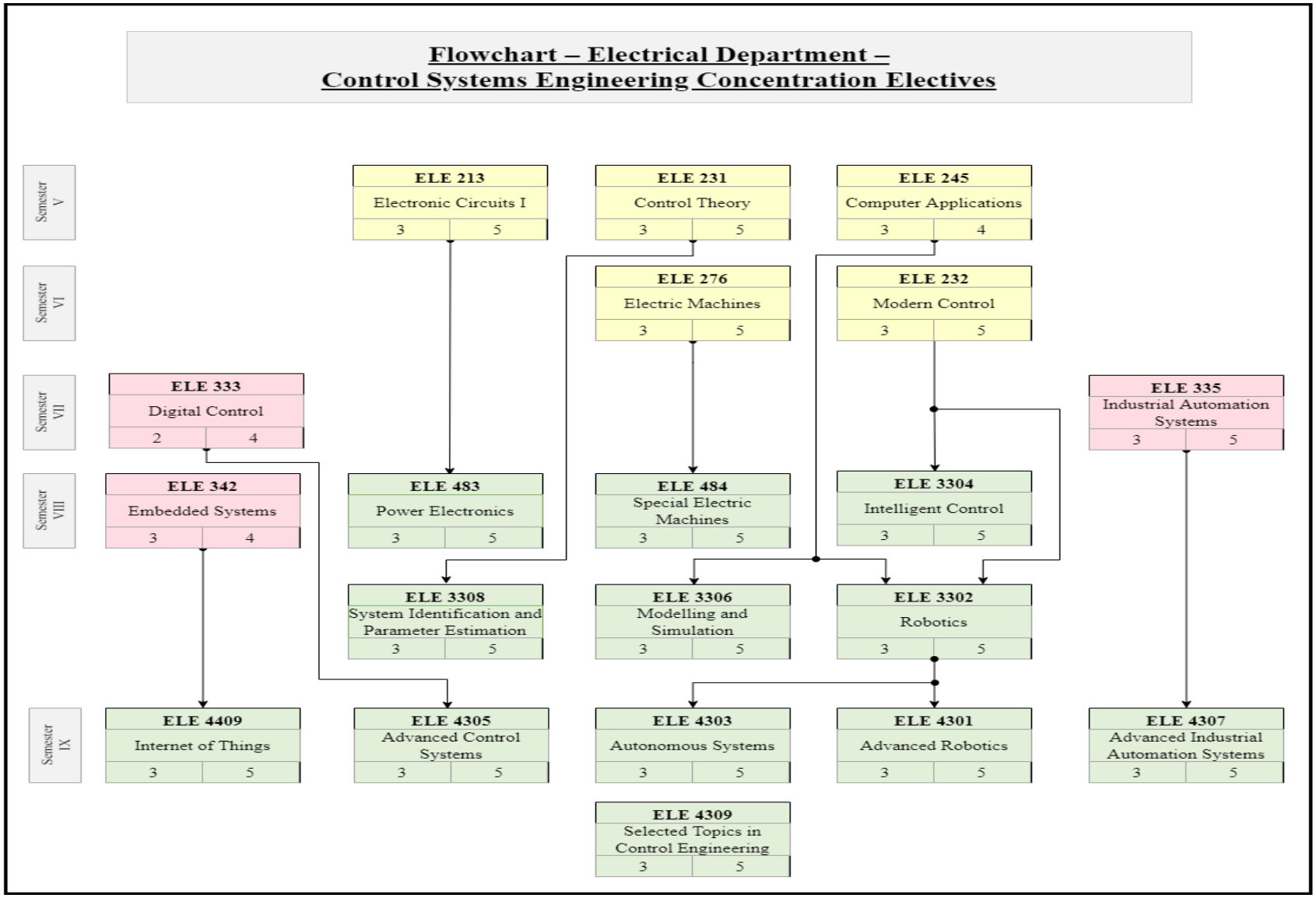
Map of Elective Courses



Flowchart of Elective Courses Map – Computer Engineering Concentration



Flowchart of Elective Map – Control Systems Engineering Concentration



Study of External Reference with the Program (Benchmark)

- **Program Learning Outcomes Benchmark**

In addition to NARS2018, the program learning outcomes benchmarks are:

1. ACM, IEEE CC2020, Computing Curricula 2020, Paradigm for Global Computing Education, ISBN: 978-1-4503-9059-0.
2. Lac Hong University, Control and Automation Engineering Technology Program, Bien Hoa, Vietnam
3. Faculty of Electrical Engineering and Information Technologies, Computer Systems Engineering, Automation and Robotics, Skopje

The mapping of the benchmark to the program is shown below:

BM	Benchmark Outcome	Computer and Control Systems Program Outcomes
1	Evaluate and apply programming paradigms and languages to solve a wide variety of software design problems being mindful of trade-offs including maintainability, efficiency, and intellectual property constraints.	Determine the characteristics of a given problem, choose the appropriate method to solve, analyze, design and apply programming paradigm in Algorithm design/software design problems/intelligent systems design/ software engineering and testing
	Determine the characteristics of a given problem that an intelligent system must solve and present the results to a project team	
	Design and/or implement basic and advanced I/O techniques, both synchronous and asynchronous and serial/parallel, including interrupts and time considerations	Design and Implement Embedded Systems/ Image and Signal Processing Systems/ Systems Using Programmable Devices/Systems Using ASIC Design, taking into account relevant system design constraint (time, interrupts, reliability, reducing failure, bridging the analog and digital domains,....)
	Design and implement an example of an embedded system in a non-electronic device, including sensor feedback, low-power, and mobility.	
	Design signal processing systems applying knowledge of sampling and quantization to bridge the analog and digital domains.	
	Design a control or datapath circuit using programmable logic and considering relevant system design constraints and testability concerns.	
	Develop, deploy, maintain, and evaluate the performance of wireless and wired networking solutions in the context of relevant standards	Develop, deploy, manage, maintain, and evaluate the performance and security of wireless and wired networking principles in the context of relevant standards.
2	an ability to identify, formulate, and solve control and automation engineering problems	Analyze, design, model and evaluate basic control systems, multivariable systems and dynamic nonlinear systems for real world systems
3	Demonstrates knowledge and understanding of research, development, and application of knowledge in computer system engineering, automation and robotics, as well as engineering design in industrial processes.	Formulate and describe different types of Industrial robots: structure and applications, robot kinematics, dynamics, control systems, apply robot software tools, formulate solutions to solve problems related to robotics, industry and automation, apply principles and techniques in varied application domains related to industry and artificial intelligence.
	An ability to identify, analyze and solve problems related to computer system engineering, automation and robotics.	

	An ability to provide answers to both theoretical and practical issues, in order to give explanations and choose the appropriate solution.	
2	an ability to use the techniques, skills, and modern engineering tools necessary for control and automation engineering practice	Consolidate electrical, electronic, and digital components and equipment, and apply modern techniques, skills and engineering tools to electrical, power, machines, and intelligent engineering systems.
	a knowledge of electrical, electronics & communication, computer and other applied engineering necessary to analyze and design complex systems containing hardware and software components used in control and automation engineering applications.	

▪ Curriculum Courses Benchmark:

The benchmark of computer engineering is:

1- ACM, IEEE CC2020, Computing Curricula 2020, Paradigm for Global Computing Education, ISBN: 978-1-4503-9059-0.
2- ACM, IEEE CE2016, Computer Engineering Curricula 2016, Curriculum Guidelines for Undergraduate Degree Programs in Computer Engineering, ISBN: 978 – 1- 4503 – 4875 – 1, DOI: 10.1145/3025098.

The benchmark divides the Computer Engineering body of knowledge into 12 knowledge areas; each of them contains from 8 to 14 knowledge unit as shown in the following table:

CE-CAE Circuits and Electronics CE-CAE-1 History and overview CE-CAE-2 Relevant tools, standards, and/or engineering constraints CE-CAE-3 Electrical quantities and basic elements CE-CAE-4 Electrical circuits [11] CE-CAE-5 Electronic materials, diodes, and bipolar transistors CE-CAE-6 MOS transistor circuits, timing, and power [12] CE-CAE-7 Storage cell architecture CE-CAE-8 Interfacing logic families CE-CAE-9 Operational amplifiers CE-CAE-10 Mixed-signal circuit design CE-CAE-11 Design parameters and issues CE-CAE-12 Circuit modeling and simulation methods	**CE-CAL Computing Algorithms** CE-CAL-1 History and overview CE-CAL-2 Relevant tools, standards and/or engineering constraints CE-CAL-3 Basic algorithmic analysis CE-CAL-4 Algorithmic strategies CE-CAL-5 Classic algorithms for common tasks CE-CAL-6 Analysis and design of application-specific algorithms CE-CAL-7 Parallel algorithms and multi-threading CE-CAL-8 Algorithmic complexity CE-CAL-9 Scheduling algorithms CE-CAL-10 Basic computability theory
CE-CAO Computer Architecture and Organization CE-CAO-1 History and overview CE-CAO-2 Relevant tools, standards and/or engineering constraints CE-CAO-3 Instruction set architecture CE-CAO-4 Measuring performance CE-CAO-5 Computer arithmetic	**CE-DIG Digital Design** CE-DIG-1 History and overview CE-DIG-2 Relevant tools, standards, and/or engineering constraints CE-DIG-3 Number systems and data encoding CE-DIG-4 Boolean algebra applications CE-DIG-5 Basic logic circuits CE-DIG-6 Modular design of combinational circuits

CE-CAO-6 Processor organization CE-CAO-7 Memory system organization and architectures CE-CAO-8 Input/Output interfacing and communication CE-CAO-9 Peripheral subsystems CE-CAO-10 Multi/Many-core architectures CE-CAO-11 Distributed system architectures	CE-DIG-7 Modular design of sequential circuits CE-DIG-8 Control and datapath design CE-DIG-9 Design with programmable logic CE-DIG-10 System design constraints CE-DIG-11 Fault models, testing, and design for testability
CE-ESY Embedded Systems CE-ESY-1 History and overview CE-ESY-2 Relevant tools, standards, and/or engineering constraints CE-ESY-3 Characteristics of embedded systems CE-ESY-4 Basic software techniques for embedded applications CE-ESY-5 Parallel input and output CE-ESY-6 Asynchronous and synchronous serial communication CE-ESY-7 Periodic interrupts, waveform generation, time measurement CE-ESY-8 Data acquisition, control, sensors, actuators CE-ESY-9 Implementation strategies for complex embedded systems CE-ESY-10 Techniques for low-power operation CE-ESY-11 Mobile and networked embedded systems CE-ESY-12 Advanced input/output issues CE-ESY-13 Computing platforms for embedded systems	**CE-NWK Computer Networks** CE-NWK-1 History and overview CE-NWK-2 Relevant tools, standards, and/or engineering constraints CE-NWK-3 Network architecture CE-NWK-4 Local and wide area networks CE-NWK-5 Wireless and mobile networks CE-NWK-6 Network protocols CE-NWK-7 Network applications CE-NWK-8 Network management CE-NWK-9 Data communications CE-NWK-10 Performance evaluation CE-NWK-11 Wireless sensor networks
CE-PPP Preparation for Professional Practice CE-PPP-1 History and overview CE-PPP-2 Relevant tools, standards, and/or engineering constraints CE-PPP-3 Effective communication strategies CE-PPP-4 Interdisciplinary team approaches CE-PPP-5 Philosophical frameworks and cultural issues CE-PPP-6 Engineering solutions and societal effects CE-PPP-7 Professional and ethical responsibilities CE-PPP-8 Intellectual property and legal issues CE-PPP-9 Contemporary issues CE-PPP-10 Business and management issues CE-PPP-11 Tradeoffs in professional practice	**CE-SEC Information Security** CE-SEC-1 History and overview CE-SEC-2 Relevant tools, standards, and/or engineering constraints CE-SEC-3 Data security and integrity CE-SEC-4 Vulnerabilities: technical and human factors CE-SEC-5 Resource protection models CE-SEC-6 Secret and public key cryptography CE-SEC-7 Message authentication codes CE-SEC-8 Network and web security CE-SEC-9 Authentication CE-SEC-10 Trusted computing CE-SEC-11 Side-channel attacks
CE-SGP Signal Processing CE-SGP-1 History and overview CE-SGP-2 Relevant tools, standards, and/or	**CE-SPE Systems and Project Engineering** CE-SPE-1 History and overview CE-SPE-2 Relevant tools, standards and/or

engineering constraints CE-SGP-3 Convolution CE-SGP-4 Transform analysis CE-SGP-5 Frequency response CE-SGP-6 Sampling and aliasing CE-SGP-7 Digital spectra and discrete transforms CE-SGP-8 Finite and infinite impulse response filter design CE-SGP-9 Window functions CE-SGP-10 Multimedia processing CE-SGP-11 Control system theory and applications	engineering constraints CE-SPE-3 Project management principles CE-SPE-4 User experience* CE-SPE-5 Risk, dependability, safety and fault tolerance CE-SPE-6 Hardware and software processes CE-SPE-7 Requirements analysis and elicitation CE-SPE-8 System specifications CE-SPE-9 System architectural design and evaluation CE-SPE-10 Concurrent hardware and software design CE-SPE-11 System integration, testing and validation CE-SPE-12 Maintainability, sustainability, manufacturability
CE-SRM Systems Resource Management CE-SRM-1 History and overview CE-SRM-2 Relevant tools, standards, and/or engineering constraints CE-SRM-3 Managing system resources CE-SRM-4 Real-time operating system design CE-SRM-5 Operating systems for mobile devices CE-SRM-6 Support for concurrent processing CE-SRM-7 System performance evaluation CE-SRM-8 Support for virtualization	**CE-SWD Software Design** CE-SWD-1 History and overview CE-SWD-2 Relevant tools, standards, and/or engineering constraints CE-SWD-3 Programming constructs and paradigms CE-SWD-4 Problem-solving strategies CE-SWD-5 Data structures CE-SWD-6 Recursion CE-SWD-7 Object-oriented design CE-SWD-8 Software testing and quality CE-SWD-9 Data modeling CE-SWD-10 Database systems CE-SWD-11 Event-driven and concurrent programming CE-SWD-12 Using application programming interfaces CE-SWD-13 Data mining CE-SWD-14 Data visualization

In addition to these knowledge areas, there are 4 related computer engineering mathematics as shown in the following table:

CE-ACF Analysis of Continuous Functions CE-ACF-1 History and overview CE-ACF-2 Relevant tools and engineering applications CE-ACF-3 Differentiation methods CE-ACF-4 Integration methods CE-ACF-5 Linear differential equations CE-ACF-6 Non-linear differential equations CE-ACF-7 Partial differential equations CE-ACF-8 Functional series	**CE-DSC Discrete Structures** CE-DSC-1 History and overview CE-DSC-2 Relevant tools and engineering applications CE-DSC-3 Functions, relations, and sets CE-DSC-4 Boolean algebra principles CE-DSC-5 First-order logic CE-DSC-6 Proof techniques CE-DSC-7 Basics of counting CE-DSC-8 Graph and tree representations and properties CE-DSC-9 Iteration and recursion
CE-LAL Linear Algebra CE-LAL-1 History and overview	**CE-PRS Probability and Statistics** CE-PRS-1 History and overview

CE-LAL-2 Relevant tools and engineering applications CE-LAL-3 Bases, vector spaces, and orthogonality CE-LAL-4 Matrix representations of linear systems CE-LAL-5 Matrix inversion CE-LAL-6 Linear transformations CE-LAL-7 Solution of linear systems CE-LAL-8 Numerical solution of non-linear systems CE-LAL-9 System transformations CE-LAL-10 Eigensystems	CE-PRS-2 Relevant tools and engineering applications CE-PRS-3 Discrete probability CE-PRS-4 Continuous probability CE-PRS-5 Expectation and deviation CE-PRS-6 Stochastic Processes CE-PRS-7 Sampling distributions CE-PRS-8 Estimation CE-PRS-9 Hypothesis tests CE-PRS-10 Correlation and regression

The knowledge areas' units are covered by the Computer and Control Systems Engineering Program as shown in the following table:

Computer Engineering Courses/Benchmark Knowledge Area

	Course		Knowledge Area												
	Code	Title	CE-CAE	CE-SGP	CE-DIG	CE-CAO	CE-ESY	CE-SPE	CE-NWK	CE-SEC	CE-SWD	CE-CAL	CE-PPP	CE-SRM	Related Mathematic
Semester I	BES 011	Mathematics I													CE-ACF
	BES 021	Mechanics I													
	BES 041	General Chemistry													
	BES 031	Physics I													
	MEC 011	Engineering Graphics I													
	UHS 101	Foreign Language											3		
	UHS 102	Information and Communication Technology											1-2, 8		
Semester II	BES 012	Mathematics II													CE-LAL
	BES 022	Mechanics II													
	MEC 012	Production Engineering													
	BES 032	Physics II	1-3												
	MEC 014	Computer Aided Drafting													
	ELE 042	Fundamentals									1-3				
	UHS 103	Societal Issues													
Semester III	BES 111	Differential Equations													CE-ACF
	BES 113	Mathematics III													CE-ACF
	ELE 179	Electric Circuits Analysis	1-4, 9, 12												
	ELE 141	Digital Logic Circuits			1-5										
	ELE 143	Object Oriented Programming									3-4,7				
	ELE 173	Electrical Applications													
	UHS XXX	Humanities Elective I	Refer to Humanities Electives												
Semester IV	BES 112	Numerical Analysis													CE-LAL
	BES 114	Discrete Mathematics and Linear Programming													CE-DSC
	ELE 132	Measurements and Instrumentations I					8								
	ELE 142	Digital System Design			2, 6-7, 9										
	ELE 144	Data Structure and Algorithms									4-6	1-2,5			
	ELE 114	Semiconductor Physics	1-2, 5												
Semester V	ELE 211	Signals and Systems		1-7											
	ELE 213	Electronic Circuits I	5-6, 9, 12												
	ELE 231	Control Theory		5,11											
	ELE 241	Computer Architecture			8, 9	1-3, 5-6									
	ELE 243	Algorithms Analysis and Design									4	1-6,8			
	ELE 245	Computer Applications	12												
Semester VI	BES 211	Engineering Statistics and Probability													CE-PRS
	ELE 276	Electric Machines													
	ELE 232	Modern Control Systems		5,11											
	ELE 242	Computer Organization			8,10	1, 4,6-8, 10									
	ELE 244	Operating Systems				7						9		1-4,8	
	ELE 246	Computer Network							1-6						

	Course		Knowledge Area												
	Code	Title	CE-CAE	CE-SGP	CE-DIG	CE-CAO	CE-ESY	CE-SPE	CE-NWK	CE-SEC	CE-SWD	CE-CAL	CE-PPP	CE-SRM	Related Mathematic
Semester VII	ELE 244	Microprocessor Based Systems				3,8-9	7								
	ELE 331	Machine Learning									13				
	ELE 333	Digital Control		5,11											
	ELE 335	Industrial Automation Systems					8								
	ELE 343	Database Systems									9-10				
	UHS XXX	Humanities Elective II	Refer to Humanities Electives												
Semester VIII	ELE 342	Embedded Systems					1-9								
	ELE 3XX	Elective I	Refer to Computer Engineering Electives												
	ELE 3XX	Elective II													
	ELE 3XX	Elective III													
	ELE 392	Senior Design Project I						6-12							
	UHS XXX	Humanities Elective III	Refer to Humanities Electives												
Semester IX	BES 241	Pollution and Industrial Safety													
	ELE 4XX	Elective IV	Refer to Computer Engineering Electives												
	ELE 4XX	Elective V													
	ELE 4XX	Elective VI													
	ELE 491	Senior Design Project II						6-12							
	UHS 104	Professional Ethics											1-2, 7		
Humanities Elective I	UHS 201	Principles of Enterprenuership and Project Management											6, 10		
	UHS 202	Introduction to Economics and Accounting											10		
	UHS 203	Human Resources Management													
	UHS 301	Communication and Presentation Skills											3		
	UHS 302	Leadership Skills											4		
	UHS 801	Research Methodologies													
	UHS 803	Thinking Skills													
Computer Engineering Electives	ELE 3402	Advanced Topics in Computer Networks							6-11						
	ELE 3404	Computer and Nework Security								1-8					
	ELE 3406	Software Engineering									8-9, 11-12				
	ELE 3408	Data Analysis									13-14				
	ELE 3118	Digital Electronics	1-2, 6-8, 11, 12												
	ELE 3410	Web Development							7						
	ELE 3412	Fault-Tolerant Computing			10-11			8							
	ELE 3414	Cloud Computing				11			7						
	ELE 441	Image Processing		10											
	ELE 4401	Parallel and Distributed Systems				10-11						7			
	ELE 4403	Digital Forensics								4, 8-11			9		
	ELE 4405	Software Project Management						1-5							
	ELE 4407	Compilers										10			
	ELE 4409	Internet of Things					10-13								
	ELE 4411	RTL Design			8-10	5									

The Matching of the Computer and Control Engineering with ABET Requirements

Curriculum Criteria

	Computer and Control Systems Engineering	ABET
Mathematics and Basic Science	33 cr. Hrs.	>=30 Cr.Hrs.
Discipline	67 Cr.Hrs.	>=45 Cr.Hrs.

- **ABET Program Criteria for Electrical/ Computer Engineering**

ABET Criteria	Computer and Control Systems Engineering to Cover the Criteria
Probability and Statistics	ELE 211 Engineering Statistics and Probability
Mathematics	BES 011 Mathematics I – BES 012 Mathematics II – BES 111 Differential Equations – BES 113 Mathematics III – BES 112 Numerical Analysis -
Sciences	BES 021 Mechanics I – BES 041 General Chemistry – BES 031 Physics I – BES 022 Mechanics II – BES 032 Physics II -
Discrete Mathematics	BES 114 Discrete Mathematics and Linear Programming
Topics to analyze and design complex electrical and electronic devices	ELE 179 Electric Circuits Analysis – ELE 141 Digital Logic Circuits – ELE 173 Electrical Applications –ELE 114 Semiconductor Physics – ELE 211 Signals and Systems – ELE 213 Electronic Circuits I – ELE 245 Computer Applications – ELE 276 Electric Machines – ELE 346 Computer Simulation Methods – ELE 3118 Digital Electronics – ELE 484 Special Electric Machines – ELE 3306 Modelling and Simulation – ELE 483 Power Electronics
Topics to analyze and design complex software	ELE 042 Computer Programming Fundamentals – ELE 143 Object Oriented Programming – ELE 144 Data Structure and Algorithms – ELE 243 Algorithms Analysis and Design – ELE 343 Database Systems –ELE 3406 Software Engineering – ELE 4405 Software Project Management – ELE 4407 Compilers -
Topics to analyze and design complex hardware systems	ELE 142 Digital System Design – ELE 241 Computer Architecture – ELE 242 Computer Organization – ELE 341 Microprocessor Based Systems – ELE 342 Embedded Systems – ELE 4411 RTL Design
Operating Systems and Networks	ELE 244 Operating Systems – ELE 246 Computer Networks – ELE 3402 Advanced Topics in Computer Networks
Apply Concepts of automatic control	ELE 231 Control Theory – ELE 232 Modern Control Systems – ELE 333 Digital Control – ELE 3304 Intelligent Control – ELE 4305 Advanced Control Systems
Apply concepts of measurements and sensor selection	ELE 132 Measurements and Instrumentations I – ELE 335 Industrial Automation Systems
Utilize programmable logic controllers	ELE 335 Industrial Automation Systems – ELE 4307 Advanced Industrial Automation Systems
Robotic and Automation Fields	ELE 3302 Robotics – ELE 4301 Advanced Robotics – ELE 4303 Autonomous Systems -
Topics to demonstrate the breadth and depth of the program	ELE 331 Machine Learning – ELE 3404 Computer and Network Security – ELE 3408 Data Analytics – ELE 3410 Web Engineering – ELE 3412 Fault-Tolerant Computing – ELE 3414 Cloud Computing – ELE 441 Image Processing – ELE 4401 Parallel and Distributed Systems – ELE 4401 Digital Forensics – ELE 4409 Internet of Things -

Program # 6 Electronics and Electrical Communications Engineering Program

Program Description

The Electronics and Electrical Communications Engineering program offers a specialization for those who want to combine the specialty of Electronics and Communications Engineering as it provides a balanced mix of electronics and communications. This mix has become necessary for the presence of modern electronics, digital systems, and communication systems. This is also in line with the knowledge economy and the dynamic nature of specialization. Each branch has become a stand-alone industry such as the electronics industry, digital systems industry, and the telecommunications technology industry. This specialization is considered one of the modern specializations on the international level, where the department grants a bachelor's degree to graduates in electronics and communications engineering after preparing them with a comprehensive curriculum according to NARS 2018 standards. It also explores new areas in electronics and electrical communications engineering where the program integrates knowledge in different areas of electronic circuits design, digital systems design, communication systems design, electronic systems' applications, digital systems applications, communication networks' connections, information theory and channel coding, modern wireless communication basics, satellites communications, and cellular communications, as well as areas of digital signal processing.

Basic Information

Program Mission

The Electronics and Electrical Communications Engineering program at Benha Faculty of Engineering aims to prepare scientifically qualified and professional engineers in the fields of communications and electronics engineering, able to compete in the local and regional labor market and conduct scientific research to serve the community and develop the environment.

Program Objectives

Program Objectives

The Electronics and Electrical Communications Engineering program is planned to:

1. Apply a wide spectrum of engineering knowledge, science, and specialized skills with analytic, critical, and systemic thinking to design systems, conduct experiments, analyze data, manage projects, identify, and solve engineering problems in real life situation.
2. Enhance the engineering skills by using modern engineering software programs and engineering tools for engineering practice.
3. Behave professionally and adhere to engineering ethics, standards, and work to develop the profession and the community and promote sustainability principles.
4. Work in and lead a heterogeneous team of professionals from different engineering specialties and display leadership qualities, business administration, and entrepreneurial skills.
5. Identify communication, presentation, and language skills to ensure effective communication, demonstrate professional and ethical responsibilities, and engage in lifelong self-learning so that graduates are prepared for post-graduate and research studies beside working in modern and complex work environments in a creative manner.
6. Design, operate, analyze, and maintain different electronic circuits and communication systems.
7. Use modern software tools to design, simulate, and implement different parts of electronics and communication system.

Graduate Attributes

Graduate attributes are the academic abilities, personal qualities, and skills which electronics and electrical communications engineering graduates should have. In addition to all engineering graduate attributes defined by NARS 2018, Electronics and Electrical Communications Engineering graduate should be able to:

1. Master a wide spectrum of engineering knowledge and specialized skills and can apply acquired knowledge using theories and abstract thinking in real life situations
2. Apply analytic critical and systemic thinking to identify, diagnose and solve engineering problems with a wide range of complexity and variation.
3. Behave professionally and adhere to engineering ethics and standards.
4. Work in and lead a heterogeneous team of professionals from different engineering specialties and assume responsibility for own and team performance.
5. Recognize his/her role in promoting the engineering field and contribute to the development of the profession and the community.
6. Value the importance of the environment, both physical and natural, and work to promote sustainability principles.
7. Use techniques, skills, and modern engineering tools necessary for engineering practice.
8. Assume full responsibility for own learning and self-development, engage in lifelong learning and demonstrate the capacity to engage in post- graduate and research studies.
9. Communicate effectively using different modes, tools, and languages with various audiences; to deal with academic/professional challenges in a critical and creative manner.
10. Demonstrate leadership qualities, business administration and entrepreneurial skills.
11. Design, operate, analyze, and maintain different electronic circuits and systems.
12. Design, operate, analyze, and maintain different communication systems.
13. Use modern software tools to design, simulate, and implement different parts of electronics and communication system.

Program Learning Outcomes

The program courses fulfill the NARS 2018. A graduate must be able to:

Level A:

The Engineering Graduate must be able to:

PLO1. Identify, formulate, and solve complex engineering problems by applying engineering fundamentals, basic science, and mathematics.

PLO2. Develop and conduct appropriate experimentation and/or simulation, analyze and interpret data, assess, and evaluate findings, and use statistical analyses and objective engineering judgment to draw conclusions.

PLO3. Apply engineering design processes to produce cost-effective solutions that meet specified needs with consideration for global, cultural, social, economic, environmental, ethical, and other aspects as appropriate to the discipline and within the principles and contexts of sustainable design and development.

PLO4. Utilize contemporary technologies, codes of practice and standards, quality guidelines, health and safety requirements, environmental issues, and risk management principles.

PLO5. Practice research techniques and methods of investigation as an inherent part of learning.

PLO6. Plan, supervise and monitor implementation of engineering projects, taking into consideration other trades requirements.

PLO7. Function efficiently as an individual and as a member of multi-disciplinary and multi-cultural teams.

PLO8. Communicate effectively – graphically, verbally and in writing – with a range of audiences using contemporary tools.

PLO9. Use creative, innovative, and flexible thinking and acquire entrepreneurial and leadership skills to anticipate and respond to new situations.

PLO10. Acquire and apply new knowledge, and practice self, lifelong and other learning strategies.

Level B:

In addition to the competencies for all engineering programs, the BASIC ELECTRICAL Engineering graduate and similar programs must be able to:

PLO11. Design, model and analyze an electrical/electronic/digital system or component for a specific application; and identify the tools required to optimize this design.

PLO12. Design and implement elements, modules, sub-systems, or systems in electrical/electronic/digital engineering using technological and professional tools.

PLO13. Estimate and measure the performance of an electrical/electronic/digital system and circuit under specific input excitation and evaluate its suitability for a specific application.

PLO14. Adopt suitable national and international standards and codes to design, build, operate, inspect and maintain electrical/electronic/digital equipment, systems and services.

Level C:

In addition to competencies for all engineering programs (Level A, NARS 2018), and specific Electric Engineering competencies (Level B, NARS 2018), electronics and electrical communications engineer must be able to:

PLO15. Understand the underlying physical phenomena and limitations of the performance of components and systems in electronics and communications engineering.

PLO16. Design, model and analyze of elements, modules, and sub-systems in communication and electronics systems for specific applications using technological and professional tools and identify the software tools required to optimize this design.

PLO17. Design and compare between alternative components and systems in electronics and communications Engineering; Demonstrate the knowledge about state of the art of circuits and systems in electronics and communications engineering.

PLO18. Estimate and measure the performance of sub-block in a communication system or the whole communication and electronics system under specific working conditions and evaluate its suitability for a specific application.

PLO19. Design and Implement Embedded Systems/ Image and Signal Processing Systems/ Systems Using Programmable Devices/Systems Using ASIC Design, taking into account relevant system design constraints (time, interrupts, reliability, reducing failure, bridging the analog and digital domains, ...).

Faculty Mission vs. Program Mission Matrix

Faculty Mission		Program Mission		
		The Electronics and Electrical Communications Engineering program at Benha Faculty of Engineering aims to prepare scientifically qualified and professional engineers in the fields of communications and electronics engineering, able to compete in the local and regional labor market and conduct scientific research to serve the community and develop the environment.		
		prepare scientifically qualified and professional engineers in the fields of communications and electronics engineering	able to compete in the local and regional labor market and conduct scientific research	participate effectively and ethically in serving their professional and societal communities
Benha University is committed to graduate well prepared engineers equipped with knowledge and skills necessary to compete in labor market, and capable of using and developing modern technology, and providing research in engineering fields to serve society and community.	graduate well prepared engineers equipped with knowledge and skills	√		
	compete in labor market capable of using and developing modern technology, and providing research in engineering fields		√	
	serve society and community.			√

Program Mission vs. Program Objectives Matrix

Program Mission		Program Objectives						
		PO1	PO2	PO3	PO4	PO5	PO6	PO7
The Electrical Communications and Electronics Engineering program at Benha Faculty of Engineering aims to prepare scientifically qualified and professional engineers in the fields of communications and electronics engineering, able to compete in the local and regional labor market and conduct scientific research to serve the community and develop the environment.	prepare scientifically qualified and professional engineers in the fields of communications and electronics engineering	√	√				√	√
	able to compete in the local and regional labor market and conduct scientific research			√	√	√		
	participate effectively and ethically in serving their professional and societal communities			√	√	√		

Program Objectives vs. Graduate Attributes Matrix

Program Objectives	Graduate Attributes												
	G.A 1	G.A 2	G.A 3	G.A 4	G.A 5	G.A 6	G.A 7	G.A 8	G.A 9	G.A 10	G.A 11	G.A 12	G.A 13
PO1	√	√											
PO2							√						
PO3			√		√	√							
PO4				√						√			
PO5								√	√				
PO6											√	√	
PO7													√

Program Competencies vs. Program Objectives Matrix

Program Objectives	Program Competencies																		
	Level A										Level B				Level C				
	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	B1	B2	B3	B4	C1	C2	C3	C4	C5
PO1	√	√	√								√	√	√						
PO2					√						√	√				√			
PO3				√	√									√					
PO4						√	√	√											
PO5					√			√	√	√									
PO6			√	√							√	√	√	√	√	√	√	√	√
PO7		√		√								√				√			√

Career Prospects

Electronics engineers work in most industries, including the digital computer, automobile, aerospace, wired and wireless communications, manufacturing, defense, and electronics industries. They design high-tech devices ranging from tiny microelectronic integrated-circuit chips to powerful systems that utilize those chips and efficient communication systems that interconnect those systems. Communications engineers analysis, design, and develop communications equipment and systems. They are also involved in the production of these systems. As a communication engineer you could work within several industries, including internet and computing technologies, networking and telecommunications, and radio transmission. Many posts include elements of both managerial and technical responsibilities but it's also possible for you to focus on just one of these areas.

List of Electronics and Electrical Communications Engineering Requirement Courses

Requirement	Cr. Hrs.	Ct. Hr			
		Lec	Lab	Tut	Tot
Benha University Requirements	14	14	0	0	14
Benha Faculty of Engineering Requirements	32	19	34	47	50
Discipline Requirements	68	45	30	29	104
Electronics and Electrical Communications Program Requirements	46	29	28	19	76
Total	**160**	**107**	**92**	**95**	**244**

Basic Science Requirements of Electronics and Electrical Communications Engineering

Code	Course Title	Pre-Req	Cr. Hrs.	Ct. Hr.			
				Lec	Lab	Tut	Sum
BES 011	Mathematics I		3	2	0	2	4
BES 041	General Chemistry		4	3	2	1	6
BES 031	Physics I		3	2	2	1	5
BES 012	Mathematics II	BES 011	3	2	0	2	4
BES 032	Physics II		3	2	2	1	5
BES 111	Differential Equations	BES 012	3	2	0	2	4
BES 112	Numerical Analysis	BES 111	3	2	2	0	4
*BES 141	Pollution and Industrial Safety	BES 041	2	2	1	0	3
BES 113	Mathematics III	BES 012	3	2	0	2	4
BES 211	Engineering Statistics and Probability	BES 012	3	2	1	1	4
**ELE 114	Semiconductors Physics	BES 032	3	2	0	2	4
Total			**30**	**21**	**10**	**18**	**41**

* Course teaching is shared between the Basic Engineering Science Department and Electrical Engineering Department.

** One credit hour is considered as Basic Engineering Science topics and two Cr. Hrs. are Electrical Engineering topics.

Program Requirements of Electronics and Electrical Communications Engineering

Code	Course Title	Pre-Req	Cr. Hrs.	Ct. Hr.			
				Lec	Lab	Tut	Sum
BES 111	Differential Equations	BES 012	3	2	0	2	4
BES 112	Numerical Analysis	BES 111	3	2	2	0	4
ELE 111	Electric Circuits I	BES 032	3	2	1	2	5
ELE 112	Electric Circuits II	ELE 111	3	2	1	2	5
ELE 114	Semiconductor Physics	BES 032	3	2	0	2	4
ELE 141	Digital Logic Circuits		3	2	1	2	5
ELE 142	Digital System Design	ELE 141	3	2	2	1	5
ELE 143	Object Oriented Programming	ELE 042	3	2	2	0	4
ELE 144	Data Structure and Algorithms	ELE 143	3	2	2	0	4
ELE 173	Electrical Applications		2	1	3	0	4
ELE 132	Measurements and Instrumentations I	ELE 179 or ELE 111	3	2	2	1	5
BES 113	Mathematics III	BES 012	3	2	0	2	4
BES 211	Engineering Statistics and Probability	BES 012	3	2	1	1	4
ELE 211	Signals and Systems	BES 111	3	2	0	2	4
ELE 213	Electronic Circuits I	BES 131 or ELE 114	3	2	1	2	5
ELE 214	Electronic Circuits II	ELE 213	3	2	1	2	5
ELE 245	Computer Applications	ELE 042	3	2	2	0	4
ELE 216	Electromagnetic Field	BES 113	3	2	0	2	4
ELE 241	Computer Architecture	ELE 142	3	2	2	1	5
ELE 242	Computer Organization	ELE 241	3	2	2	1	5
ELE 231	Control Theory	BES 111	3	2	1	2	5
ELE 2xx	Elective I		3	2	2	1	5
ELE 341	Microprocessor Based Systems	ELE 242	3	2	1	2	5
Total			**68**	**45**	**30**	**29**	**104**

Pool of Electives of Discipline Requirements of Electronics and Electrical Communications Engineering

Elective	Code	Course	Pre-Req
Elective I	ELE 246	Computer Network	
	ELE 232	Modern Control	ELE 231

Major Requirements of Electronics and Electrical Communications Engineering

Code	Course Title	Pre-Req	Cr. Hrs.	Ct. Hr.			
				Lec	Lab	Tut	Tot
ELE 212	Analog Communication Systems	ELE 211	3	2	1	2	5
ELE 311	Digital Communication Systems	ELE 212	3	2	1	2	5
ELE 312	Wireless Communication Systems	ELE 211	3	2	1	2	5
ELE 313	Information Theory	BES 211	2	2	1	1	4
ELE 314	Digital Signal Processing I	ELE 211	3	2	1	2	5
ELE 315	Transmission Lines	ELE 216	3	2	1	2	5
ELE 316	Antenna Theory and Wave Propagation I	ELE 315	3	2	1	2	5
ELE 317	Electronic Circuit Design	ELE 214	3	2	1	2	5
ELE 4411	RTL design	ELE 242	3	2	2	1	5
ELE 411x	Elective II		3	2	2	1	5
ELE 412x	Elective III		3	2	2	1	5
ELE 413x	Elective IV		3	2	2	0	4
ELE 442x	Elective V		3	2	2	1	5
ELE 415x	Elective VI		3	2	2	0	4
*ELE 392	Senior Design Project I		2	0	4	0	4
ELE 491	Senior Design Project II	ELE 392	3	1	4	0	5
Total			**46**	**29**	**28**	**19**	**76**

*The student can register the Senior Design Project course after passing 70% of the program cr. hrs, i.e., 105 Cr. Hr.

Pool of Electives of Electronics and Electrical Communications Engineering

Elective	Code	Course Title	Pre-Req
Elective II	ELE 4111	Satellite Communication	ELE 312
	ELE 4112	Cellular Communication	ELE 312
Elective III	ELE 4121	Antenna Theory and Wave Propagation II	ELE 316
	ELE 4122	Microwave Circuits and Devices	ELE 316
Elective IV	ELE 4131	Forward Error Correction Codes	ELE 313
	ELE 4132	Embedded Systems	ELE 341
Elective V	ELE 4425	VLSI Design	ELE 4411
	ELE 4427	ASIC Design	ELE 4411
Elective VI	ELE 4151	Digital Signal Processing II	ELE 314
	ELE 4152	Detection and Estimation Theory	ELE 211

Proposed Study Plan for Electronics and Electrical Communications Engineering

Level 0-1													
Code	Course	Pre-Req	Cr. Hrs.	Ct. Hr.				Final Exam time	Assessment				
				Lec	Lab	Tut	Sum		SA	MT	PE/OE	Final Exam	Sum
BES 011	Mathematics I		3	2	0	2	4	2	30	30	-	40	100
BES 021	Mechanics I		3	2	0	2	4	2	30	30	-	40	100
BES 041	General Chemistry		4	3	2	1	6	2	10	30	20	40	100
BES 031	Physics I		3	2	2	1	5	2	10	30	20	40	100
MEC 011	Engineering Graphics		2	0	0	4	4	2	30	30	-	40	100
UHS 101	Foreign Language		2	2	0	0	2	2	30	30	-	40	100
UHS 102	Information and Communication technology		2	2	0	0	2	2	30	30	-	40	100
Total			**19**	**13**	**4**	**10**	**27**						**700**

Level 0-2													
Code	Course	Pre-Req	Cr. Hrs.	Ct. Hr.				Final Exam time	Assessment				
				Lec	Lab	Tut	Sum		SA	MT	PE/OE	Final Exam	Sum
BES 012	Mathematics II	BES 011	3	2	0	2	4	2	30	30	-	40	100
BES 022	Mechanics II	BES 021	3	2	0	2	4	2	30	30	-	40	100
BES 032	Physics II		3	2	2	1	5	2	10	30	20	40	100
MEC 012	Production Engineering		2	1	3	0	4	2	10	30	20	40	100
MEC 014	Computer Aided Drafting	MEC 011	2	1	2	0	3	2	10	30	20	40	100
ELE 042	Computer Programming Fundamentals		2	0	2	2	4	2	10	30	20	40	100
UHS 103	Societal Issues		2	2	0	0	2	2	30	30	-	40	100
Total			**17**	**10**	**9**	**7**	**26**						**700**

Level 1-1													
Code	Course	Pre-Req	Cr. Hrs.	Ct. Hr.				Final Exam time	Assessment				
				Lec	Lab	Tut	Sum		SA	MT	PE/OE	Final Exam	Sum
ELE 111	Electric Circuits I	BES 032	3	2	1	2	5	2	10	30	20	40	100
ELE 141	Digital Logic Circuits		3	2	1	2	5	2	10	30	20	40	100
ELE 143	Object Oriented Programming	ELE 042	3	2	2	0	4	2	10	30	20	40	100
ELE 173	Electrical Application		2	1	3	0	4	2	10	30	20	40	100
BES 111	Differential Equations	BES 012	3	2	0	2	4	2	30	30	-	40	100
BES 141	Pollution and Industrial Safety	BES 041	2	2	1	0	3	2	10	30	20	40	100
UHS 2XX	Humanities Elective I		2	2	0	0	2	2	30	30	-	40	100
Total			**18**	**13**	**8**	**6**	**27**						**700**

Level 1-2													
Code	Course	Pre-Req	Cr. Hrs.	Ct. Hr.				Final Exam time	Assessment				
				Lec	Lab	Tut	Sum		SA	MT	PE/OE	Final Exam	Sum
ELE 112	Electric Circuits II	ELE 111	3	2	1	2	5	2	10	30	20	40	100
ELE 142	Digital System Design	ELE 141	3	2	2	1	5	2	10	30	20	40	100
ELE 144	Data Structure and Algorithms	ELE 143	3	2	2	0	4	2	10	30	20	40	100
ELE 132	Measurements and Instrumentations I	ELE 111 or ELE 179	3	2	2	1	5	2	10	30	20	40	100
BES 112	Numerical Analysis	BES 111	3	2	2	0	4	2	10	30	20	40	100
ELE 114	Semiconductors Physics	BES 032	3	2	0	2	4	2	30	30	-	40	100
Total			**18**	**12**	**9**	**6**	**27**						**600**

Field Training I													
Code	Course	Pre-Req	Cr. Hrs.	Ct. Hr.				Final Exam time	Assessment				
				Lec	Lab	Tut	Sum		SA	MT	PE/OE	Final Exam	Sum
FTR 103	Field Training I	Completion of 65 Cr. Hr	0	0	0	0	0	Oral	-	-	-	Pass or Fail	-

Level 2-1													
Code	Course	Pre-Req	Cr. Hrs.	Ct. Hr.				Final Exam time	Assessment				
				Lec	Lab	Tut	Sum		SA	MT	PE/OE	Final Exam	Sum
ELE 211	Signals and Systems	BES 111	3	2	0	2	4	2	30	30	-	40	100
ELE 213	Electronic Circuits I	ELE 114	3	2	1	2	5	2	10	30	20	40	100
ELE 245	Computer Applications	ELE 042	3	2	2	0	4	2	10	30	20	40	100
ELE 241	Computer Architecture	ELE 142	3	2	2	1	5	2	10	30	20	40	100
ELE 231	Control Theory	BES 111	3	2	1	2	5	2	10	30	20	40	100
BES 113	Mathematics III	BES 012	3	2	0	2	4	2	30	30	-	40	100
Total			**18**	**12**	**6**	**9**	**27**						**600**

Level 2-2													
Code	Course	Pre-Req	Cr. Hrs.	Ct. Hr.				Final Exam time	Assessment				
				Lec	Lab	Tut	Sum		SA	MT	PE/OE	Final Exam	Sum
ELE 212	Analog Communication Systems	ELE 211	3	2	1	2	5	2	10	30	20	40	100
ELE 214	Electronic Circuits II	ELE 213	3	2	1	2	5	2	10	30	20	40	100
ELE 216	Electromagnetic Fields	BES 113	3	2	0	2	4	2	30	30	-	40	100
ELE 242	Computer Organization	ELE 241	3	2	2	1	5	2	10	30	20	40	100
BES 211	Engineering Statistics and Probability	BES 012	3	2	1	1	4	2	10	30	20	40	100
ELE 2xx	Elective I		3	2	2	1	5	2	10	30	20	40	100
Total			**18**	**12**	**7**	**9**	**28**						**600**

Field Training II													
Code	Course	Pre-Req	Cr. Hrs.	Ct. Hr.				Final Exam time	Assessment				
				Lec	Lab	Tut	Sum		SA	MT	PE/OE	Final Exam	Sum
FTR 203	Field Training II	Completion of 96 Cr. Hr	0	0	0	0	0	Oral	-	-	-	Pass or Fail	-

Level 3-1													
Code	Course	Pre-Req	Cr. Hrs.	Ct. Hr.				Final Exam time	Assessment				
				Lec	Lab	Tut	Sum		SA	MT	PE/OE	Final Exam	Sum
ELE 311	Digital Communication Systems	ELE 212	3	2	1	2	5	2	10	30	20	40	100
ELE 313	Information Theory	BES 211	2	2	1	1	4	2	10	30	20	40	100
ELE 315	Transmission Lines	ELE 216	3	2	1	2	5	2	10	30	20	40	100
ELE 317	Electronic Circuit Design	ELE 214	3	2	1	2	5	2	10	30	20	40	100
ELE 341	Microprocessor Based Systems	ELE 242	3	2	1	2	5	2	10	30	20	40	100
UHS 104	Professional Ethics		2	2	0	0	2	2	30	30	-	40	100
UHS 3XX	Humanities Elective II		2	2	0	0	2	2	30	30	-	40	100
Total			**18**	**14**	**5**	**9**	**28**						**700**

Level 3-2													
Code	Course	Pre-Req	Cr. Hrs.	Ct. Hr.				Final Exam time	Assessment				
				Lec	Lab	Tut	Sum		SA	MT	PE/OE	Final Exam	Sum
ELE 312	Wireless Communication Systems	ELE 311	3	2	1	2	5	2	10	30	20	40	100
ELE 314	Digital Signal Processing I	ELE 211	3	2	1	2	5	2	10	30	20	40	100
ELE 316	Antenna Theory and Wave Propagation I	ELE 315	3	2	1	2	5	2	10	30	20	40	100
ELE 4411	RTL design	ELE 242	3	2	2	1	5	2	10	30	20	40	100
ELE 392	Senior Design Project I		2	0	4	0	4	2	50	-	50	--	100
UHS 8XX	Humanities Elective III		2	2	0	0	2	2	30	30	-	40	100
Total			**16**	**10**	**9**	**7**	**26**						**600**

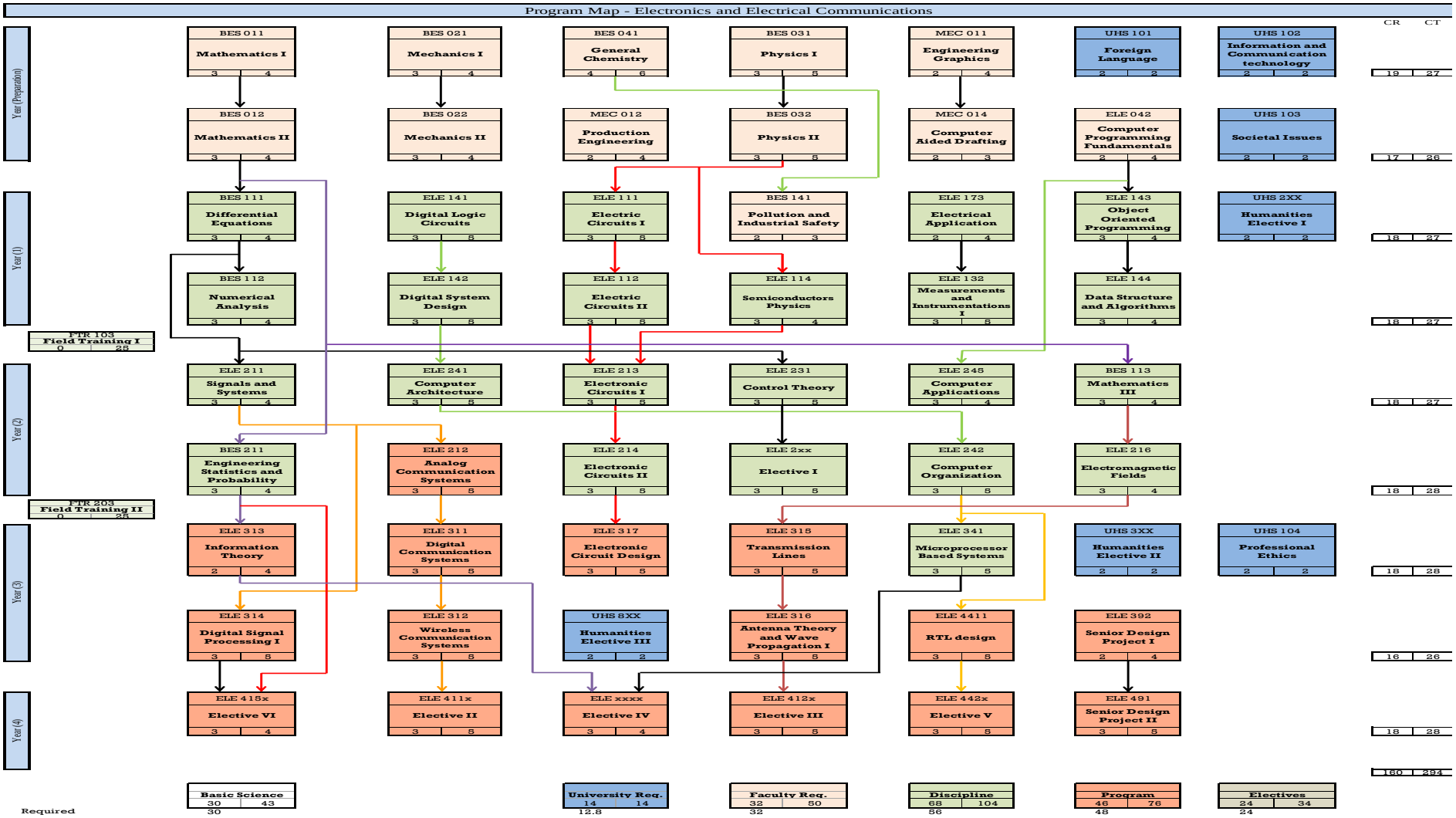
Level 4-1													
Code	Course	Pre-Req	Cr. Hrs.	Ct. Hr.				Final Exam time	Assessment				
				Lec	Lab	Tut	Sum		SA	MT	PE/OE	Final Exam	Sum
ELE 411x	Elective II		3	2	2	1	5	2	10	30	20	40	100
ELE 412x	Elective III		3	2	2	1	5	2	10	30	20	40	100
ELE 413x	Elective IV		3	2	2	0	4	2	10	30	20	40	100
ELE 442x	Elective V		3	2	2	1	5	2	10	30	20	40	100
ELE 415x	Elective VI		3	2	2	0	4	2	10	30	20	40	100
ELE 491	Senior Design Project II	ELE 392	3	1	4	0	5	2	50	-	50	--	100
Total			**18**	**11**	**14**	**3**	**28**						**600**

Curriculum Plan

Program Map - Electronics and Electrical Communications

								CR	CT
Year (Preparation)	BES 011 Mathematics I 3 4	BES 021 Mechanics I 3 4	BES 041 General Chemistry 4 6	BES 031 Physics I 3 5	MEC 011 Engineering Graphics 2 4	UHS 101 Foreign Language 2 2	UHS 102 Information and Communication technology 2 2	19	27
	BES 012 Mathematics II 3 4	BES 022 Mechanics II 3 4	MEC 012 Production Engineering 2 4	BES 032 Physics II 3 5	MEC 014 Computer Aided Drafting 2 3	ELE 042 Computer Programming Fundamentals 2 4	UHS 103 Societal Issues 2 2	17	26
Year (1)	BES 111 Differential Equations 3 4	ELE 111 Electric Circuits I 3 5	ELE 141 Digital Logic Circuits 3 5	ELE 143 Object Oriented Programming 3 4	ELE 173 Electrical Application 2 4	BES 141 Pollution and Industrial Safety 2 3	UHS 2XX Humanities Elective I 2 2	18	27
	BES 112 Numerical Analysis 3 4	ELE 112 Electric Circuits II 3 5	ELE 142 Digital System Design 3 5	ELE 144 Data Structure and Algorithms 3 4	ELE 132 Measurements and Instrumentations I 3 5	ELE 114 Semiconductors Physics 3 4		18	27
	FTR 103 Field Training I 0 25								
Year (2)	BES 113 Mathematics III 3 4	ELE 211 Signals and Systems 3 4	ELE 213 Electronic Circuits I 3 5	ELE 245 Computer Applications 3 4	ELE 241 Computer Architecture 3 5	ELE 231 Control Theory 3 5		18	27
	BES 211 Engineering Statistics and Probability 3 4	ELE 212 Analog Communication Systems 3 5	ELE 214 Electronic Circuits II 3 5	ELE 216 Electromagnetic Fields 3 4	ELE 242 Computer Organization 3 5	ELE 2xx Elective I 3 5		18	28
	FTR 203 Field Training II 0 25								
Year (3)	ELE 311 Digital Communication Systems 3 5	ELE 313 Information Theory 2 4	ELE 315 Transmission Lines 3 5	ELE 317 Electronic Circuit Design 3 5	ELE 341 Microprocessor Based Systems 3 5	UHS 3XX Humanities Elective II 2 2	UHS 104 Professional Ethics 2 2	18	28
	ELE 312 Wireless Communication Systems 3 5	ELE 314 Digital Signal Processing I 3 5	ELE 316 Antenna Theory and Wave Propagation I 3 5	ELE 4411 RTL design 3 5	UHS 8XX Humanities Elective III 2 2	ELE 392 Senior Design Project I 2 4		16	26
Year (4)	ELE 411x Elective II 3 5	ELE 412x Elective III 3 5	ELE xxxx Elective IV 3 4	ELE 442x Elective V 3 5	ELE 415x Elective VI 3 4	ELE 491 Senior Design Project II 3 5		18	28
								160	244
	Basic Science 30 43		University Req. 14	Faculty Req. 32 50	Discipline 68 104	Program 46 76	Electives 24 34		
Required	30		12.8	32	56	48	24		

Curriculum Flowchart



Program Learning Outcomes to Program Courses Matrix

Level	CODE	Course Name	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO 7	PLO 8	PLO 9	PLO 10	PLO 11	PLO 12	PLO 13	PLO 14	PLO 15	PLO 16	PLO 17	PLO 18	PLO 19
Level-1	BES 011	Mathematics I	√		√																
	BES 021	Mechanics I	√	√																	
	BES 041	General Chemistry	√	√																	
	BES 031	Physics I	√	√																	
	MEC 011	Engineering Graphics						√		√											
	UHS 101	Foreign Language								√		√									
	UHS 102	Information and Communication technology				√						√									
Level-2	BES 012	Mathematics II	√		√																
	BES 022	Mechanics II	√	√																	
	BES 032	Physics II	√	√																	
	MEC 012	Production Engineering				√		√													
	MEC 014	Computer Aided Drafting				√				√											
	ELE 042	Computer Programming Fundamentals	√		√																
	UHS 103	Societal Issues							√			√									
Level-3	ELE 111	Electric Circuits I		√									√								
	ELE 141	Digital Logic Circuits	√	√	√								√								
	ELE 143	Object Oriented Programming			√						√			√							
	ELE 173	Electrical Application				√	√						√			√					
	BES 111	Differential Equations	√	√																	
	BES 141	Pollution and Industrial Safety	√		√	√															
	UHS 2XX	Humanities Elective I									√										
Level-4	ELE 112	Electric Circuits II		√	√	√									√						
	ELE 142	Digital System Design		√	√									√							
	ELE 144	Data Structure and Algorithms			√			√													
	ELE 132	Measurements and Instrumentations I											√		√	√					
	BES 112	Numerical Analysis	√	√																	
	ELE 114	Semiconductors Physics											√		√						
	FTR 103	Field Training I							√			√									
Level-5	ELE 211	Signals and Systems											√		√						

	ELE 213	Electronic Circuits I											√	√						
	ELE 245	Computer Applications		√								√		√						
	ELE 241	Computer Architecture		√								√	√							
	ELE 231	Control Theory		√	√								√	√						
	BES 113	Mathematics III	√	√																
Level-6	ELE 212	Analog Communication Systems					√			√							√	√	√	√	
	ELE 214	Electronic Circuits II		√									√	√						
	ELE 216	Electromagnetic Fields										√		√						
	ELE 242	Computer Organization								√	√	√		√						
	BES 211	Engineering Probability and Statistics	√	√																
	ELE 2xx	Elective I		√	√									√	√					
	FTR 203	Field Training II							√			√								
Level-7	ELE 311	Digital Communication Systems					√			√								√	√	√	
	ELE 313	Information Theory	√		√		√										√	√	√	√	
	ELE 315	Transmission Lines	√				√								√		√	√	√	√	
	ELE 317	Electronic Circuit Design			√							√	√				√	√	√		
	ELE 341	Microprocessor Based Systems											√	√							
	UHS 104	Professional Ethics				√															
	UHS 3XX	Humanities Elective II							√		√										
Level-8	ELE 312	Wireless Communication Systems					√		√	√	√							√	√	√	√
	ELE 314	Digital Signal Processing I	√	√							√						√	√	√		√
	ELE 316	Antenna Theory and Wave Propagation I	√	√	√								√		√			√	√	√	
	ELE 4411	RTL design						√	√		√							√	√		√
	ELE 392	Senior Design Project I					√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
	UHS 8XX	Humanities Elective III					√					√									
Level-9	ELE 411x	Elective II					√			√						√	√	√	√	√	
	ELE 412x	Elective III											√		√			√	√	√	
	ELE 413x	Elective IV						√										√	√		√
	ELE 442x	Elective V							√		√							√	√	√	√
	ELE 415x	Elective VI										√						√	√	√	√
	ELE 491	Senior Design Project II			√		√	√	√	√	√	√	√	√	√	√	√	√	√	√	√

The Matching of the Electronics and Electrical Communications Engineering Program with ABET Requirements

Curriculum Criteria

	Electronics and Electrical Communications Engineering Program	ABET
Mathematics and Basic Science	30 cr. Hrs.	>=30 Cr.Hrs.
Discipline	68 Cr.Hrs.	>=45 Cr.Hrs.

ABET Program Criteria for Electronics and Electrical Communications Engineering

ABET Criteria	Electronics and Electrical Communications Engineering to Cover the Criteria
Probability and Statistics	ELE 211 Engineering Statistics and Probability.
Mathematics	BES 011 Mathematics I, BES 012 Mathematics II, BES 111 Differential Equations, BES 113 Mathematics III, BES 112 Numerical Analysis.
Sciences	BES 021 Mechanics I, BES 022 Mechanics II, BES 031 Physics I, BES 032 Physics II, ELE 114 Semiconductors Physics, BES 041 General Chemistry, BES 141 Pollution and Industrial Safety.
Topics to analyze and design complex electrical and electronic devices, software, and systems containing hardware and software components.	ELE 111 Electric Circuits I, ELE 112, Electric circuits II, ELE 141 Digital Logic Circuits, ELE 142 Digital System Design, ELE 143 Object Oriented Programming, ELE 144 Data Structure and Algorithms, ELE 173 Electrical Applications, ELE 245 Computer Applications, ELE 132 Measurements and Instrumentations I, ELE 211 Signals and Systems, ELE 213 Electronic Circuits I, ELE 214 Electronic Circuits II, ELE 216 Electromagnetic Fields, ELE 241Computer Architecture, ELE 242 Computer Organization, ELE 231 Control Theory, ELE 232 Modern Control, ELE 341Microprocessor Based Systems, ELE 246 Computer Network, ELE 317 Electronic Circuit Design, ELE 4411 RTL design, ELE 4425 VLSI Design, ELE 4427 ASIC Design.
advanced mathematics, such as differential equations, linear algebra, complex variables, and discrete mathematics.	BES 111 Differential Equations, BES 113 Mathematics III, ELE 211 Signals and Systems, ELE 314 Digital Signal Processing I.
topics in communication theory and systems.	ELE 212 Analog Communication Systems, ELE 311 Digital Communication Systems, ELE 312 Wireless Communication Systems, ELE 313 Information Theory, ELE 314 Digital Signal Processing I, ELE 315 Transmission Lines, ELE 316 Antenna Theory and Wave Propagation I, ELE 4111Satellite Communication, ELE 4112 Cellular Communication, ELE 4121Antenna Theory and Wave Propagation II, ELE 4122 Microwave Circuits and Devices, ELE 4131 Forward Error Correction Codes, ELE 4151 Digital Signal Processing II, ELE 4152 Detection and Estimation Theory.

Program# 7 Biomedical Engineering Program

Program Description

Biomedical Engineering is a discipline that integrates the science and technology of design, implementation, controlling and maintenance of software and hardware components of computing systems, computer-controlled equipment, and networks of intelligent devices. Generally, Biomedical Engineering is some combination of both electrical engineering and computer science.

Because of the breadth of the Biomedical Engineering field, computer-related coursework typically comes from computer organization and architecture, networks, algorithms, programming, databases, software engineering, automation, and intelligent systems. Electrical engineering related coursework typically comes from circuits, digital logic, microelectronics, signal processing, control systems, and integrated circuit design. Foundational areas typically include basic sciences, mathematics for both discrete and continuous domains, and applications of probability and statistics.

Basic Information

Program Mission

The mission of the Biomedical Engineering program is to provide the highest standard of excellence in higher education and to pursue continuous quality improvement of various engineering and management aspects in Biomedical Engineering and healthcare field. And to provide the community with graduates capable of effectively using relevant scientific and technical knowledge in digital healthcare. Problem-solving capabilities, teamwork, and communications skills developed by the graduates of the program will contribute to qualify the healthcare facilities for accreditation.

Program Objectives

Biomedical Engineering program is planned to:

1. Providing fundamental knowledge required for practicing high quality medical engineering .
2. Scientific principles, rigorous analysis, and creative design necessary for advanced study to serve healthcare systems.
3. Providing knowledge of important current issues, that are necessary for productive careers in both public and private sectors, and for the pursuit of graduate education .
4. Qualifying graduates for local, regional (particularly, in the Arab and African regions) and international markets .
5. Developing high communication skills, and emphasizing professional attitudes and ethics, so that graduates are prepared for complex modern work environments and lifelong learning .
6. Providing an environment that enables students to pursue their goals in an innovative program that is rigorous, challenging, open, and supportive .
7. To realize the impact of multidisciplinary engineering and scientific technologies in healthcare.

Graduate Attributes

Graduate attributes are the academic abilities, personal qualities, and skills which Biomedical Engineering graduates should have.
According to NARS 2018 all engineering graduates must:

1. Master a wide spectrum of engineering knowledge and specialized skills and can apply acquired knowledge using theories and abstract thinking in real life situations.
2. Apply analytic critical and systemic thinking to identify, diagnose and solve engineering problems with a wide range of complexity and variation.
3. Behave professionally and adhere to engineering ethics and standards.
4. Work in and lead a heterogeneous team of professionals from different engineering specialties and assume responsibility for own and team performance.
5. Recognize his/her role in promoting the engineering field and contribute in the development of the profession and the community;
6. Value the importance of the environment, both physical and natural, and work to promote sustainability principles.
7. Use techniques, skills, and modern engineering tools necessary for engineering practice.
8. Assume full responsibility for own learning and self-development, engage in lifelong learning and demonstrate the capacity to engage in post- graduate and research studies.
9. Communicate effectively using different modes, tools, and languages with various audiences; to deal with academic/professional challenges in a critical and creative manner.
10. Demonstrate leadership qualities, business administration and entrepreneurial skills.

In addition to all engineering graduate attributes defined by NARS 2018, Biomedical Engineering graduate should be able to:

11. Apply knowledge of mathematics, science, and engineering concepts to the solution of engineering problems.
12. Design a system; component and process to meet the required needs within realistic constraints.
13. Consider the impacts of engineering solutions on society and environment.

Program Learning outcomes

- **Level A learning outcomes**

The Engineering Graduate must be able to:

PLO1. Identify, formulate, and solve complex engineering problems by applying engineering fundamentals, basic science, and mathematics

PLO2. Develop and conduct appropriate experimentation and/or simulation, analyze and interpret data, assess, and evaluate findings, and use statistical analyses and objective engineering judgment to draw conclusions

PLO3. Apply engineering design processes to produce cost-effective solutions that meet specified needs with consideration for global, cultural, social, economic, environmental, ethical, and other aspects as appropriate to the discipline and within the principles and contexts of sustainable design and development

PLO4. Utilize contemporary technologies, codes of practice and standards, quality guidelines, health and safety requirements, environmental issues, and risk management principles

PLO5. Practice research techniques and methods of investigation as an inherent part of learning.

PLO6. Plan, supervise and monitor implementation of engineering projects, taking into consideration other trades requirements

PLO7. Function efficiently as an individual and as a member of multi-disciplinary and multi-cultural teams

PLO8. Communicate effectively – graphically, verbally and in writing – with a range of audiences using contemporary tools

PLO9. Use creative, innovative, and flexible thinking and acquire entrepreneurial and leadership skills to anticipate and respond to new situations

PLO10. Acquire and apply new knowledge, and practice self, lifelong and other learning strategies

Level D learning outcomes

In addition to the program learning outcomes for All Engineering Programs the BASIC ELECTRICAL Engineering graduate and similar programs must be considered as: NARS 2018 & https://www.sydney.edu.au/handbooks/engineering/engineering_combined/combined_biomedical.shtml (Bench Mark (BM))

PLO11. Design, model and analyze an electrical/electronic/digital system or component for a specific application; and identify the tools required to optimize this design.

PLO12. Design and implement elements, modules, sub-systems or systems in electrical/electronic/digital engineering using technological and professional tools.

PLO13. Estimate and measure the performance of an electrical/electronic/digital system and circuit under specific input excitation and evaluate its suitability for a specific application.

PLO14. Adopt suitable national and international standards and codes to design, build, operate, inspect and maintain electrical/electronic/digital equipment, systems and services.

PLO15. Determine the characteristics of a given problem, choose the appropriate method to solve, analyze, design, and apply programming paradigm in Algorithm design/software design problems/intelligent systems design/ software engineering and testing

PLO16. Design and Implement Embedded Systems/ Image and Signal Processing Systems/ Systems Using Programmable Devices/Systems Using ASIC Design, taking into account relevant system design constraints (time, interrupts, reliability, reducing failure, bridging the analog and digital domains,…)

PLO17 Effectively address non-routine design and troubleshooting problems in biomedical engineering, and apply diverse strategies to develop and implement innovative ideas in biomedical engineering.

PLO18 Plan, design, and review biomedical systems, services, embedded system in a medical device and policies to support biomedical engineering decision making.

PLO19 Contribute as an individual to multidisciplinary and multicultural teams to deliver projects related to biomedical engineering, and apply relevant values, standards and judgement to contribute to the economic, social and environmental sustainability of biomedical engineering systems.

Faculty Mission vs. Program Mission Matrix

Faculty Mission		Program Mission		
		The mission of the Biomedical Engineering program is to provide the highest standard of excellence in higher education and to pursue continuous quality improvement of various engineering and management aspects in Biomedical Engineering and healthcare field. And to provide the community with graduates capable of effectively using relevant scientific and technical knowledge in digital healthcare. Problem-solving capabilities, teamwork, and communications skills developed by the graduates of the program will contribute to qualify the healthcare facilities for accreditation.		
		provide the highest standard of excellence in higher education and to pursue continuous quality improvement of various engineering and management aspects in Biomedical Engineering and healthcare field	provide the community with graduates capable of effectively using relevant scientific and technical knowledge in digital healthcare	Problem-solving capabilities, teamwork, and communications skills developed by the graduates of the program will contribute to qualify the healthcare facilities for accreditation.
Benha Faculty of Engineering - Benha University is committed to graduate well prepared engineers equipped with knowledge and skills necessary to compete in labor market, and capable of using and developing modern technology, and providing research in engineering fields to serve society and community.	committed to graduate well prepared engineers equipped with knowledge and skills necessary to compete in labor market	√		
	capable of using and developing modern technology, and providing research in engineering fields		√	
	serve society and community			√

Program Mission vs. Program Objectives Matrix

Program Mission		Program Objectives						
		PO1	PO2	PO3	PO4	PO5	PO6	PO7
The mission of the Biomedical Engineering program is to provide the highest standard of excellence in higher education and to pursue continuous quality improvement of various engineering and management aspects in Biomedical Engineering and healthcare field. And to provide the community with graduates capable of effectively using relevant scientific and technical knowledge in digital healthcare. Problem-solving capabilities, teamwork, and communications skills developed by the graduates of the program will contribute to qualify the healthcare facilities for accreditation.	provide the highest standard of excellence in higher education and to pursue continuous quality improvement of various engineering and management aspects in Biomedical Engineering and healthcare field	√	√	√	√			√
	provide the community with graduates capable of effectively using relevant scientific and technical knowledge in digital healthcare					√	√	√
	Problem-solving capabilities, teamwork, and communications skills developed by the graduates of the program will contribute to qualify the healthcare facilities for accreditation.			√	√		√	√

Program Objectives Vs Graduate Attributes

Program Objectives	Graduate Attribute												
	GA1	GA2	GA3	GA4	GA5	GA6	GA7	GA8	GA9	GA10	GA11	GA12	GA13
PO1	√												
PO2		√									√		
PO3	√	√			√								
PO4			√	√			√						
PO5						√				√			
PO6						√			√			√	√
PO7								√					

Program Competencies vs. Program Objectives Matrix

Program Objectives	Competencies																		
	Level A									Level D									
	A1	A2	A 3	A4	A5	A6	A7	A8	A9	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10
PO1	√	√	√	√	√														
PO2		√		√		√		√		√									
PO3	√		√	√				√	√	√									
PO4	√				√		√			√		√							
PO5		√	√	√	√		√			√									
PO6			√		√			√			√	√	√	√		√	√		√
PO7												√			√		√	√	√

Career Prospects

Based on multidiscipline knowledge and learned courses, Biomedical engineers can work in many functions related to healthcare facilities. They start from designing high-tech devices ranging from tiny microelectronic integrated-circuit chips reaching for smart systems. Biomedical engineers also work as Biomedical Engineer, clinical engineer, medical planning and hospital design, technical support for medical equipment and clinical applications, medical equipment manufacture, integrated systems and healthcare operation. In addition to implement advanced software application to serve and facilitate medical signal and image processing.

List of Biomedical Engineering Requirement Courses

Requirement	Cr. Hrs.	Ct. Hr			
		Lec	Lab	Tut	Sum
University Requirements	14	14	0	0	14
Faculty of Engineering Requirements	32	19	34	47	100
Discipline Requirements	67	45	31	26	102
Biomedical Engineering Program Requirements	47	30	30	14	74
Total	160	108	95	87	288

Basic Science Requirements of Biomedical Engineering

Code	Course	Pre-Req	Cr. Hrs.	Ct. Hr.			
				Lec	Lab	Tut	Sum
BES 011	Mathematics I		3	2	0	2	4
BES 041	General Chemistry		4	3	2	1	6
BES 031	Physics I		3	2	2	1	5
BES 012	Mathematics II	BES 011	3	2	0	2	4
BES 032	Physics II		3	2	2	1	5
BES 111	Differential Equations	BES 012	3	2	0	2	4
BES 113	Mathematics III	BES 012	3	2	0	2	4
BES 112	Numerical Analysis	BES 111	3	2	2	0	4
BES 114	Discrete Mathematics and Linear Programming	BES 012	3	2	0	2	4
*BES 141	Pollution and Industrial Safety	BES 041	2	2	1	0	3
BES 211	Engineering Statistics and Probability	BES 012	3	2	1	1	4
Total			33	23	10	14	47

* Course teaching is shared between the Basic Engineering Science Department and Electrical Engineering Dep

Discipline Requirements of Biomedical Engineering

Code	Course	Pre-Req	Cr. Hrs.	Ct. Hr.			
				Lec	Lab	Tut	Sum
BES 111	Differential Equations	BES 012	3	2	0	2	4
BES 113	Mathematics III	BES 012	3	2	0	2	4
ELE 179	Electric Circuits Analysis	BES 032	3	2	1	2	5
ELE 141	Digital Logic Circuits		3	2	1	2	5
ELE 143	Object Oriented Programming	ELE 042	3	2	2	0	4
ELE 173	Electrical Applications		2	1	3	0	4
BES 112	Numerical Analysis	BES 111	3	2	2	0	4
ELE 132	Measurements and Instrumentations I	ELE 179 or ELE 111	3	2	2	1	5
ELE 142	Digital System Design	ELE 141	3	2	2	1	5
ELE 144	Data Structures and Algorithms	ELE 143	3	2	2	0	4
ELE 114	Semiconductor Physics	BES 032	3	2	0	2	4
ELE 211	Signals and Systems	BES 111	3	2	0	2	4
ELE 213	Electronic Circuits I	ELE 114	3	2	1	2	5
ELE 231	Control Theory	BES 111	3	2	1	2	4
ELE 241	Computer Architecture	ELE 142	3	2	2	1	5
ELE 245	Computer Applications	ELE 042	3	2	2	0	4
BES 211	Engineering Statistics and Probability	BES 012	3	2	1	1	5
ELE 276	Electric Machines	ELE 179	3	2	1	1	4
MEC 251	Mechanical Engineering	MEC 012	2	2	0	1	3
ELE 214	Electronic Circuits II	ELE 213	3	2	2	1	5
ELE 218	Digital Signal Processing	ELE 211	3	2	2	1	5
ELE 254	AI and advanced algorithms	ELE 144, BES 111	3	2	1	2	5
ELE 342	Embedded Systems	ELE 141	3	2	2	1	5
Total			67	45	30	27	102

Biomedical Engineering Program Requirements

Code	Course	Pre-Req	Cr. Hrs.	Ct. Hr.			
				Lec	Lab	Tut	Sum
ELE 255	Anatomy and Physiology		2	2	0	0	2
ELE 256	Introduction to Biomedical Engineering	ELE 142	3	2	1	2	4
ELE 351	Hospital Instrumentation	ELE 241	3	2	0	1	4
ELE 353	Biomedical Modeling and Simulation	ELE 211, BES 112	3	2	2	1	5
ELE 355	Medical Imaging, I		3	2	2	1	5
ELE 357	Bioinformatics	ELE 211, ELE 254	3	2	2	1	5
ELE 359	Image Processing for Biomedical	ELE 245	3	2	2	1	5
ELE 356	Medical Imaging II	ELE 355	3	2	2	1	5
ELE 3XX	Elective I		3	2	2	1	5
ELE 3XX	Elective II		3	2	2	1	5
ELE 4XX	Elective III		3	2	2	1	5
ELE 4XX	Elective IV		3	2	2	1	5
ELE 4XX	Elective V		3	2	2	1	5
ELE 4XX	Elective VI		3	2	2	1	5
ELE 392	Senior Design Project I	70% of total CH	2	0	4	0	4
ELE 491	Senior Design Project II	ELE 392	3	1	4	0	5
Total			46	30	30	14	74

*The student can register the senior design Project I course after passing 70% of the program cr. hrs, i.e., 112 Cr. Hr

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Pool Courses for Elective I, II, III, IV, and V							
Code	Course	Pre-Req	Cr. Hrs.	Ct. Hr.			
				Lec	Lab	Tut	Sum
ELE 350	Biomechanics	BES 022	3	2	2	1	5
ELE 352	Rehabilitation Engineering and Assistive Technology	BES 022	3	2	2	1	5
ELE 354	Cardiovascular Biomechanics	BES 022	3	2	2	1	5
ELE 358	Introduction to Information Theory	BES 114	3	2	2	1	5
ELE 360	Biometrics	BES 114	3	2	2	1	5
ELE 361	Pattern Recognition	ELE 451	3	2	2	1	5
ELE 362	Medical Robotics	BES 022	3	2	2	1	5
ELE 363	Advanced Human Biodynamics	BES 022	3	2	2	1	5
ELE 364	Artificial Organs	BES 022	3	2	2	1	5
ELE 365	Kinematics and Kinetics of Human Movement	BES 022	3	2	2	1	5
ELE 331	Machine Learning	ELE 254	3	2	2	1	5
ELE 367	Deep Learning in Medicine	ELE 254	3	2	2	1	5
ELE 368	Medical Image Computing	ELE 355 &BES 114	3	2	2	1	5
ELE 450	Computational Methods for Medical Image Analysis	ELE 355	3	2	2	1	5
ELE 451	Advanced Image Processing Techniques	ELE 359	3	2	2	1	5
ELE 452	RF (Radiofrequency) Medical Devices	ELE 256	3	2	2	1	5
ELE 453	Biomedical Optical Microscopy	ELE 141	3	2	2	1	5
ELE 454	Bioinstrumentation: Bio-signals and Biosensors	ELE 256	3	2	2	1	5
ELE 455	Clinical Engineering Fundamentals	ELE 256	3	2	2	1	5
ELE 456	Clinical Equipment Management	ELE 256	3	2	2	1	5
ELE 457	Medical Instrumentation in the Hospital	ELE 256	3	2	2	1	5
ELE 458	Engineering Problems in the Hospital	ELE 256	3	2	2	1	5
ELE 459	Clinical Systems Engineering	ELE 256	3	2	2	1	5
ELE 460	Medical Device Cybersecurity	ELE 256	3	2	2	1	5
ELE 461	Computer Applications in Bioengineering	ELE 143	3	2	2	1	5
ELE 462	Biomedical Applications of Signal Processing	ELE 354	3	2	2	1	5
ELE 464	Digital Communication Systems	ELE 352	3	2	2	1	5
ELE 465	Digital and Analog Filters Design	ELE 352	3	2	2	1	5
ELE 466	Vision Sensors	ELE 256	3	2	2	1	5
ELE 467	Advanced Random Signals and Information Technology	BES 114	3	2	2	1	5
ELE 468	Neural Networks in Medical Fields	BES 114	3	2	2	1	5
ELE 469	Quantum for Information and Encoding	BES 114	3	2	2	1	5

* The course content must be approved by Electric Engineering Department Council before any student can register it.

Proposed Study Plan for Biomedical Engineering

Level 0-1													
Code	Course	Pre-Req	Cr. Hrs.	Ct. Hr.				Final Exam Time	Assessment				
				Lec	Lab	Tut	Sum		SA	MT	PE/ OE	Final Exam	Sum
BES 011	Mathematics I		3	2	0	2	4	2	30	30	-	40	100
BES 021	Mechanics I		3	2	0	2	4	2	30	30	-	40	100
BES 041	General Chemistry		4	3	2	1	6	2	10	30	20	40	100
BES 031	Physics I		3	2	2	1	5	2	10	30	20	40	100
MEC 011	Engineering Graphics		2	0	0	4	4	2	30	30	-	40	100
UHS 101	Foreign Language		2	2	0	0	2	2	30	30	-	40	100
UHS 102	Information and Communication Technology		2	2	0	0	2	2	30	30	-	40	100
Total			19	13	4	10	27						700

Level 0-2													
Code	Course	Pre-Req	Cr. Hrs.	Ct. Hr.				Final Exam Time	Assessment				
				Lec	Lab	Tut	Sum		SA	MT	PE/ OE	Final Exam	Sum
BES 012	Mathematics II	BES 011	3	2	0	2	4	2	30	30	-	40	100
BES 022	Mechanics II	BES 021	3	2	0	2	4	2	30	30	-	40	100
MEC 012	Production Engineering		2	1	3	0	4	2	10	30	20	40	100
BES 032	Physics II		3	2	2	1	5	2	10	30	20	40	100
MEC 014	Computer Aided Drafting	MEC 011	2	1	2	0	3	2	10	30	20	40	100
ELE 042	Computer Programming Fundamentals		2	0	2	2	4	2	10	30	20	40	100
UHS 103	Societal Issues		2	2	0	0	2	2	30	30	-	40	100
Total			17	10	9	7	26						700

Level 1-1													
Code	Course	Pre-Req	Cr. Hrs.	Ct. Hr.				Final Exam Time	Assessment				
				Lec	Lab	Tut	Sum		SA	MT	PE/ OE	Final Exam	Sum
BES 111	Differential Equations	BES 012	3	2	0	2	4	2	30	30	-	40	100
BES 113	Mathematics III	BES 012	3	2	0	2	4	2	30	30	-	40	100
ELE 179	Electric Circuits Analysis	BES 032	3	2	1	2	5	2	10	30	20	40	100
ELE 141	Digital Logic Circuits		3	2	1	2	5	2	10	30	20	40	100
ELE 143	Object Oriented Programming	ELE 042	3	2	2	0	4	2	10	30	20	40	100
ELE 173	Electrical Applications		2	1	3	0	4	2	10	30	20	40	100
UHS XXX	Humanities Elective I		2	2	0	0	2	2	30	30	-	40	100
Total			19	13	7	8	28						700

Level 1-2													
Code	Course	Pre-Req	Cr. Hrs.	Ct. Hr.				Final Exam Time	Assessment				
				Lec	Lab	Tut	Sum		SA	MT	PE/ OE	Final Exam	Sum
BES 112	Numerical Analysis	BES 111	3	2	2	0	4	2	10	30	20	40	100
BES 114	Discrete Mathematics and Linear Programming	BES 012	3	2	0	2	4	2	30	30	-	40	100
ELE 132	Measurements and Instrumentations I	ELE 179 or ELE 111	3	2	2	1	5	2	10	30	20	40	100
ELE 142	Digital System Design	ELE 141	3	2	2	1	5	2	10	30	20	40	100
ELE 144	Data Structure and Algorithms	ELE 143	3	2	2	0	4	2	10	30	20	40	100
ELE 114	Semiconductor Physics	BES 032	3	2	0	2	4	2	30	30	-	40	100
Total			18	12	8	6	26						600

1st Field Training													
Code	Course	Pre-Req	Cr. Hrs.	Ct. Hr.				Final Exam Time	Assessment				
				Lec	Lab	Tut	Sum		SA	MT	PE/ OE	Final Exam	Sum
FTR 103	Field Training, I	Completed 65 CH	0	0	0	0	0	-	-	-	-	-	Pass or fail

Level 2-1													
Code	Course	Pre-Req	Cr. Hrs.	Ct. Hr.				Final Exam Time	Assessment				
				Lec	Lab	Tut	Sum		SA	MT	PE/ OE	Final Exam	Sum
ELE 211	Signals and Systems	BES 111	3	2	0	2	4	2	30	30	-	40	100
ELE 213	Electronic Circuits I	ELE 114	3	2	1	2	5	2	10	30	20	40	100
ELE 231	Control Theory	BES 111	3	2	1	2	5	2	10	30	20	40	100
ELE 241	Computer Architecture	ELE 142	3	2	2	1	5	2	10	30	20	40	100
ELE 255	Anatomy and Physiology		2	2	0	0	2	2	30	30	-	40	100
ELE 245	Computer Applications	ELE 042	3	2	2	0	4	2	10	30	20	40	100
Total			17	12	6	7	25						600

Level 2-2													
Code	Course	Pre-Req	Cr. Hrs.	Ct. Hr.				Final Exam Time	Assessment				
				Lec	Lab	Tut	Sum		SA	MT	PE/ OE	Final Exam	Sum
BES 211	Engineering Statistics and Probability	BES 012	3	2	1	1	4	2	10	30	20	40	100
ELE 276	Electric Machines	ELE 179	3	2	1	1	4	2	10	30	20	40	100
ELE 214	Electronic Circuits II	ELE 213	3	2	2	1	5	2	10	30	20	40	100
ELE 218	Digital Signal Processing	ELE 211	3	2	1	2	5	2	10	30	20	40	100
ELE 254	AI and advanced algorithms	ELE 144, BES 111	3	2	2	1	5	2	10	30	20	40	100
ELE 256	Introduction to Biomedical Engineering		3	2	1	1	4	2	10	30	20	40	100
Total			18	12	8	7	27						600

2nd Field Training													
Code	Course	Pre-Req	Cr. Hrs.	Ct. Hr.				Final Exam Time	Assessment				
				Lec	Lab	Tut	Sum		SA	MT	PE/ OE	Final Exam	Sum
FTR 203	Field Training, II	Completed 96 CH	0	0	0	0	0	-	-	-	-	-	Pass or Fail

Level 3-1													
Code	Course	Pre-Req	Cr. Hrs.	Ct. Hr.				Final Exam Time	Assessment				
				Lec	Lab	Tut	Sum		SA	MT	PE/ OE	Final Exam	Sum
ELE 351	Hospital Instrumentation	ELE 256	3	2	1	1	4	2	10	30	20	40	100
ELE 353	Biomedical Modeling and Simulation	ELE 256, BES 112	3	2	2	1	5	2	10	30	20	40	100
ELE 355	Medical Imaging I		3	2	2	1	5	2	10	30	20	40	100
ELE 357	Bioinformatics	ELE 256, ELE 254	3	2	2	1	5	2	10	30	20	40	100
ELE 359	Image Processing for biomedical	ELE 245	3	2	2	1	5	2	10	30	20	40	100
UHS XXX	Humanities - Elective II		2	2	0	0	2	2	30	30	-	40	100
Total			17	12	9	5	26						600

Level 3-2													
Code	Course	Pre-Req	Cr. Hrs.	Ct. Hr.				Final Exam Time	Assessment				
				Lec	Lab	Tut	Sum		SA	MT	PE/ OE	Final Exam	Sum
ELE 342	Embedded Systems	ELE 141	3	2	2	0	4	2	10	30	20	40	100
ELE 356	Medical Imaging II	ELE 355	3	2	2	1	5	2	10	30	20	40	100
ELE 3XX	Elective I		3	2	2	1	5	2	10	30	20	40	100
UHS 104	Professional Ethics		2	2	0	0	2	2	30	30	-	40	100
ELE 3XX	Elective II		3	2	2	1	5	2	10	30	20	40	100
ELE 392	Senior Design Project I	70% of total CH	2	0	4	0	4	2	50	-	50	--	100
ELE 332	Innovation Management and Entrepreneurship		2	2	0	0	2	2	30	30	-	40	100
Total			18	13	11	3	27						

Level 4-1													
Code	Course	Pre-Req	Cr. Hrs.	Ct. Hr.				Final Exam Time	Assessment				
				Lec	Lab	Tut	Sum		SA	MT	PE/ OE	Final Exam	Sum
BES 141	Pollution and Industrial Safety	BES 041	2	2	1	0	3	2	10	30	20	40	100
ELE 4XX	Elective III		3	2	2	1	5	2	10	30	20	40	100
ELE 4XX	Elective IV		3	2	2	1	5	2	10	30	20	40	100
ELE 4XX	Elective V		3	2	2	1	5	2	10	30	20	40	100
ELE 491	Senior Design Project II	ELE 392	3	1	4	0	5	2	50	-	50	--	100
UHS XXX	Humanities Elective III		2	2	0	0	2	2	30	30	-	40	100
Total			18	11	11	3	25						600

Courses Plan and Matrix

Curriculum Plan for Biomedical Engineering

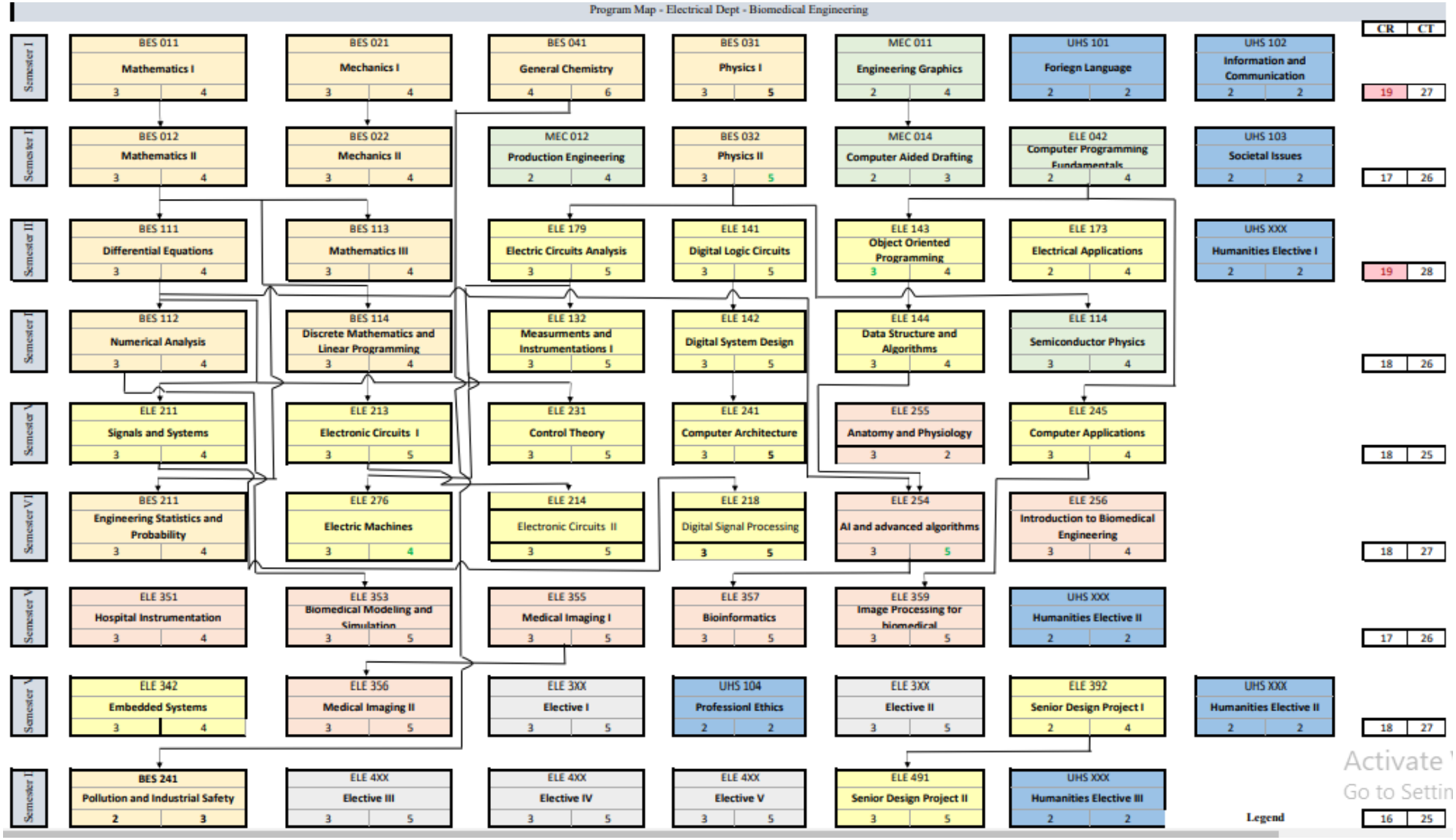
Program Map - Electrical Dept - Biomedical Engineering

							CR	CT
Semester I	BES 011 Mathematics I (3, 4)	BES 021 Mechanics I (3, 4)	BES 041 General Chemistry (4, 6)	BES 031 Physics I (3, 5)	MEC 011 Engineering Graphics (2, 4)	UHS 101 Foriegn Language (2, 2)	UHS 102 Information and Communication Technology (2, 2)	19	27
Semester II	BES 012 Mathematics II (3, 4)	BES 022 Mechanics II (3, 4)	MEC 012 Production Engineering (2, 4)	BES 032 Physics II (3, 5)	MEC 014 Computer Aided Drafting (2, 3)	ELE 042 Computer Programming Fundamentals (2, 4)	UHS 103 Societal Issues (2, 2)	17	26
Semester III	BES 111 Differential Equations (3, 4)	BES 113 Mathematics III (3, 4)	ELE 179 Electric Circuits Analysis (3, 5)	ELE 141 Digital Logic Circuits (3, 5)	ELE 143 Object Oriented Programming (3, 4)	ELE 173 Electrical Applications (2, 4)	UHS XXX Humanities Elective I (2, 2)	19	28
Semester IV	BES 112 Numerical Analysis (3, 4)	BES 114 Discrete Mathematics and Linear Programming (3, 4)	ELE 132 Measurments and Instrumentations I (3, 5)	ELE 142 Digital System Design (3, 5)	ELE 144 Data Structure and Algorithms (3, 4)	ELE 114 Semiconductor Physics (3, 4)		18	26
Semester V	ELE 211 Signals and Systems (3, 4)	ELE 213 Electronic Circuits I (3, 5)	ELE 231 Control Theory (3, 5)	ELE 241 Computer Architecture (3, 5)	ELE 255 Anatomy and Physiology (3, 2)	ELE 245 Computer Applications (3, 4)		18	25
Semester VI	BES 211 Engineering Statistics and Probability (3, 4)	ELE 276 Electric Machines (3, 4)	ELE 214 Electronic Circuits II (3, 5)	ELE 218 Digital Signal Processing (3, 5)	ELE 254 AI and advanced algorithms (3, 5)	ELE 256 Introduction to Biomedical Engineering (3, 4)		18	27
Semester VII	ELE 351 Hospital Instrumentation (3, 4)	ELE 353 Biomedical Modeling and Simulation (3, 5)	ELE 355 Medical Imaging I (3, 5)	ELE 357 Bioinformatics (3, 5)	ELE 359 Image Processing for biomedical (3, 5)	UHS XXX Humanities Elective II (2, 2)		17	26
Semester VIII	ELE 342 Embedded Systems (3, 4)	ELE 356 Medical Imaging II (3, 5)	ELE 3XX Elective I (3, 5)	UHS 104 Professionl Ethics (2, 2)	ELE 3XX Elective II (3, 5)	ELE 392 Senior Design Project I (2, 4)	UHS XXX Humanities Elective II (2, 2)	18	27
Semester IX	BES 241 Pollution and Industrial Safety (2, 3)	ELE 4XX Elective III (3, 5)	ELE 4XX Elective IV (3, 5)	ELE 4XX Elective V (3, 5)	ELE 491 Senior Design Project II (3, 5)	UHS XXX Humanities Elective III (2, 2)		16	25

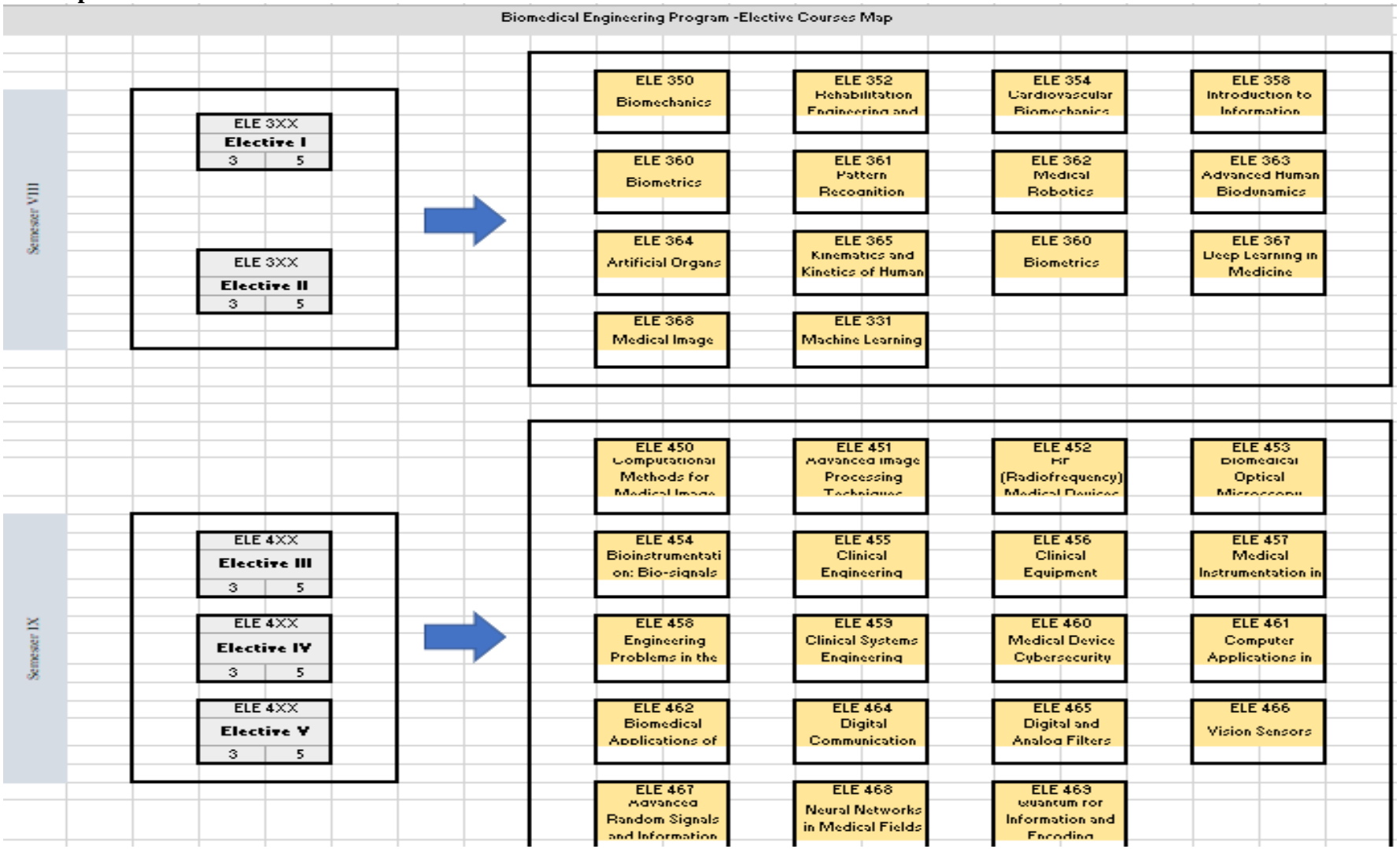
Legend

- Basic Science
- Faculty Req.
- University Req.
- Major
- Electives
- Program

Curriculum Flowchart for Biomedical



Map of Elective Courses



Program Learning Objectives to Biomedical Engineering Courses Matrix

	Code	Title	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	D1	D2	D3	D4	D5	D6	D7	D8	D9
Semester I	BES 011	Mathematics I	*		*																
	BES 021	Mechanics I	*	*																	
	BES 041	General Chemistry	*	*																	
	BES 031	Physics I	*	*																	
	MEC 011	Engineering Graphics						*		*											
	UHS 101	Foreign Language								*		*									
	UHS 102	Information and Communication Technology				*						*									
Semester II	BES 012	Mathematics II	*		*																
	BES 022	Mechanics II	*	*																	
	MEC 012	Production Engineering				*		*													
	BES 032	Physics II	*	*																	
	MEC 014	Computer Aided Drafting							*	*											
	ELE 042	Computer Programming Fundamentals	*		*																
	UHS 103	Societal Issues							*			*									

	Code	Title	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	D1	D2	D3	D4	D5	D6	D7	D8	D9
Semester III	BES 111	Differential Equations	*	*																	
	BES 113	Mathematics III	*	*																	
	ELE 179	Electric Circuits Analysis		*									*								
	ELE 141	Digital Logic Circuits	*	*	*								*								
	ELE 143	Object Oriented Programming			*						*			*							
	ELE 173	Electrical Applications				*	*						*			*					
	UHS XXX	Humanities Elective I	Refer to the Next Three Courses																		
	UHS 201	Principles of Enterprenuership and Project Management						*			*										
	UHS 202	Introduction to Economics and Accounting						*			*										
	UHS 203	Human Resources Management						*			*										
Semester IV	BES 112	Numerical Analysis	*	*																	
	BES 114	Discrete Mathematics and Linear Programming	*		*																
	ELE 132	Measurments and Instrumentations I											*		*	*					
	ELE 142	Digital System Design		*	*									*							
	ELE 144	Data Structure and Algorithms			*			*													
	ELE 114	Semiconductor Physics											*		*						
	FTR 203	Field Training I							*			*									

	Code	Title	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	D1	D2	D3	D4	D5	D6	D7	D8	D9
Semester V	ELE 211	Signals and Systems											*		*						
	ELE 213	Electronic Circuits I												*	*						
	ELE 231	Control Theory		*	*									*	*						
	ELE 241	Computer Architecture		*									*	*							
	ELE 243	Anatomy and physiology																	*		*
	ELE 245	Computer Applications		*									*		*						
Semester VI	BES 211	Engineering Statistics and Probability	*	*																	
	ELE 276	Electric Machines					*						*								
	ELE 214	Electronic Circuits II												*	*						
	ELE 218	Digital Signal Processing	*	*										*	*						
	ELE 254	AI and advanced algorithms	*		*							*								*	*
	ELE 256	Introduction to Biomedical Engineering						*							*		*	*			
	FTR 303	Field Training II							*			*									

	Code	Title	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	D1	D2	D3	D4	D5	D6	D7	D8	D9
Semester VII	ELE 351	Hospital Instrumentation						*		*						*	*	*	*		*
	ELE 353	Biomedical Modeling and Simulation	*	*	*								*						*	*	*
	ELE 355	Medical Imaging I			*													*		*	
	ELE 357	Bioinformatics							*	*									*	*	*
	ELE 359	Image Processing for biomedical		*																*	*
	UHS XXX	Humanities - Elective II	Refer to the Next Two Courses																		
	UHS 301	Communication and Presentation Skills								*	*										
	UHS 302	Leadership Skills								*	*										
Semester VIII	ELE 342	Embedded Systems												*				*			
	ELE 356	Medical Imaging II			*							*						*		*	
	UHS 104	Professional Ethics				*	*														
	ELE 3XX	Elective I	Refer to Biomedical Engineering Elective Courses																		
	ELE 3XX	Elective II																			
	ELE 392	Senior Design Project I					*	*	*	*	*	*									
	UHS XXX	Humanities - Elective III	Refer to the Next Two Courses																		
	UHS 801	Research Methodologies					*					*									
	UHS 803	Thinking Skills					*					*									

	Code	Title	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	D1	D2	D3	D4	D5	D6	D7	D8	D9
Semester IX	BES 241	Pollution and Industrial Safety	*		*	*															
	ELE 4XX	Elective III	Refer to Biomedical Engineering Elective Courses																		
	ELE 4XX	Elective IV																			
	ELE 4XX	Elective V																			
	ELE 491	Senior Design Project II					*	*	*	*	*	*							*	*	*
	UHS XXX	Humanities - Elective III					*					*									

	Code	Title	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	D1	D2	D3	D4	D5	D6	D7	D8	D9
Biomedical Engineering Electives	ELE 352	Rehabilitation Engineering and Assistive Technology																			*
	ELE 354	Cardiovascular Biomechanics																	*		*
	ELE 358	Introduction to Information Theory																			*
	ELE 360	Biometrics															*	*			
	ELE 361	Pattern Recognition																		*	
	ELE 362	Medical Robotics												*					*		*
	ELE 363	Advanced Human Biodynamics								*											*
	ELE 364	Artificial Organs								*				*							*
	ELE 365	Kinematics and Kinetics of Human Movement								*											
	ELE 331	Machine Learning																		*	
	ELE 367	Deep Learning in Medicine	*	*								*								*	*
	ELE 368	Medical Image Computing		*								*								*	
	ELE 450	Computational Methods for Medical Image Analysis	*																	*	
	ELE 451	Advanced Image Processing Techniques																		*	*
	ELE 452	RF (Radiofrequency) Medical Devices		*									*	*			*	*		*	*
	ELE 453	Biomedical Optical Microscopy			*								*			*	*	*		*	
	ELE 454	Bioinstrumentation: Bio-signals and Biosensors			*								*		*		*	*	*	*	
	ELE 455	Clinical Engineering Fundamentals				*		*	*	*				*	*						
	ELE 456	Clinical Equipment Management				*		*	*	*						*	*	*	*		
	ELE 457	Medical Instrumentation in the Hospital			*	*							*		*	*	*	*	*	*	
	ELE 458	Engineering Problems in the Hospital											*						*	*	
	ELE 459	Clinical Systems Engineering														*			*		*
	ELE 460	Medical Device Cybersecurity															*		*		
	ELE 461	Computer Applications in Bioengineering								*			*							*	
	ELE 462	Biomedical Applications of Signal Processing								*				*						*	*

Matching Biomedical Engineering Program Courses with ABET Requirements

ABET criteria for Bioengineering and Biomedical and Similarly Named Engineering Programs. Lead Society: Biomedical Engineering Society Cooperating Societies: American Ceramic Society, American Institute of Chemical Engineers, American Society of Agricultural and Biological Engineers, American Society of Mechanical Engineers, and Institute of Electrical and Electronics Engineers

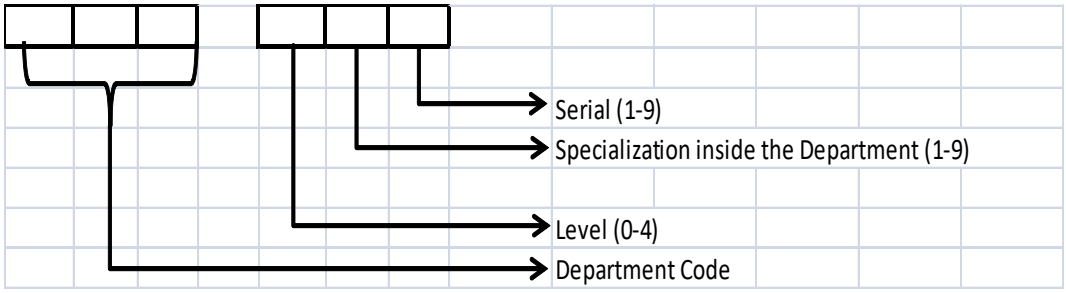
Biomedical Engineering Program Courses Required to Cover ABET Criteria				
ABET Criteria		**CODE**	**Course Name**	**Cr. Hrs.**
A minimum of 30 semester Cr. Hrs. (or equivalent) of a combination of college-level mathematics and basic sciences with experimental experience appropriate to the program.	The curriculum must prepare graduates to apply knowledge of mathematics through differential equations.	BES 011	Mathematics I	3
		BES 012	Mathematics II	3
		BES 111	Differential Equations	3
		BES 113	Mathematics III	3
	At least one additional area of basic science; apply probability and statistics to address uncertainty	BES 112	Numerical Analysis	3
		BES 211	Engineering Statistics and Probability	3
	Chemistry	BES 041	General Chemistry	4
		BES 141	Pollution and Industrial Safety	2
	Calculus-based physics	BES 031	Physics I	3
		BES 032	Physics II	3
Total				**30**
ABET Criteria		**CODE**	**Course Name**	**Cr. Hrs.**
A minimum of 45 semester Cr. Hrs. (or equivalent) of engineering topics appropriate to the program, consisting of engineering and computer sciences and engineering design and utilizing modern engineering tools.	Analyze and design electrical and medical processes and systems in a biomedical engineering specialty field.	ELE 173	Electrical Applications	3
		ELE 142	Digital System Design	3
		ELE 245	Computer Applications	3
		ELE 276	Electric Machines	3
		ELE 254	AI and advanced algorithms	3
		ELE 342	Embedded Systems	3
		ELE 353	Biomedical Modeling and Simulation	3
	Apply knowledge of methods, materials, equipment, planning, scheduling, safety, and cost analysis; to explain basic legal and ethical concepts and the importance of professional engineering licensure in the biomedical industry	ELE 042	Computer Programming Fundamentals	3
		ELE 179	Electric Circuits Analysis	3
		ELE 141	Digital Logic Circuits	3
		ELE 114	Semiconductor Physics	3
		ELE 231	Control Theory	3
		ELE 255	Anatomy and Physiology	2

	Explain basic concepts of economics, business, accounting, communications, leadership, decision and optimization methods, engineering economics	UHS XXX	Humanities Elective II	2
	the engineering relationships between the management tasks of planning, organization, leadership, control, and the human element in production, research, and service organizations;	UHS XXX	Humanities Elective I	2
		UHS XXX	Humanities Elective III	2
	The stochastic nature of management systems	ELE 351	Hospital Instrumentation	3
	Integrating management systems into a series of different technological environments	ELE 456	Clinical Equipment Management	3
		ELE 457	Medical Instrumentation in the Hospital	3
		ELE 458	Engineering Problems in the Hospital	3
		ELE 459	Clinical Systems Engineering	3
Total				**55**

Courses offered to Electrical Engineering Programs

The course coding is divided into two parts and follows the following convention:

1. Three Letters which are the Department code.
2. Three Numbers indicating the Level, the Specialization inside the department, and a counter inside the specialization.



The Electrical Engineering Department is responsible for teaching courses that serve the following programs:

1. Power and Electrical Machines Program.
2. Computers and Control Systems Program.
3. Electrical Communication and Electronics Program
4- Biomedical Program

The coding system is demonstrated in the following table:

ELE x1x ELE x2x	Course offered by Electrical Engineering Department/ Electrical Communication and Electronics Program
ELE x3x ELE x4x	Course offered by Electrical Engineering Department/ Computers and Control Systems Program
ELE x5x ELE x6x	Course offered by Electrical Engineering Department/ Biomedical Program
ELE x7x ELE x8x	Course offered by Electrical Engineering Department/ Power and Electrical Machines Program
ELE x9x	Graduation Project

The following Abbreviation are used in the contents table:

Pre-req	Prerequisite	**CH**	Credit Hour	**SA**	Student Activity
MT	Midterm Exam	**PE**	Practical Exam	**OE**	Oral Exam

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
ELE 103	Electrical Circuits	BES 032	2	Lec.	Lab	Tut	Sum	ST	MT	PE/OE	Final
				1	0	2	3	30	30	0	40
Course Content	DC circuit analysis: Circuit Variables, Kirchhoff's Laws, Simple Resistive Circuits,The Wheatstone Bridge, Δ to-Y (or π -to-) EquivalentCircuits,TheNode-Voltage Method and Dependent Sources,TheMesh-Current Method and Dependent Sources,TheVenin and Norton Equivalents, Maximum Power Transfer, Superposition, Topology in Circuit Analysis,TheOperational Amplifier circuits,Inductance and Capacitance, The Natural Response of RL and RC Circuits, Step Response of First-Order RL and RC Circuits.										
References	• Nilsson, J. W., & Riedel, S. A., "Electric circuits", 12th Edition, Pearson Education Limited, 2020.										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
ELE104	Electronic DevicesandCircuits	ELE 103	2	Lec.	Lab	Tut	Sum	ST	MT	PE/OE	Final
				1	0	2	3	30%	20%	0%	50%
Course Content	Semiconductorphysics,Structureofdiodes,Diodecircuitsandrectifiers,StructureofBJT,Biasingandoperationmodesoftransistors,DCandsmallsignalanalysisoftransistorcircuits,AmplifierscircuitsusingBJT, Poweramplifiers,Fieldeffecttransistors,BiasingofFET,SmallsignalmodelofFET.AmplifiercircuitsusingFET,Designofamplifiercircuits,Frequency response ofamplifiercircuits,Active filters, Feedbackinelectronic circuits,Differentfeedbackconfigurationinelectroniccircuits,Oscillators circuits.										
References	• Sedra / Smith, Microelectronic Circuits, 8th Edition, Oxford University Press, 2019.										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab	Tut	Sum	SA	MT	PE/OE	Final
ELE 111	Electric Circuits I	BES 032	3	2	1	2	5	10	30	20	40
Course Content	The concepts of current, voltage, power and energy. Circuit Variables - Ohm's Low. Kirchhoff's Laws - Simple Resistive Circuits - Δ to-Y Equivalent Circuits - The Node-Voltage Method and Dependent Sources - The Mesh-Current Method and Dependent Sources - Thevenin and Norton Equivalents - Maximum Power Transfer - Superposition, Topology in Circuit Analysis - The Operational Amplifier circuits - Inductance and Capacitance - The Natural Response of RL and RC Circuits - Step Response of First Order RL and RC Circuits - Natural and Step Responses of RLC Circuits. Sinusoidal Steady-State Analysis - The Phasor - The Passive Circuit Elements – circuit theorems and Laws in the Frequency Domain.										
References	• Nilsson and Riedel, Electric Circuits, 11th Edition, Pearson, 2018, ISBN-13:978-0134746968.										
Laboratory	• Ohm's Low. • Kirchhoff's Laws • Series and Parallel Connection of Resistors • Voltage Divider in No-load Operation • Superposition's and Thevenin's Theorems • Ohmic Resistance in AC Circuits. • R-C And R-L Circuits in AC.										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab	Tut	Sum	SA	MT	PE/OE	Final
ELE 112	Electric Circuits II	ELE 111	3	2	1	2	5	10	30	20	40
Course Content	Sinusoidal Steady-State Power Calculations Appliance Ratings. Balanced Three-Phase Circuits - Power Calculations - Mutual Inductance - The Dot Convention - Energy Calculations - The Linear and Ideal Transformer - Series and Parallel Resonance - The Laplace Transform - The Step and Impulse Functions - Functional and Operational Transforms - The Inverse Laplace Transform - Circuit Elements and Circuit Analysis in the s-Domain - The Transfer Function - Two-Port Circuits.										
References	• Nilsson and Riedel, Electric Circuits, 11th Edition, Pearson, 2018, ISBN-13:978-0134746968.										
Laboratory	• Power calculations in AC circuits • RC circuits, RL circuits • Ideal transformer circuits • Series resonance circuit • Parallel resonance circuit • OP-AMP circuits										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab	Tut	Sum	SA	MT	PE/OE	Final
ELE 114	Semiconductors Physics	BES 032	3	2	0	2	4	30	30	-	40
Course Content	Crystal structure of solid, Miller indices, Types of bonding. Semiconductor in Equilibrium: Bonding model and energy band model, Fermi-Dirac distribution, Intrinsic carrier concentration, Doped semiconductors, Charge-neutrality Equation and Mass action law. Carrier transport phenomena: mobility, drift current, diffusion current and the Einstein relation. Nonequilibrium excess carrier in semiconductors: carrier generation and recombination, carrier lifetime and continuity equation. Dielectrics: Electric dipoles, Capacitors without and with dielectrics, Losses in dielectrics, Polarization vector and susceptibility, Local fields, Clausius-Mosotti relation, microscopic models for polarization, Time and frequency response of dielectric materials										
References	• S.M. Sze, Kwok K. Ng, "Physics of Semiconductor Devices", John Wiley & Sons, 2007. • Marius Grundmann, "The Physics of Semiconductors", Springer, 2016										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab	Tut	Sum	SA	MT	PE/OE	Final
ELE 132	Measurements and Instrumentations I	ELE 179 or ELE 111	3	2	2	1	5	10	30	20	40
Course Content	Introduction, Error analysis and accuracy, operating principles of sensors and transducers. Analog measuring instruments. - Consideration for selection and evaluation of measurement equipment. - Measurement of current, voltage, resistance, power, energy, frequency, and power factor DC bridges – AC bridges. - Measurements of nonelectrical quantities (Speed, Displacement, Level, Velocity, Temperature, pressure, …etc. - Transducers: classification, Strain gauge, Displacement, Capacitive, Inductive, Piezoelectric, Temperature, and Photoelectric Transducers. Data acquisition system, Signal conditioning circuit. Digital to Analog and Analog to Digital converters. Data acquisition system and computerized control. - The relevance of the sensed and processed signals, Analogue/Digital and Digital/Analogue conversion										
References	Alan S Morris, “Measurement and Instrumentation Principles”, Third Edition, Publisher: Butterworth-Heinemann; 2001.										
Laboratory	• Basic principles of electronics measurements and calibration. • Error analysis and accuracy on DC circuit. • Simple DC Circuits using a Digital Multi-Meter and Analogue Multi-Meter to measure voltage, current, and resistance, power, an oscilloscope to display time-varying voltages; a power supply to produce constant (DC) voltages; and a function generator to produce time varying (AC) voltages. • AC Measurements. Characterization and measurement of waveforms using an oscilloscope • Different type of transducers, calibration, connection, and measurements. • Introduction to signal processing										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab	Tut	Sum	SA	MT	PE/OE	Final
ELE 237	Measurements and Instruments II	ELE 132	3	2	1	2	5	10	30	20	40
Course Content	Cathode ray Oscilloscopes (CRO): Block diagram - Vertical Deflection Circuit - Horizontal Deflection Circuit - Trigger Circuits - Multiple trace Oscilloscopes -Analog storage oscilloscopes - Digital storage oscilloscopes. Transducers: Strain Gauges - Temperature Transducers - Displacement, velocity and acceleration Transducers - Force and Pressure Transducers - Light Transducers Digital Instruments: Data Converters - Voltage to Frequency Converters - A/D and D/A Converters - Basics of digital instruments: Time base - Amplified DC Meter - Digital Voltmeters - Digital Frequency Meters										
References	• John G. Webster, HalitEren, "Measurement, Instrumentation, and Sensors Handbook", 2nd Edition, CRC Press, 2016 • K. Lal Kishore, "Electronic Measurements and Instrumentation", Pearson India, 2009, ISBN-13: 978-8131721995. • Alan S Morris, "Measurement and Instrumentation Principles", 3rd Edition Butterworth-Heinemann; 2001.										
Laboratory	• Using Photoelectric transducer in designing small control circuit • Basic Oscilloscope Operation and Measurements • Measuring frequency and phase shift with oscilloscope • Designing Simple A/D converter applied in digital meters										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab	Tut	Sum	SA	MT	PE/OE	Final
ELE 141	Digital Logic Circuits	-	3	2	1	2	5	10	30	20	40
Course Content	Introduction to Digital Concepts with emphasis on the difference between analog and digital system and the need for digital system design – Number systems - number-based conversion – The binary arithmetic operations on the signed and unsigned binary numbers – Coding systems – Boolean Algebra - Logic Gates – logic minimization techniques (Karnaugh maps, Quine-McCluskey) Combinational circuits: Gate level design, Multiplexer, decoder, encoder, decoder, and adder. Sequential circuits: Flip-flops, latches, analysis and design of simple sequential circuits, state tables and state diagrams, counters, registers										
References	• John Wakerly, "Digital Design: Principles and Practices", 5th Edition, Pearson, 2018, ISBN-13: 978-0134460093 • M. Morris Mano, Michael D. Ciletti, "Digital Design: With an Introduction to the Verilog HDL, VHDL, and System Verilog", 6th Edition, Pearson, 2017, ISBN-13: 978-0134549897. • Floyd, Thomas L, "Digital Fundamentals", 11th Edition, Pearson Education, 2014, ISBN-13: 978-0132737968										
Laboratory	• Logic Trainer Familiarization • Breadboards and Building Digital Circuits. • adders, subtractors, encoders and decoders, multiplexers and demultiplexers. • Flip-flops • design and analysis of combinational circuit • design and analysis of simple sequential circuit										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab	Tut	Sum	SA	MT	PE/OE	Final
ELE 142	Digital System Design	ELE 141	3	2	2	1	5	10	30	20	40
Course Content	Modular design of combinational circuits – synchronous circuit designs using discrete gates and flip-flops (Registers, Counters, ...) – Moore and Mealy machines Finite State Machines analysis and design – Top-down digital systems design approach – Timing aspects of digital systems – ASM charts – Digital circuit representation formats including high level hardware description languages such as Verilog-HDL – Design methodologies using current computer aided design tools – Synthesis and modern digital circuit design – Modern programmable devices (PLDs) including ROMs, CPLDs and FPGAs – Mapping the designs to programmable logic devices in the form of FPGAs and CPLDS.										
References	• John Wakerly, "Digital Design: Principles and Practices", 5th Edition, Pearson, 2018, ISBN-13: 978-0134460093 • M. Morris Mano, Michael D. Ciletti, "Digital Design: With an Introduction to the Verilog HDL, VHDL, and System Verilog", 6th Edition, Pearson, 2017, ISBN-13: 978-0134549897. • Charles H. Roth, Jr., Lizy K. John, "Digital Systems Design Using VHDL" 3rd Edition, Cengage Learning, 2017, ISBN-13: 978-1305635142 • F. P. Processor, D. E. Wiskel, "The art of digital Design and introduction to top- Down Design", 3rd Edition., Prentice Hall										
Laboratory	• implement combinational circuit using HDL • implement sequential circuit using HDL • structural design • Interfacing with FPGA/CPLD boards • mapping designs on FPGA										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab	Tut	Sum	SA	MT	PE/OE	Final
ELE 143	Object Oriented Programming	ELE 042	3	2	2	0	4	10	30	20	40
Course Content	Revision on Structured Programming - Fundamentals of Object Oriented Programming, necessity and advantages - Unified Modelling Language (UML) -Objects and Classes - Encapsulation - data and method binding - access specification - modularity based encapsulation - Inheritance: passing knowledge down, single versus multiple inheritance, sub- and super-classes - Code reuse - Polymorphism: Simple polymorphism, method overloading, subtype polymorphism through method overriding, 'virtual' methods - abstraction through polymorphism - Exception Handling - Templates - Comparison of Popular OOPLs, OOPL varieties. Comparing C++, Java, C#, and Python										
References	• W. Savitch, "Problem Solving with C++" 10th Edition, Pearson, 2018, ISBN-13: 978-0134448282 • Reema Thareja, "Python Programming Using Problem Solving Approach", Oxford University Press, 2017, ISBN-13: 978-0199480173 • R. Sedgweck, K. Wayne, "Introduction to Programming in Java: An Interdisciplinary Approach", 2nd Edition, Addison-Wesley Professional, 2017, ISBN-13: 978-0672337840										
Laboratory	The laboratory includes solving problems and implementing programs focusing on OOP to cover the lecture topics along with the course including: • Programs to create classes and objects (Classes with primitive data members, arrays, pointers, and constants as data members) • Constructors and Destructors • Programs to illustrate Access Specifiers (public, private and protected) • Operator Overloading • Inheritance (single, hierarchical, multiple, multi-level and hybrid) • Polymorphism (Compile and Run Time) • Virtual Functions and classes • Exception Handling • Templates (template class, member function templates)										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab	Tut	Sum	SA	MT	PE/OE	Final
ELE 144	Data Structure and Algorithms	ELE 143	3	2	2	0	4	10	30	20	40
Course Content	Pointers - Dynamic Memory allocation - Abstract Data types and representation – Stacks: Representation, elementary operations, and applications. - Queues: Simple queue, circular queue, dequeue, elementary operations and applications - Linked lists: Linear, circular, and doubly linked lists, elementary operations, and applications - Trees: Binary tree, tree traversal, complete binary tree, other operations, and applications of trees - Hashing: hash tables, hash functions, open addressing - File structures: Introduction, data file types, file organization, file access methods. Algorithms: Searching algorithms – Sorting Algorithms (Bubble, selection, insertion, quick)										
References	• W. Savitch, "Problem Solving with C++" 10th Edition, Pearson, 2018, ISBN-13: 978-0134448282 • M.J. Augenstein, A.M. Tenenbaum, Y. Langsam, "Data Structure Using C & C++", 2nd edition, Prentice Hall of India, 2007, ISBN-13: 978-0387202778. • M. Goodrich, R. Tammasia, M. Goldwasser, "Data Structure and Algorithms in Python", Willey, 2013, ISBN-13: 978-1118290279 • M. T. Goodrich, R. Tamassia and M. H. Goldwasser, "Data Structures and Algorithms in Java", 6th Edition, Wiley 2014, ISBN-13: 978-1118771334										
Laboratory	Laboratory includes writing programs to implement the basic operations with different data structures using a high-level language as (C, C++, Java, Python, …. etc.)										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab	Tut	Sum	SA	MT	PE/OE	Final
ELE 173	Electrical Application		2	1	3	0	4	10	30	20	40
Course Content	Laboratory Safety, Familiarization with electronic components(resistors, capacitors, inductors, Diodes, Transistors, ICs, ...etc. Principals of layout of electrical and electronic circuits - modern representation for modern block diagrams - Designation, abbreviations and standards - wiring and cabling - PCB design process and issues – Etching - Electrical drawing and diagrams - Printed circuit board - Introduction to CAD- Simple electronic projects - Assembly of complete electronic project- Electrical Power System Elements- Relays and contactors types - Control and power circuits - 3 phase motor direction reversal - Star- Delta starting of 3 phase Induction Moto										
References	• Lecture Notes • Electrical Engineering: Principles and Applications (Allan R. Hambley).										
Laboratory	Monostable circuit • astable circuit • power supply • Digit BCD Counter • start stop induction motor • reverse induction motor										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab	Tut	Sum	SA	MT	PE/OE	Final
ELE 179	Electric Circuits Analysis	BES 032	3	2	1	2	5	10	30	20	40
Course Content	Circuit Topologies and DC Analysis: Concepts, resistive network. Network laws and theorems: The Node-Voltage Method and Dependent Sources - The Mesh-Current Method and Dependent Sources - Thevenin and Norton Equivalents - Maximum Power Transfer - Superposition, Topology in Circuit Analysis - Inductance and capacitance. The Operational Amplifier circuits - Transient Response: RC circuits, RL circuits, RLC circuits. The Natural Response of RL and RC Circuits - Step Response of First Order RL and RC Circuits - Natural and Step Responses of RLC Circuits -Sinusoidal Steady-State Analysis - The Phasor - The Passive Circuit Elements – circuit theorems and Laws in the Frequency Domain - Sinusoidal Steady-State Power Calculations Appliance Ratings.										
References	• Nilsson, J. W., & Riedel, S. A., "Electric circuits", 12th Edition, Pearson Education Limited, 2020.										
Laboratory	Verify laws and theorems in the course using experiments, project construction and simulation, the topics include: Series/parallel connection circuit for resistance, Capacitance Circuit, Inductance Circuit, RC & RL Circuit, LC Resonance Circuit										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab	Tut	Sum	ST	MT	PE/OE	Final
ELE 201	Electric Machinery	ELE 103	2	1	2	0	3	10%	30%	20%	40%
Course Content	Rotating electrical machines, operating principles, main terminology, and industrial standards. Static conversion of electrical energy: three- phase inverter and current control. DC motor: principle of operation, main characteristics and construction, electrical drives with DC motor, sizing of real application examples. Synchronous motor ("brushless"): principle of operation, main characteristics and construction, electrical drives with synchronous motor. A synchronous motor: Principle of operation, main characteristics and construction, electrical drives with a synchronous motor. Stepper motors.										
References	"Electric machines and drives", By G.R. Slemon, Addison Wesley, MA, 1992										
Laboratory	Polarity-test for single-phase Transformer Open-circuit test for single-phase Transformer Short-circuit test for single-phase Transformer Parallel-operation for single-phase Transformer Three-phase Transformer's connections Magnetization curve or Open circuit characteristic of DC Machine (plot of Ea vs. Ia). Armature Control of DC Machine Drives. Field Control of DC Machine Drives. Voltage Regulation and Speed Regulation of DC Machine. Starting a DC Motor with DC Manual Starter. Principles of Induction Motor Star Delta Starter of Induction Motor Speed Control of Induction Motor Drives Speed Regulation of Induction motor Parameters determinations Starting of Synchronous Machine Connection of Synchronous Machines in Parallel or with the Grid The effect of changes in field currents on Power-factor Speed Control of Synchronous Machines Drives Speed Control of Stepper motor Drives										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab	Tut	Sum	ST	MT	PE/OE	Final
ELE 204	Logic Circuits Design & Applications	ELE 104	3	2	2	0	4	20	20	20	40
Course Content	Number systems and data representation - Boolean algebra - simplification of Boolean functions - logic gates - combinational and sequential logic circuits. Registers, counters, and adders – Memory. Digital electronics. Performance of analogue and digital transducers; selecting a proper transducer for a given application. Digital transducers: optical encoders, ultrasonic sensors. Data acquisition systems (A/D and D/A converters). Stepper motors: microprocessors: structure, programming, applications.										
References	• Charles H. Roth Jr., Larry L Kinney, 2009, "Fundamentals of Logic Design", 6th Edition, Publisher: CL Engineering • Sajjan G. Shiva, 1998, "Introduction to logic design", M. Dekker, New York										
Laboratory	• Project: At the end of the course the student must provide a project emphasizing the course content										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab	Tut	Sum	SA	MT	PE/OE	Final
ELE 211	Signals and Systems	BES 111	3	2	0	2	4	30	30	-	40
Course Content	Signals and systems: Continuous time and discrete-time signals - Exponential and sinusoidal signals - The unit Impulse and unit step functions - Basic system properties -Linear time invariant systems: Discrete-time LTI systems: The convolution sum - Continuous-time LTI systems - Properties of LTI systems - Causal LTI systems described by differential and difference equations - Filters described by differential equations and filters described by difference equations - The continuous-time Fourier Analysis – Discrete Fourier Transform -Energy and power spectral densities.										
References	• B.P. Lathi, “Signal Processing and Linear Systems”, 2nd Edition, Oxford University, 2021. • Oppenheim, Alan V., Willsky, Alan S. with Nawab, S. Hamid, “Signals & Systems”, 2nd Edition, Pearson, 2014.										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab	Tut	Sum	SA	MT	PE/OE	Final
ELE 212	Analog Communication Systems	ELE 211	3	2	1	2	5	10	30	20	40
Course Content	Review on Fourier analysis, Canonical representation of Band-Pass signals, Band-pass systems, Phase and Group delay, Amplitude Modulation, DSB-SC modulation, Filtering of Sidebands, Vestigial Sideband Modulation, Single Sideband Modulation, Frequency Translation, Frequency-Division Multiplexing, Angle Modulation, Frequency Modulation, Phase-Locked Loop, Nonlinear Effects in FM systems, Superheterodyne receiver, Noise in DSB-SC receiver, Noise in SSB receiver, Noise in AM receiver, Noise in FM receiver, Pre-emphasis and De-emphasis in FM										
References	• "Simon Haykin, ""Communication Systems"", Wiley, 4th edition • Lathi, ""Modern Digital and Analog Communication System"", Oxford University Press, 5th edition"										
Laboratory	• Generation of AM signal • Generation of DSB-SC signal • Coherent detector receiver • Generation of SSB signal • Generation of narrowband and wideband FM signal • FM detection using frequency discrimination • FM detection using PPL										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab	Tut	Sum	SA	MT	PE/OE	Final
ELE 213	Electronic Circuits I	BES 131 or ELE 114	3	2	1	2	5	10	30	20	40
Course Content	The course offers the specific materials pertain to analog electronics including review on PN junction physics, diode circuits analysis, bipolar-junction transistors (BJT), Metal Oxide Semiconductor Field Effect Transistors (MOSFET), and basic amplifier configurations. Design and analyze single stage and multistage amplifier circuits. Analyze the frequency response of small signal amplifiers. Analysis of the basic logic gates: the DTL, TTL, ECL, P-MOS, N-MOS and CMOS gates Circuit simulation. Circuit performance is predicted by means of both hand calculations and computer simulations.										
References	• Sedra / Smith, Microelectronic Circuits, 8th Edition, Oxford University Press, 2019. • Jacob Baker, CMOS Circuit Design, Layout, and Simulation, 3rd Edition, Institute of Electrical and Electronics Engineers, 2010.										
Laboratory	• PN Junction diode characteristics: Forward bias and Reverse bias. • Zener diode characteristics and voltage regulator. • Clipper, Clamping and doubler circuits. • Halfwave and Full wave Rectifiers with and without filter. • Design the transistor circuit as Switch. • Transistor CB, CC, CE characteristics (Input and Output). • Frequency response of Amplifiers.										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab	Tut	Sum	SA	MT	PE/OE	Final
ELE 214	Electronic Circuits II	ELE 213	3	2	1	2	5	10	30	20	40
Course Content	This course will enable the students to learn about the use of transistors in analog circuits like BJT differential amplifiers, MOS differential amplifiers, multistage amplifier, DC and AC analysis of multistage amplifiers, current sources and sinks, current mirrors, voltage and current references, feedback amplifiers, and the frequency response of amplifier circuits. Circuit performance is predicted by means of both hand calculations and computer simulations.										
References	• Sedra / Smith, Microelectronic Circuits, 7th Edition, Oxford University Press, 2015. • Jacob Baker, CMOS Circuit Design, Layout, and Simulation, 3rd Edition, Institute of Electrical and Electronics Engineers, 2010. • James M. Fiore, Operational Amplifiers & Linear Integrated Circuits: Theory and Application / 3E, West Group, Version 3.2.1, 20 February 2020.										
Laboratory	• Design and test operational amplifier application, Inverting amplifier, non-inverting, summer, voltage follower, integrator, and differentiator. • Plot the frequency response of two stage RC coupled amplifier and calculate the bandwidth and compare it with single stage amplifier. • Design and test using operational amplifiers for performance zero crossing detector, Schmitt trigger for different hysteresis values. • Design and test using operational amplifiers for performance of full wave precision rectifier. • Current Sources and Voltage Source.										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab	Tut	Sum	SA	MT	PE/OE	Final
ELE 216	Electromagnetic Field	BES 113	3	2	0	2	4	30	30	-	40
Course Content	Review of vector analysis. Repetition of the electrostatic and magnetostatic fields, including the polarization field in dielectrics and the magnetization field in magnetizable media. Potential theory with applications in electrostatics, magnetostatics and stationary current distributions. Induction law and displacement current. Transformation of the electromagnetic field. Maxwells equations. Pointing theorem										
References	• Engineering electromagnetics by William Hyat, McGraw-Hill Education; 8th edition										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab	Tut	Sum	SA	MT	PE/OE	Final
ELE 218	Digital Signal Processing	ELE 211	3	2	1	2	5	10	30	20	40
Course Content	Introduces the fundamental theoretical concepts of digital signal processing. It covers quick review on discrete-time signals and systems, LTI systems, Z-Transform, digital filter design, filter realization, and frequency domain analysis using discrete and fast Fourier transforms.										
References	• Fundamentals of digital signal processing, Lonnie C. Ludeman, Wiley 1986. • Digital Signal Processing: Principles, Algorithms and Applications, J. Proakis, D. Manolakis, Prentice-Hall, 2006 (4-th edition)										
Laboratory	• Generation of common discrete-time signals using MATLAB. • Evaluation of impulse response and frequency response of LTI system with different ROC's. • Digital filter design using MATLAB. • Evaluation of DFT and FFT algorithms without using inherent MATLAB functions and compare algorithm complexity.										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab	Tut	Sum	SA	MT	PE/OE	Final
ELE 231	Control Theory	BES111	3	2	1	2	4	10	30	20	40
Course Content	Transfer function - Block diagrams - Signal-flow graphs - State diagram. Mathematical modeling of physical systems - DC motors - linearization of nonlinear systems. State-variable analysis: Matrix representation of state equations, state-transition matrix - state-transition equation - relationship between state equations and transfer functions - characteristic equation Stability of linear control systems: methods of determining stability - Time-domain analysis of control systems - Transient and steady state response analysis - Root locus plots - Bode Diagrams - Polar plots and frequency response analysis										
References	• Nise, N. S., "Control Systems Engineering", 8th Edition, Wiley, 2019 • Katsuhiko, Ogata, "Modern Control Engineering", 5th Edition, Pearson, 2009.										
Laboratory	MATLAB SIMULINK Programming LAB 1: • Differential Equation representation by SIMULINK • Time Response of Transfer Function to different inputs • State space representation in MATLAB • Root Locus Plots - Bode Plots • Frequency Response										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab	Tut	Sum	SA	MT	PE/OE	Final
ELE 232	Modern Control Systems	ELE 231	3	2	2	1	5	10	30	20	40
Course Content	PID controller design and tuning (Ziegler and Nichols and other advanced techniques). Nyquist stability criterion. State space modeling. Controllability and Observability. State feedback controller and observer design. Application of state-space method to the analysis and synthesis of feedback control systems. Pole Placement Using State Feedback. linear control systems with time delays – data control systems: PI – PID – Phase-Lead – Phase-Lag, Lead-Lag (Lag-Lead) – PID controller design using amplitude optimization methods. Case studies applied to Inverted Pendulum and Magnetic levitation using MATLAB.										
References	• Dorf, Richard C., and Robert H. Bishop, "Modern Control Systems", 13th Edition, Pearson, 2016. • Katsuhiko, Ogata. "Modern Control Engineering" 5th Edition, Pearson, 2009.										
Laboratory	• Time response for transfer function including P, PI, PD and PID Controllers • Lag-Lead compensators and overall system time and frequency response • State space representation for different systems (Benchmark-inverted pendulum, ball-beam system) • State feedback controller and observer design and Pole Placement techniques applications using MATLAB										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab	Tut	Sum	SA	MT	PE/OE	Final
ELE 241	Computer Architecture	ELE 142	3	2	2	1	5	10	30	20	40
Course Content	Basics of Computer Architecture, Computer arithmetic: Fixed-point arithmetic operations, Floating-point Arithmetic Operations, multiplication techniques, Instruction Set Architecture: introduction to ISA, Instruction formats- Instruction types and addressing modes, instruction cycle, Assembly language programming, Single cycle Data path design, RISC and CISC architecture.										
References	• Linda Null, "Essentials of Computer Organization and Architecture", 5th Edition, Jones & Bartlett Learning, 2018. • David A. Patterson and John L. Hennessy, "Computer Organization and Design MIPS Edition: The Hardware/Software Interface", 5th Edition, Morgan Kaufmann, 2013. • William Stallings, "Computer Organization and Architecture", 11th Edition, Pearson, 2018M. Morris R. Mano, "Computer System Architecture", 3rd edition, Prentice-Hall of India, 2003.										
Laboratory	• Processor simulators • Design single cycle or multi-cycle data path processor using VHDL • Assembly Programming										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
ELE 242	Computer Organization	ELE 241	3	Lec.	Lab	Tut	Sum	SA	MT	PE/OE	Final
				2	2	1	5	10	30	20	40
Course Content	Performance analysis - Building single cycle Datapath processor - Pipelining: examples of some pipeline in modern processors, pipeline hazards (Structure, data, and control hazards) - Techniques to handle hazards, performance improvement with pipelines and effect of hazards on the performance. - Superscalar and VLIW processors - Memory Hierarchy Design: A Top-Level View, Cache Memory, Main Memory. - Input/Output organization - Classification of models, Flynn's taxonomy of machine models (SISD, SIMD, MISD, MIMD). - Cache Coherency										
References	• Linda Null, "Essentials of Computer Organization and Architecture", 5th Edition, Jones & Bartlett Learning, 2018. • David A. Patterson and John L. Hennessy, "Computer Organization and Design MIPS Edition: The Hardware/Software Interface", 5th Edition, Morgan Kaufmann, 2013. • William Stallings, "Computer Organization and Architecture", 11th Edition, Pearson, 2018. • John L. Hennessy and David A. Patterson, "Computer Architecture: A Quantitative Approach" 5th Edition, Morgan Koffman, 2011										
Laboratory	• Design processor Datapath and control • Design pipelined processor using VHDL • Pipelined processor simulator										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
ELE 243	Algorithms Analysis and Design	BES 114, ELE 144	3	Lec.	Lab	Tut	Sum	SA	MT	PE/OE	Final
				2	2	1	5	10	30	20	40
Course Content	Algorithms Design and analysis- examples - Techniques for designing efficient algorithms - analysis of complexity - Decrease and conquer - Divide-and Conquer paradigm - Greedy Algorithms - Branch-and-bound - Dynamic Programming - Fundamentals of parallel algorithms - Scheduling Algorithms - Applications (approximate string matching, data compression, computational geometry) - NP-Hard and NP complete problems, Introduction to approximation algorithms.										
References	• Douglas R. Stinson, "Techniques for Designing and Analyzing Algorithms", Routledge, 2021, ISBN-13: 978-0367228897 • T. Cormen, C.E. Leiserson, R. Rivest, "Introduction to Algorithms" 3rd Edition, MIT Press, 2009 • Anany Levitin, "Introduction to the Design and Analysis of Algorithms" 3rd Edition, Pearson, 2011 • R. Sedgweck, K. Wayne, "Algorithms" 4th Edition, Addison-Wesley Professional, 2011										
Laboratory	Laboratory experiments will be set based on the course topics. It includes programming problems for practicing, designing, and comparing different algorithm design paradigms.										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab	Tut	Sum	SA	MT	PE/OE	Final
ELE 244	Operating Systems	ELE 241	3	2	1	1	4	10	30	20	40
Course Content	Introduction to Operating Systems, Operating System Structure, Process: Operation, structure, and Management - CPU Scheduling: Context Switching, Algorithms - Process Synchronization: hardware, Semaphore – Deadlock - Memory Management: address binding, logical and physical address, swapping, Paging and Virtual Memory – Storage: files, file systems. – OS interfaces – LINUX, Android, IOS.										
References	• Abraham Silberschatz Peter B. Galvin and Greg Gagne, "Operating System Concepts",10th Edition, Wiley, 2018. • Andrew S. Tanenbaum and Herbert Bros, "Modern Operating Systems", 4th Edition, Pearson, 2016.										
Laboratory	• Working with Linux, Shell script, System calls, Scheduling algorithms, Producer consumer problems, System Process, System Log										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab	Tut	Sum	SA	MT	PE/OE	Final
ELE 245	Computer Applications	ELE 042	3	2	2	0	4	10	30	20	40
Course Content	Computer Programming with MATLAB : Introduction to MATLAB – MATLAB Desktop tools -Data Representation in MATLAB - M files - Control Statements – Loops - Functions (Rules for writing MATLAB functions, function arguments, MATLAB function and Debugging) - Importing and exporting Data - Getting Help - MATLAB and algebra : Vectors and Matrices (operations and functions) - Solving Linear Equations – Polynomials - Differential Equations - MATLAB Graphic: Two-Dimensional Plots -Three-dimensional plots - MATLAB GUI - MATLAB Simulink.										
References	• Holly Moore, "MATLAB for Engineers", 3rd Edition, Salt Lake Community College, 2011, ISBN-13: 978-0-13-210325-1 • Amos Gilate, "MATLAB: An Introduction with Applications", 5th Edition, John Wiley &Sons, Ic., 2015. ISBN 978-1-118-62986-4 (paper) • "SIMULINK Dynamic System Simulation for MATLAB", Version 4, COPYRIGHT 1990 - 1999 by The MathWorks, Inc.										
Laboratory	Problem solving labs to apply explained topics in each lecture including: • Input to a Script File, Output Commands • The Save and Load Commands, Importing and Exporting Data • Relational and Logical Operators, Conditional Statements. • Loops: for-end loops, and while-end loops • User-Defined Functions and Function Files: Creating a Function File, Structure of a Function File. • Local And Global Variables. Saving A Function File. Using A User-Defined Function • Controlling the Simulation, Simulation Time, Solver Parameters, Solving Differential Equations. • Plotting in two dimension and three dimensions. • Modeling Equations in MATLAB Simulink. Simplification of Simulink Systems. The Function Block. Construction of Subsystems in Simulation. Link M file with Simulink file. Interface GUI with Simulink. * Project: At the end of the course, the student must provide a project emphasizing the course content.										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab	Tut	Sum	SA	MT	PE/OE	Final
ELE 246	Computer Network		3	2	2	1	5	10	30	20	40
Course Content	Network applications, hardware, software, reference models: OSI and TCP/IP reference model - Internet Control Message Protocol - Address Resolution Protocol - Describe switching concepts (MAC learning , Frame switching, Frame flooding, MAC address table) - The difference between the router, switch and the rest of the linking devices - Network Device Domains (Collision, Broadcast Domains) - IPv4 Addressing - Subnetting - Variable length subnet mask - Route summarization - Router components - Router Configuration - Remote Access Telnet - Dynamic Host Configuration Protocol Operation - Configuring a Router as a DHCP Server - DHCP Relay Agent.										
References	• A.S. Tanenbaum, "Computer Networks", 6th Edition, Pearson Education, 2021. • James F. Kurose, Keith W. Ross, "Computer Networking a Top-Down Approach", Pearson, 8thedition, 2021, ISBN-13: 978-0-13-285620-1 • Peter L Dordal, "An Introduction to Computer Networks", 2020 available in: https://intronetworks.cs.luc.edu/current2/html/ • "CCNA-200-301-Official-Cert-Guide - volume 1 and 2", WENDELL ODOM, 2020, ISBN-10: 0-13-579273-8, Published by: Cisco Press										
Laboratory	• Network cables (How to prepare a UTP cable and testing a UTP cable using RJ45/RJ11 Cable Tester) • IP Addresses, Network Communications and Share Files between Two Computers Using LAN Cable • Viewing the Switch MAC Address Table • Identifying IPv4 Addresses • Configuring Basic Router Settings • Router configuration on real cisco devices • Designing and Implementing a Sub netted IPv4 Addressing Scheme • Design and Implement a VLSM Addressing Scheme • Configuring DHCP service on a generic server in Packet Tracer • Configure real Cisco router as DHCP server										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab	Tut	Sum	SA	MT	PE/OE	Final
ELE 254	AI and advanced algorithms	ELE 144, BES 111	3	2	2	1	5	10	30	20	40
Course Content	Introduction to decision theory, artificial intelligence, heuristic search, uncertain reasoning, classification, and machine learning. Acquisition and representation of clinical expertise in the computer. Example applications of using AI in medical diagnosis.										
References	• Artificial Intelligence: A Modern Approach (3rdedition) by Stuart Russell and Peter Norvig, a.k.a AIMA(3e) • Introduction to Artificial Intelligence, Shinji Araya, KYORITSU SHUPPAN, ISBN4-320-12116-3 (in Japanese) • New Artificial Intelligence (Fundamental), Takashi Maeda and Fumio Aoki, Ohmsha, ISBN4-274-13179 (in Japanese) • New Artificial Intelligence (Advanced), Takashi Maeda and Fumio Aoki, Ohmsha, ISBN4-274-13198-X (in Japanese) • Artificial Intelligence: a modern approach, S. Russell and P. Norvig, Prentice Hall, ISBN0-13-080302-2										
Laboratory	• Introduction to Python, Searching problem, CSPs Problem, Game Trees, Markov Decision process, Reinforcement learning, Probability model, Bayes' Net, Decision Diagrams, ML: Perceptron's										

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab.	Tut.	Sum	St. Act.	Mids	Exp.	Final
ELE 255	Anatomy and Physiology	---	2	2	0	0	2	30	30	-	40
Course Contents	Application of statics to the musculoskeletal system: Systems in equilibrium, joints, muscle forces, joint reaction forces, indeterminate problems. Application of dynamics to study human motion: Linear and angular kinematics, linear and angular kinetics, impulse and momentum, work, and energy. Strength of materials: stress and strain, elastic and viscoelastic materials, linear and nonlinear constitutive equations. Material properties of biological tissues: bone, muscle, cartilage, tendons, and ligaments. Assessment of failure of bone under different loading conditions. Selected advanced topics: prosthetics design, total hip joint replacement.										
References	Science of Yoga: Understand the Anatomy and Physiology to Perfect Your Practice Dorling Kindersley DK, Ann Swanson, 2019 Anatomy & Physiology: The Unity of Form and Function McGraw-Hill Science/Engineering/Math Kenneth Saladin, 2003										

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab.	Tut.	Sum	St. Act.	Mids	Exp.	Final
ELE 256	Introduction to Biomedical Engineering	ELE 142	3	2	0	2	4	10	30	20	40
CourseContents	Analog signals, Digital signals, Analog to digital conversion, low power consuming circuits digital signal processing, biological instrumentation, and biomedical applications.										
References	John Enderle, Joseph Bronzino, 2011, Introduction to Biomedical Engineering, 3rd Edition, Academic Press										
	Street, Laurence J, 2011, Introduction to Biomedical Engineering Technology, Second EditionCRC Press										

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec	Lab	Tut	Sum	SA	MT	PE/OE	Final
ELE 271	Electrical Power System I	ELE 112	3	2	0	2	4	30	30	0	40
Course Contents	Representation of power systems, Generating stations, Parameters of transmission lines: series impedance, inductance and electrical capacitance, Electrical design of transmission lines, Models of transmission lines, Analysis of short, medium and long transmission lines, Performance of transmission lines, Mechanical design, Overhead transmission lines insulators, Corona, Distribution systems-general, DC distribution, AC distribution, underground cables.										
References	• Stevenson, W. D., Elements of Power System Analysis, McGraw Hill, 1995. • Mehta, V. K. and Mehta, R., Principles of Power System, AMIE and Other Engineering Examinations. S. Chand Publishing, 2005. • Glover, J. D., Sarma, M. S., &Overbye, T., Power system analysis &design,Cengage Learning, 2012.										

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec	Lab	Tut	Sum	SA	MT	PE/OE	Final
ELE 272	Electrical Power System II	ELE 271	3	2	0	2	4	30	30	0	2
Course Contents	Power factor improvement, Essential features of switchgear, Basic elements of switchgear, substations and circuit breakers, Voltage control in AC power systems, Transients and dynamics of over voltages in high-voltage systems, DC power transmission systems, Introduction to FACTS, Introduction to power system planning.										
References	• Stevenson, W.D., Elements of Power System Analysis, McGraw Hill, 1995. • Mehta, V. K. and Mehta, R., Principles of Power System, AMIE and Other Engineering Examinations. S. Chand Publishing, 2005. • Glover, J. D.; Sarma, M. S., and Overbye, T., Power system analysis and design, SI version. Cengage Learning, 2012.										

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec	Lab	Tut	Sum	SA	MT	PE/OE	Final
ELE 273	Power Electronics I	ELE 213	3	2	1	2	5	10	30	20	40
Course Contents	Introduction of power electronics devices- circuits, and applications- Power semiconductors: types, construction and performance of switching states of Power Diodes, Power Transistors and Thyristors- Characteristics, ratings, and types of power diodes, power transistors, and Thyristors- Protection of power semiconductors switches and their circuits against temperature rise, over current and over voltage - Uncontrolled and controlled rectifier: operation, performance analysis and Design - Design of output Voltage with LC Filter- Dual ,series and parallel controlled rectifier -Thyristors commutation- Firing and drive circuit.										
References	• Bose, B.K., Power Electronics and AC Drives, Prentice Hall, 1986 • Mohan, N., Undeland, T.M. and Robbines, W.P., Power Electronics: Converters,Applications and Design, John Wiley and Sons Inc., 1990 • Rashid, M.H., Power Electronics, Circuits, Devices And Applications, Prentice Hall, 1995.										
Laboratory	Characteristics of the switching devices (diode, thyristor, BJT, IGBT,) Single phase half wave uncontrolled and controlled rectifiers with different loads (resistive, inductive, battery,..) Single phase full wave uncontrolled and controlled rectifiers with different loads (resistive, inductive, battery ,..)										

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec	Lab	Tut	Sum	SA	MT	PE/OE	Final
ELE 274	Power Electronics II	ELE 273	3	2	1	2	5	10	30	20	40
Course Contents	DC–AC inverters: operation, performance analysis and design- harmonic Reductions- AC Voltage Controllers: operation, performance analysis and design- DC–DC converters (DC choppers): operation, performance analysis and design. Update of power electronic circuit and system.										
References	•Bose, B.K., Power Electronics and AC Drives, Prentice Hall, 1986 •Mohan, N., Undeland, T.M. and Robbines, W.P., Power Electronics: Converters,Applications and Design, John Wiley and Sons Inc., 1990 •Rashid, M.H., Power Electronics, Circuits, Devices And Applications, Prentice Hall, 1995.										
Laboratory	Single phase inverter with different loads (resistive, inductive) Three- phase square wave inverter (120°- 180°) with different loads (resistive, inductive) DC chopper (buck) Boost (DC chopper) Single phase AC voltage controller with different loads (resistive, inductive)										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab	Tut	Sum	SA	MT	PE/OE	Final
ELE 276	Electric Machines	ELE 179	3	2	2	1	5	10	30	20	40
Course Content	Magnetics, electromagnetic forces, generated voltage, and energy conversion - Motor action, and generator action - Transformer principles, construction, transformer action, ideal transformer, equivalent impedance of transformer, voltage regulation, per-unit impedance of transformer, transformer losses and efficiency. Transformer polarity and standard markings, transformer nameplates, autotransformers. Overview on Generation, Transmission and Distribution of Electrical Energy. Principles of DC machines, armature winding, developed torque. Principles of three phase induction motors - Synchronous Motors - Principles of DC machines.										
References	• Charles I. Hubert, "Electric Machines Theory, Operating Applications, and Control", 2nd Edition, Pearson 2020, ISBN-13: 978-0130612106. • Sen, P.C., "Principles of Electrical Machines and Power Electronics",3rd edition, Wiley, 2013										
Laboratory	• Experiments on magnetics and electromagnetic forces and generated voltage • Transformer Polarity Experiment, Loading and Unloading Exp. • Voltage Regulation Exp. • Open-Circuit Test and Short-Circuit Test Exp. • Instrument Transformers • Armature Control of DC Machines • Field Control of DC Machines. • Measure voltage, current and frequency of I.M. at starting and running. • Measuring of synchronous speed, rotor speed, and slip of I.M. • Speed reversing of I.M. • I.M. Starting Methods • Speed Control of I.M.										

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec	Lab	Tut	Sum	SA	MT	PE/OE	Final
ELE 277	Electrical Machine I	ELE 112	3	2	1	2	5	10	30	20	40
Course Contents	Magnetics, Electromagnetic Forces, Generated Voltage, and Energy Conversion; Motor Action, and Generator Action. Single-Phase Transformer Principles, construction, Transformer Action, Ideal Transformer, Equivalent Impedance of Transformer, Voltage Regulation, Per-Unit Impedance of Transformer, Transformer Losses and Efficiency. and Determination of Transformer Parameters. Transformer Polarity and Standerd Terminal Markings, Transformer Nameplates, Autotransformers.										
References	• Say, M.G., Theory and Performance of ac Machines- Third Edition, Pitman.										
Laboratory	• Some Experiments Belongs to Magnetcs and Electromagnetc Forces and generated Voltage • Transformer Polarity Experiment • Transformer Loading and Unloading Exp. • Voltage Regulation Exp. • Open-Circuit Test and Short-Circuit Test Exp. • Parallel Operation of Transformers • Three-Phase connections of Single Phase Transformers • Three-Phase Transformers										

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec	Lab	Tut	Sum	SA	MT	PE/OE	Final
ELE 278	Electrical Machine II	ELE 277	3	2	1	2	5	10	30	20	40
Course Contents	Principles of Three-Phase Induction Motors, Introduction, I.M. Action, Reversal of Rotation, Construction, Synchronous Speed, Slip and its effect on Rotor frequency, and Voltage, Equivalent Circuit of an I.M., Air Gap power, Mechanical Power and Developed Torque, Torque-Speed Characteristics, Losses, Efficiency and Power Factor, Classification, Equivalent Circuits of I.M., Performance, Applications, and Operations of Induction Machines, Squirrel-cage I.M. NEMA design, NEMA Tables, Wound-Rotor I.M., Motor Nameplate Data, per-Unit values of I.M. Parameters, Determination of I.M. Parameters, Induction Generators, I.G., I.M. Starting. Synchronous Motors, S.M., Introduction, construction, Types; (Cylindrical and Sailent Poles); Starting of S.M., Shaft Load, Power Angle and Developed Torque, Counter-EMF and Armature Reaction Voltage, Equivalent Circuit and Phasor Diagram of S.M., Power Equation (Magnet Power), V-Curves, S.M. losses and Efficiency, Sailent-Pole S.M., pull-In Torque, Speed Control of S.M. Synchronous Generators (Alternators), Introduction, Motor to Generator Transition, S.G. Power Equation, paralleling of S.G., Motoring of Alternators, Safe Shutdown of AC Generators in Parallel with other Machines, Accidental Loss of Field Excitation, Per-Unit Values of S.M. Parameters, Voltage-Regulations, Determination of S.M. Parameters, Losses and Efficiency, and Some Applications.										
References	•Say, M.G., Theory and Performance of ac Machines- Third Edition, Pitman. •Sen, P.C., Introduction to Electrical Machines and Power Electronics - First edition, Pitman •Lecture Notes •Fitzgerald, A.E.; Kingsley, C. and Umans, S.D., Electric Machinery - Fifth edition, McGraw Hill Co •Charles I. Hubert , Electric machines Theory, Operation, Applications, Adjustment, and Control-Second Edition,2002										
Laboratory	•Some Exps. To measue Voltage, Current and frequency of Wound Rotor I.M. at starting and Running. •Measuring of Synchronous Speed,Rotor Speed, and Slip of I.M. •Speed reversing of I.M. •Determination of I.M. Parameters (DC-Test, Blocked Rotor Test, and No-Load Test). •I.M. Starting Methods •Speed Control of I.M. •Starting of S.M. •Reversing the Rotation of S.M. •Determination of S.G. Parameters (DC-Test, Open-Circuit Test, Short-Circuit Test).										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab	Tut	Sum	ST	MT	PE/OE	Final
ELE 301	Power Electronics	ELE 234	3	2	2	0	4	15%	20%	15%	50%
Course Content	Power semiconductor devices, diodes, thyristors, MOSFETS, and other insulated gate devices such as the IGBT, MCT and the FCT. Static and switching characteristics, gate drive and protection techniques. Drive circuit design and protection techniques. Power converter circuits Applications of AC-DC, DC-DC, and DC-AC power converter circuits. Analyses of input and output waveforms of these circuits, harmonic performance. A basic understanding of devices, circuit principles and implications in input/output waveform quality. Application considerations for remote and un-interruptible power supplies, and for computer systems, telecommunications, automobiles, traction and other industrial processes; Utility interaction, harmonic distortion.										
References	• Adel S. Sedra and Kenneth C. Smith, “Microelectronic Circuits”, by Oxford University press.										
Laboratory	• Characteristic of silicon-controlled rectifier • Triggering of IGBT, MOSFET & Power Transistor • Experimental study Bridge inverter using IGBT • Experimental study Series Inverter using MOSFET										
Used in Program	Mechatronics Engineering Program						Semester	7			

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab	Tut	Sum	SA	MT	PE/OE	Final
ELE 311	Digital Communication Systems	ELE 212	3	2	1	2	5	10	30	20	40
Course Content	Review Sampling Theory, Pulse Amplitude Modulation, Time-Division Multiplexing, Pulse-Position Modulation, Quantization Process, Pulse-Code Modulation, Noise Considerations in PCM systems, Delta Modulation, Differential Pulse-Code Modulation. Matched filter, Error Rate due to Noise, Intersymbol interference, Nyquest's Criterion for Distortionless Baseband Binary transmission, Correlative-Level coding, Baseband M-ary PAM transmission, Taped-Delay line Equalization, Eye Pattern, Passband transmission model, Gram-Schmidt Orthogonaliztion procedure, Gemotric interpretation of Signals, Response of Bank of Correlators to Noisy Input.										
References	• Simon Haykin, Communication Systems, Wiley, 4th edition • Lathi, Modern Digital and Analog Communication System, Oxford University Press, 5th edition										
Laboratory	• Sampling of band-limited signal • Pulse Amplitude Modulation • Pulse Position Modulation • Time-Division multiplexing • Pulse Code Modulation • Delta Modulation • Intersymbol Interference and Eye Pattern										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab	Tut	Sum	SA	MT	PE/OE	Final
ELE 312	Wireless Communication Systems	ELE 311	3	2	1	2	5	10	30	20	40
Course Content	Coherent Detection of Signals in Noise, Probability of Error, Correlation receiver, Detection of signals with unknown phase, Coherent Binary PSK, Coherent Binary FSK, Coherent QPSK, Coherent Minimum Shift Keying, Noncoherent Orthogonal Modulation, Noncoherent FSK, Differential PSK, Comparison of Binary and Quaternary Modulation Schemes, M-ary Modulation Techniques, Power Spectrum Density and Bandwidth Efficiency, Synchronization in Digital receivers, Time Varying Channel Models, characteristics of Time varying Channel, Signal transmission through frequency non-selective slow fading channel, Signal transmission through frequency selective slow fading channel, signal transmission through fast fading channel, Diversity transmission in wireless communication.										
References	• Simon Haykin, Communication Systems, Wiley, 4th edition • Lathi, Modern Digital and Analog Communication System, Oxford University Press, 5th edition										
Laboratory	• Binay PSK modulation. • Binary FSK modulation. • Binary ASK modulation. • QPSK modulation. • Differential PSK modulation. • Non-coherent FSK modulation. • Carrier and symbols synchronization in digital receiver. • Simulation of Fading Channel.										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab	Tut	Sum	SA	MT	PE/OE	Final
ELE 313	Information Theory	BES 211	2	2	1	1	4	10	30	20	40
Course Content	Uncertainty, Information, and Entropy. Source coding theory. Data Compaction. Discrete memoryless channels. Mutual information. Channel capacity. Channel Coding theory. Implications of the information capacity theory. Rate distortion theory. Linear block Codes.										
References	• Simon Haykin, Communication Systems, Wiley, 4th edition • Shu Lin, Daniel Castello, Error Control Coding, Pearson, 2nd										
Laboratory	• Simulation of Huffman source encoder and decoder. • Simulation of Limpel-Ziv source encoder and decoder. • Simulation of BPSK system with repetition code. • Simulation of BPSK system with Hamming block code.										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab	Tut	Sum	SA	MT	PE/OE	Final
ELE 314	Digital Signal Processing I	ELE 211	3	2	1	2	5	10	30	20	40
Course Content	Introduces the fundamental theoretical concepts of digital signal processing. It covers quick review on discrete-time signals and systems, LTI systems, Z-Transform, digital filter design, filter realization, and frequency domain analysis using discrete and fast Fourier transforms.										
References	• Fundamentals of digital signal processing, Lonnie C. Ludeman, Wiley 1986. • Digital Signal Processing: Principles, Algorithms and Applications, J. Proakis, D. Manolakis, Prentice-Hall, 2006 (4-th edition)										
Laboratory	• Generation of common discrete-time signals using MATLAB. • Evaluation of impulse response and frequency response of LTI system with different ROC's. • Digital filter design using MATLAB. • Evaluation of DFT and FFT algorithms without using inherent MATLAB functions and compare algorithm complexity.										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab	Tut	Sum	SA	MT	PE/OE	Final
ELE 315	Transmission Lines	ELE 216	3	2	1	2	5	10	30	20	40
Course Content	Understanding of RF microwaves transmission line theory. Uniform Plane Wave propagated in several medias and power consideration. Reflection of uniform plane waves at normal incident and standing wave ratio phenomena. Infinite and terminated transmission line. Phase and group velocity. Impedance matching. Graphical Methods (Smith Chart). Microstrip line and Waveguides.										
References	• Engineering Electromagnetics, William Hayt, 6th edition. • Elements of Power System Analysis, Fourth Edition, William D. Stevenson, Jr., McGraw-Hill Book Company, 1982, Chapter 5.										
Laboratory	• Steady-state performance characteristics of power transmission lines. • Open, short, and matched loaded transmission line. • Measurements under Transient Conditions (Characteristic Impedance & Velocity of Propagation. • Microstrip line transmission line. • Matching circuits.										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab	Tut	Sum	SA	MT	PE/OE	Final
ELE 316	Antenna Theory and Wave Propagation I	ELE 315	3	2	1	2	5	10	30	20	40
Course Content	Theory of radiation, fundamental antenna parameters and concepts. Influence of earth on antenna radiation pattern and impedance. Radiation from several types of wire antennas like dipoles and loop antennas. Antenna matching from lumped elements and baluns. Antenna arrays and the general array formula.										
References	• Antenna Theory, Wiley, 3th edition, C. Balanis • Antenna Theory and Design, Wiley,2nd Edition, Warren L. Stutzman, Gary A. Thiele.										
Laboratory	• Radiation Pattern of a λ/2 Dipole at 1 GHz. • Half Wave Folded Dipole Antennas and Impedance Balun Transformation. • Loop Antennas. • Circular Polarization and Helical Antennas. • Vertical dipole mounted on Metallic Printed Strip Disk. • Antenna polarization.										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab	Tut	Sum	SA	MT	PE/OE	Final
ELE 317	Electronic Circuit Design	ELE 214	3	2	1	2	5	10	30	20	40
Course Content	This course cover power amplifiers (Class A, Class B, Class A-B and C amplifiers), Passive filters (low-pass, high-pass, band-pass and band-reject). Passive filters frequency response characteristics. Active filters, Design and analyze higher order active filters. active filters frequency response characteristics. Oscillators, Different oscillator circuits RC and LC- phase shift, Wien's bridge, Hartley, Colpitts, and crystal oscillator. Relaxation oscillator. VCO. Phase locked loop. switched-capacitor circuits. Circuit performance is predicted by means of both hand calculations and computer simulations.										
References	• Sedra / Smith, Microelectronic Circuits, 7th Edition, Oxford University Press, 2015. • Jacob Baker, CMOS Circuit Design, Layout, and Simulation, 3rd Edition, Institute of Electrical and Electronics Engineers, 2010. • Peter D. Hiscocks, Analog Circuit Design, 2nd Edition, Department of Electrical and Computer Engineering Ryerson University, 2010.										
Laboratory	• Design and test the class A, B, class B complementary symmetry power amplifiers. • Design active filters: LPF, HPF, BPF and BRF. • Plot the frequency response curve of Hartley and Colpitts Oscillator. • Plot the frequency response curve of phase shift and Wein bridge Oscillator. • Design passive filters: LPF, HPF, BPF and BRF.										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab	Tut	Sum	SA	MT	PE/OE	Final
ELE 331	Machine Learning	ELE 243, BES 211	3	2	2	1	5	10	30	20	40
Course Content	Supervised learning (generative/discriminative learning, parametric/ nonparametric learning, neural networks, and support vector machines)-Unsupervised learning (clustering, dimensionality reduction, kernel methods)- Learning theory (bias/variance tradeoffs - Reinforcement learning and adaptive control.										
References	• Ethem Alpaydin, "Introduction to Machine Learning", 2nd edition, MIT Press, 2009, ISBN-13: 978-0262012430 • Theobald, Oliver, "Machine learning for absolute beginners". 3rd Edition, Scatterplot Press, 2020, ISBN-13: 978-1520951409.										
Laboratory	• Linear and Logistic Regression. • Build and evaluate machine learning models for classification and regression. • Multi-class Classification and Neural Networks. • Perform automatic hyperparameter tuning and feature selection to optimize model performance. • K-Means Clustering and PCA.										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab	Tut	Sum	SA	MT	PE/OE	Final
ELE 332	Innovation Management and Entrepreneurship		2	2	0	0	2	30	30	-	40
Course Content	What is Innovation, Technological Innovation and Innovation Management? Invention, Creativity and Innovation: What is the difference? Why innovation is necessary? What causes innovation to fail? Sources and types of innovation; Diffusion of innovation S-curves and the best timing to introduce new products / service. Introduction to Design Thinking Mindsets, and characteristics of good solutions Problem selection and team creation Empathize Stage of Design Thinking Define Stage of Design Thinking Ideation Stage of Design Thinking Prototyping Stage of Design Thinking Validation and Testing Stage of Design Thinking and What is Next Steps? Entrepreneurship mindset and characteristic of successful entrepreneur Difference between startup, Small Business. Business Model Canvas Business Model Innovation. Pitching										
References	• Alexander Osterwalder, Yves Pigneur, "Business model generation: A handbook for visionaries, game changers, and challengers", 1st edition, 2010, ISBN-13: 978-0470876411 • Eric Ries, "The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses", 1st edition, 2011, ISBN-13: 978-0307887894 • https://designthinking.ideo.com/										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab	Tut	Sum	SA	MT	PE/OE	Final
ELE 333	Digital Control	ELE 211, ELE 232	3	2	1	1	4	10	30	20	40
Course Content	Introduction to digital control, Discrete time systems, Modeling of digital controls systems, Stability of digital control systems, Digital control systems design, State space representation of digital control systems, Properties of discrete state-space models, State feedback digital control, Proportional, derivative, and integral control, Introduction to optimal digital control, Practical issues.										
References	• M. Sami Fadali, Antonio Visioli, "Digital Control Engineering: Analysis and Design", 3rd Edition, Academic Press,2019, ISBN-13: 978-0128144336										
Laboratory	Using MATLAB Program: • Explores the process of digital control representation in MATLAB, followed by a review of Z-transforms. • Demonstrates state-space representations and the construction of transfer functions and their corresponding discrete equivalents • Explores steady-state and transient response analysis using root locus, as well as frequency response plots and digital controller design using bode plots • Employs test cases and real-life examples to provide students with hands-on experience suitable for the industry										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab	Tut	Sum	SA	MT	PE/OE	Final
ELE 335	Industrial Automation Systems	ELE 232	3	2	2	1	5	10	30	20	40
Course Content	Automation versus mechanization - Programmable controller at the heart of the automated system - Study of different software package used in industrial field - Ladder diagram programming language: (bit logic, counter, timer, special functions, analog input and analog output), Sequential Function Charts (sequential functions, alternative processes and exclusive processes,) - Functional blocks diagram (PLC software and common applications) - Statement list - Structured Text- Supervisory control and data acquisition- Distributed Control Systems (DCS) and SCADA Applications										
References	• Hugh Jack, "Automating Manufacturing Systems with PLCs",7th Edition, Lulu.com, 2009. • W. Bolton, 'Programmable Logic Controllers', 6th Edition, Newnes, 2015. • Dag H. Hanssen," Programmable logic controllers a Practical approach to IEC 61131-3 Using CoDeSys", Wiley, 2015.										
Laboratory	• Classical Control Lab • PLC Bit Logic lab. • Timer and Counter lab • Function Block Diagram (FBD) • HMI/SCADA lab.										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab	Tut	Sum	SA	MT	PE/OE	Final
ELE 341	Microprocessor Based Systems	ELE 242	3	2	1	2	5	10	30	20	40
Course Content	Microprocessor-based digital system basic architecture.; Microprocessor basic architecture. Intel 8x86 Programming Model.; 80x86 family as a particular case.; Internal registers and 80x86 architecture.; Memory access and organization.; Addressing modes. Directives and operators of the 80x86 assembler.; Assembly program structure. Assembly Instructions: data transfer, arithmetic and logic operations, control, interruptions, etc.; PC Memory Map.; Interruptions: mechanism and interruption vectors.; Input/output programming techniques (I/O). (Pulling, Interruptions, DMA); Management and programming of 80x86 interruptions: the 8259A programmable controller.; PC hardware resources programming (Keyboard, Timer, Real-Time Clock (RTC)).										
References	• Giuliano Donzellini, Andrea Mattia Garavagno, Luca Oneto, "Introduction to Microprocessor-Based Systems Design", Springer, 2021, ISBN-13: 978-3030873431. • Barry B. Brey- "The Intel microprocessors 8086, 8088, 80186, 80188, 80286, 80386, 80486, The Architecture, Programming, and Interfacing", 8th Edition-Prentice Hall,2008.										
Laboratory	• Addressing modes • Arithmetic operations • Logic Operations • Memory and data transfer • Interrupts • IO mapping										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab	Tut	Sum	SA	MT	PE/OE	Final
ELE 342	Embedded Systems	ELE 141	3	2	2	0	4	10	30	20	40
Course Content	Introduction to Embedded systems, Basic Hardware foundations, - architecture of computer-controlled real time control system - Real time interfacing - IO types, Delays, Driving DC loads, Driving AC loads, adding structure to your code, meeting real time constraints, Creating an Embedded OS, Multi-State systems and function sequences, Using Serial interfaces (RS-232, I2C and SPI), ADC and DAC interfaces (PWM), Multi-Processor Arch., Different Case studies										
References	• M.J. Pont, "Patterns for Time-Triggered Embedded Systems: Building Reliable Applications with the 8051 Family of Microcontrollers",Addison-Wesley, 2001, ISBN 0201331381. • Daniele Lacamera, "Embedded Systems Architecture: Explore architectural concepts, pragmatic design patterns, and best practices to produce robust systems", Packt Publishing, 2018. • Xiaocong Fan, "Real-Time Embedded Systems: Design Principles and Engineering Practices", Newnes, 2015.										
Laboratory	• Reading Keypad • 7-Segment display • Real Time clock • Serial Interface • ADC and DAC interfaces										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab	Tut	Sum	SA	MT	PE/OE	Final
ELE 343	Database Systems	ELE 144	3	2	2	1	5	10	30	20	40
Course Content	Fundamental database concepts - data structures and operations - data modeling (ER - Relational) - database system architecture - Functional dependencies and normal forms. - implementation techniques of database management systems (index structures, concurrency control, recovery, and query processing) - data definition and data manipulation languages - query languages including Algebra and SQL - management of semi structured and complex data - security and integrity; concurrency control, distributed and NoSQL databases.										
References	• Hector Garcia, J. Ullman, and J. Widom, "Database Systems: The Complete Book",2nd edition, Pearson Prentice Hall, 2009, ISBN 978-0131873254. • R. Elmasri, S.B. Navathe, "Fundamentals of Database Systems",7th Edition, Pearson, 2015, ISBN: 978-0133970777 • T. Connolly, C. Begg, "Database Systems: A Practical Approach to Design, Implementation, and Management", 6th Edition, Pearson 2014										
Laboratory	Project based laboratory, to design a database project, the lab work includes: • ER Modelling • Schema Designing, creating Tables • Writing SQL Queries Creating Reports										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab	Tut	Sum	SA	MT	PE/OE	Final
ELE 347	Microcontroller Embedded Systems	ELE 141	3	2	2	0	4	10	30	20	40
Course Content	Introduction to Embedded systems, Basic Hardware foundations, - architecture of computer-controlled real time control system - Data Acquisition Systems (DAS) - examples of DAS cards and digital signal processing chips (DSP)- Real time interfacing - IO types, Delays, Driving DC loads, Driving AC loads, Adding structure to your code , Meeting real time constraints, Creating an Embedded OS, Multi-State systems and function sequences, Using Serial interfaces(RS-232,I2C and SPI), ADC and DAC interfaces (PWM), Multi-Processor Arch., Different Case studies .										
References	• M.J. Pont, "Patterns for Time-Triggered Embedded Systems: Building Reliable Applications with the 8051 Family of Microcontrollers", ISBN 0201331381, Addison-Wesley, 2001										
Laboratory	• • Reading K4eypad, 7-Segment display, Real Time clock, Serial Interface, ADC and DAC interfaces										

Code	Course Title	Pre-req.	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab.	Tut.	Sum	St. Act.	Mids	Exp.	Final
ELE 350	Biomechanics	BES 022	3	2	2	1	5	10	30	20	40
Course Contents	Application of statics to the musculoskeletal system: Systems in equilibrium, joints, muscle forces, joint reaction forces, indeterminate problems. Application of dynamics to study human motion: Linear and angular kinematics, linear and angular kinetics, impulse and momentum, work, and energy. Strength of materials: stress and strain, elastic and viscoelastic materials, linear and nonlinear constitutive equations. Material properties of biological tissues: bone, muscle, cartilage, tendons, and ligaments. Assessment of failure of bone under different loading conditions. Selected advanced topics: prosthetics design, total hip joint replacement.										
References	Susan Jean Hall, 8th edition, 2019, Basic biomechanics, McGraw-Hill Education										
Laboratory	Anthropometry and Body Segment Parameters: Motion Capture and Analysis: Force and Torque Measurements: Muscle Activity and Electromyography (EMG): Ergonomic Assessment and Design: Gait Analysis and Rehabilitation: Computational Modeling in Biomechanics:										

Code	Course Title	Pre-req.	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab.	Tut.	Sum	St. Act.	Mids	Exp.	Final
ELE 351	Hospital Instrumentation	ELE 241	3	2	0	1	4	10	30	20	40
Course Contents	Hospital design basics, Hospital Planning, Hospital departments, Hospital department equipment lists, Medical instrumentation pre installation requirements, critical technical specs of medical equipment										
References	John G. Webster “Medical Instrumentation Application and Design”, 4th Edition, 2009										

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab.	Tut.	Sum	St. Act.	Mids	Exp.	Final
ELE 352	Rehabilitation Engineering and Assistive Technology	BES 022	3	2	2	1	5	10	30	20	40
Course Contents	Seminar in musculoskeletal rehabilitation: gait analysis, kinetic and kinematic measurement systems. Design of orthotic and prosthetic devices, design of robotic rehabilitation devices, functional electrical stimulation (FES), BCI for rehabilitation, evaluation of rehabilitation and orthotic devices, neural engineering. Current research will be reviewed and discussed.										
References	Andrew Y. J. Szeto, "Assistive Technology and Rehabilitation Engineering", 2014										
Laboratory	Assistive Device Evaluation and Assessment: Wheelchair and Seating Simulation: Assistive Technology Prototyping: Accessible Software and Web Design: Sensory Aids and Assistive Devices: Rehabilitation Engineering Design Project										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab	Tut	Sum	SA	MT	PE/OE	Final
ELE 353	Biomedical Modeling and Simulation	ELE 211, BES 112	3	2	2	1	5	10	30	20	40
Course Content	Introduction to Modeling – Definitions – Types of Models – Purposes of Models – Modeling Methodology – Mathematical Modeling – Parameter Estimation – Basic Model Forms Basic Simulation Approaches - Handling Stepped and Event-based Time in Simulations Discrete versus Continuous Modelling - Sources and Propagation of Error - Models of Population Dynamics – Compartmental Modeling – Model from the Human Physiology – Models of Human Movement –Application of Modeling and Simulation in Biomedical Fields.										
References	• Kojic, Milos &Filipovic, Nenad&Stojanovic, Boban & Kojic, Nikola. (2009). Computer Modeling in Bioengineering: Theoretical Background, Examples and Software. Computer Modeling in Bioengineering: Theoretical Background, Examples and Software. 1-446. 10.1002/9780470751763. • Jensen, Christopher. (2009). Biological Modeling and Simulation: A Survey of Practical Models, Algorithms, and Numerical Methods. Computational Molecular Biology . By Russell Schwartz . Cambridge (Massachusetts) : MIT Press . $45.00. xii + 389 p.; ill.; index. 978-0-262-19584-3 . 2008 .. The Quarterly Review of Biology. 84. 284-284. 10.1086/644661. • Hill, Raymond. (2007). Discrete-Event Simulation: A First Course. Journal of Simulation. 1. 10.1057/palgrave.jos.4250012.										
Laboratory	- Introduction to Matlap and Simulink , RNG algorithms, Statstical model "data analysis" - DTMC/CTMC, Queueing Theory model, Montecarlo simulation, Output Analysis										

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab.	Tut.	Sum	St. Act.	Mids	Exp.	Final
ELE 354	Cardiovascular Biomechanics	BES 022	3	2	2	1	5	10	30	20	40
Course Contents	Review of relevant theories in Fluid Mechanics, followed by anatomy and physiology of the cardiovascular system, including blood rheology and vessel tissue mechanics. Cardiovascular anatomy using state-of-the-art Virtual Reality equipment. Modelling, analytical and experimental methods applied to several parts of the cardiovascular system. Application of modelling techniques to investigate correlations with disease.										
References	Peter R. Hoskins, Patricia V. Lawford, Barry J. Doyle , "Cardiovascular Biomechanics", Springer International Publishing, 2017										
Laboratory	Cardiovascular Anatomy and Physiology: Hemodynamic Measurements: Cardiovascular Imaging Techniques: Cardiovascular Stress Testing: Cardiovascular Tissue Mechanics: Computational Modeling of Cardiovascular Biomechanics: Cardiovascular Device Design and Evaluation										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab	Tut	Sum	SA	MT	PE/OE	Final
ELE 355	Medical Imaging I		3	2	2	1	5	10	30	20	40
Course Content	Computed Imaging: CT, PET, and SPECT – Magnetic Resonance Imaging. Radiation and Matter – Absorption of Radiation in Ultraviolet and Visible Regions: Sources and Detectors – Visual Colorimeters – Filter Photometers – Spectrophotometers – Spectrophotometry– Absorption of Radiation in Infrared Region: Sources and Detectors – Infrared Spectrophotometers – Molecular Luminescence – Fluorescence and Phosphorescence – Spectrofluorometry – Spectropolarimetry – Flame Photometery - Atomic Absorption - Chromatography (HPLC & GC) – Water Purification - Balances – Centrifuges - Electrophorosis - Molecular Biology Technique - Scattering of Radiation – Laser: Sources, and Applications in Chemistry and Spectroscopy - Chromatography - Automation - Performance Evaluation - Calibration of Analytical Instrumentation - Analytical Laboratory Skills - Practical Training in Clinical Sites.										
References	- Jerry L. Prince, Jonathan, Medical Imaging Signals and Systems - Bushberg, J. T., The essential physics of medical imaging, 2nd edition 2002, Philadelphia: Lippincott Williams and Wilkins. - Cho, Z-H., J. Jones, and M. Singh. Foundations of Medical Imaging. - Cherry, S. R., Sorensen, J. A. and Phelps, M. E., Physics in nuclear medicine, 3rd edition 2003, Philadelphia, PA: Saunders.										
Laboratory	- Introduction to Matlab - Image filtration and noise analysis - CT image reconstruction										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab	Tut	Sum	SA	MT	PE/OE	Final
ELE 356	Medical Imaging II	ELE 355	3	2	2	1	5	10	30	20	40
Course Content	Computed Imaging: CT, PET, and SPECT – Magnetic Resonance Imaging. Radiation and Matter – Absorption of Radiation in Ultraviolet and Visible Regions: Sources and Detectors – Visual Colorimeters – Filter Photometers – Spectrophotometers – Spectrophotometry– Absorption of Radiation in Infrared Region: Sources and Detectors – Infrared Spectrophotometers – Molecular Luminescence – Fluorescence and Phosphorescence – Spectrofluorometry – Spectropolarimetry – Flame Photometery - Atomic Absorption - Chromatography (HPLC & GC) – Water Purification - Balances – Centrifuges - Electrophorosis - Molecular Biology Technique - Scattering of Radiation – Laser: Sources, and Applications in Chemistry and Spectroscopy - Chromatography - Automation - Performance Evaluation - Calibration of Analytical Instrumentation - Analytical Laboratory Skills - Practical Training in Clinical Sites.										
References	- Jerry L. Prince, Jonathan, Medical Imaging Signals and Systems - Bushberg, J. T., The essential physics of medical imaging, 2nd edition 2002, Philadelphia: Lippincott Williams and Wilkins. - Cho, Z-H., J. Jones, and M. Singh. Foundations of Medical Imaging. - Cherry, S. R., Sorensen, J. A. and Phelps, M. E., Physics in nuclear medicine, 3rd edition 2003, Philadelphia, PA: Saunders.										
Laboratory	- Ultrasound image reconstruction from RF data to image, - Signal Analysis - Image Analysis - Doppler ultrasound spectrogram reconstruction - Hospital visit										

Code	Course Title	Pre-req.	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab.	Tut.	Sum	St. Act.	Mids	Exp.	Final
ELE 357	Bioinformatics	ELE 211, ELE 254	3	2	2	1	5	10	30	20	40
Course Contents	Biology background – types of cells (animal / plant) – DNA- RNA-Proteins – genomes – proteome – web base & biology database – Exons, Introns, and Genes - sequence alignment – Similarity – Homology - Paralogs – Orthologs - proteins function prediction – proteins structure prediction – PPI prediction - Genes and Proteins application and algorithms										
References	SupratimChoudhuri, Michael Kotewicz, Bioinformatics for beginners : genes, genomes, molecular evolution, databases and analytical tools, Elsevier/AP, Academic Press, 2014										
Laboratory	Amino Acid prediction , Sequence Alignment, Phylogenetic Analysis: , Gene Prediction and , Annotation, Protein Structure Prediction: , Omics Data Analysis:, Database Searching and Retrieval: , Programming and Scripting										

Code	Course Title	Pre-req.	CH	Ct. Hr.				Assessment			
				Lec.	Lab.	Tut.	Sum	St. Act.	Mids	Exp.	Final
ELE 358	Introduction to Information Theory	BES 114	3	2	2	1	5	10	30	20	40
Course Contents	Entropy – Conditional Entropy – Relative Entropy – Common Information – Jensen Sequences for Inequalities – Logarithmic Sum for Inequalities – Data Processing – Fano Rule for Inequalities – Data Storage – Constant Rate Encoding – Linear Encoding – Kraft Rule for Inequalities – Variable Rate Data Compression Hufmann Coding - General Rules for Information Theory – Encoding by Shanon Noiseless Theory – Modeling Information Sources – Markov Models – Loss of Memory – Modeling Information Channels – Constructing a Code for Limited Sources.										
References	Jr. Johnson, Greg A. Harris, D.C. Hankerson ,Introduction to Information Theory and Data Compression, 2nd edition, 2003										
Laboratory	Entropy Estimation and Source Coding, Channel Capacity and Error Correction, Markov Chain Modeling and Memory Loss, Information Source Modeling and Common Information.										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab	Tut	Sum	SA	MT	PE/OE	Final
ELE 359	Image Processing for Biomedical	ELE 245	3	2	2	1	5	10	30	20	40
Course Content	Introduction-digital image representation-mathematical tools for image processing-image enhancement-image processing in frequency domain-image denoising-image segmentation - Image formation-image processing-feature detection-segmentation-feature based alignment-structure from motion-stereo correspondence-3D reconstruction- Image Enhancement, Image Restoration, Wavelets and Multiresolution Processing, Image Compression, Morphological Image Processing, Image Segmentation, Representation and Description, and Object Recognition										
References	• H. Singh, "Practical Machine Learning and Image Processing: For Facial Recognition, Object Detection, and Pattern Recognition Using Python," New York, A press, 2019										
Laboratory	• Handling Image File input and Outputs. • Viewing and Printing Image Numbers. • Implementation of image Histogram and Equalization • Simulation of Edge Detections • Realization of Special Frequency Filtering. • Realization of Image Operations.										

Code	Course Title	Pre-req.	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab.	Tut.	Sum	St. Act.	Mids	Exp.	Final
ELE 360	Biometrics	BES 114	3	2	2	1	5	10	30	20	40
Course Contents	Introduction to Biometry – Feature Vector and Feature Space – Classification and Recognition Principles – Template & Shape Matching – Recognition of Fingerprint, Hand, Vein Tree, Iris, Retina, Thermograph, Speech, Keystroke, and Multimodal – Performance of Recognition Devices										
References	Biometrics: A Very Short Introduction (Very Short Introductions), Oxford University Press, Michael Fairhurst, 2019 Mayank Vatsa, Richa Singh, Angshul Majumdar, 2018, Deep Learning in Biometrics, CRC Press										
Laboratory	Image processing: , Features & segmentation, Fingerprint Recognition, Facial Recognition, Iris Recognition, Speaker Recognition, Multimodal Biometrics.										

Code	Course Name	Pre-req.	CH	Ct. Hr.				Assessment			
				Lec.	Lab.	Tut.	Sum	St. Act.	Mids	Exp.	Final
ELE 361	Pattern Recognition	ELE 451	3	2	2	1	5	10	30	20	40
Course Contents	Basics of Pattern Classification – Bayesian Decision Framework – Maximum Likelihood Estimation – Nonparametric Techniques – Linear Discriminate Analysis – Neural Networks – Fuzzy Classifiers – Unsupervised Learning and Clustering – Bi-clustering.										
References	• Christopher M. Bishop , "Pattern Recognition and Machine Learning", Springer, 2006 • Himanshu Singh, "Practical Machine Learning and Image Processing: For Facial Recognition, Object Detection, and Pattern Recognition Using Python", Apress, 2019										
Laboratory	SVM, Markov random field, Image Classification., Speech Recognition, Handwritten Digit Recognition, Text Classification, Clustering, Anomaly Detection .										

Code	Course Title	Pre-req.	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab.	Tut.	Sum	St. Act.	Mids	Exp.	Final
ELE 362	Medical Robotics	BES 022	3	2	2	1	5	10	30	20	40
Course Contents	An introduction to the kinematics, dynamics, and control of robot manipulators, robotic vision, sensing, and the programming of robots. Inverse kinematics of serial chain manipulators. The manipulator Jacobian, force relations, dynamics and control-position, and force control. Trajectory generation, collision avoidance, automatic planning of the gross motion strategies, robot programming languages. Proximity, tactile, and force sensing. Network modeling, stability are fidelity in tele-surgery. Biological analogies and medical applications of robotics.										
References	Ikuo Yamamoto, 2016, Practical Robotics and Mechatronics: Marine, Space and Medical Applications The Institution of Engineering and Technology Achim Schweikard, Floris Ernst (auth.), 2015, Medical Robotics, Springer International Publishing										
Laboratory	1. Robot Kinematics and Control. 2. Image-Guided Robotic Surgery. 3.Integrate medical imaging data (e.g. CT, MRI) 4. Teleoperation and Haptics. 5. Sensor Fusion and Navigation. 6. Robotic Assistive Devices. 7. Surgical Simulation and Training.										

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab.	Tut.	Sum	St. Act.	Mids	Exp.	Final
ELE 363	Advanced Human Biodynamics	BES 022	3	2	2	1	5	10	30	20	40
Course Contents	Human muscular-skeletal system explored in relation to engineering principles, focusing on torso, back, hip, neck and shoulder, hand, wrist, elbow, and knee. Emphasis is placed on function, biomechanics, biodynamics and modeling. Basic principles of human physiology presented from the engineering perspective. Bodily functions, their regulation and control discussed in quantitative terms and illustrated by mathematical models where feasible.										
References	Erich Blechschmidt M.D., R.F. Gasser Ph.D., Biokinetics and Biodynamics of Human Differentiation: Principles and Applications, 2015. Manish Arora, Paul Curtin, 2021, Environmental Biodynamics: A New Science of How the Environment Interacts with Human Health, Oxford University Press.										
Laboratory	1. Kinematics and Kinetics. 2. Musculoskeletal Modeling. 3. Gait Analysis. 4. Ergonomics and Workplace Design. 5. Injury Biomechanics. 6. Rehabilitation Engineering.										

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab.	Tut.	Sum	St. Act.	Mids	Exp.	Final
ELE 364	Artificial Organs	BES 022	3	2	2	1	5	10	30	20	40
Course Contents	Introduction of existing artificial organs, prostheses, and rehabilitation systems, focusing on their goals, working principles, and limitations. It further stimulates the student's innovation skills through the deep understanding of the global problem of interfacing a human with such a device.										
References	Hasan, Anwarul, 2017, Tissue engineering for artificial organs : regenerative medicine, smart diagnostics and personalized medicine, Wiley VCH										
Laboratory	1. Biomaterials. 2. Tissue Engineering. 3. Bioreactor Design. 4. Artificial Heart. 5. Artificial Kidney. 6. Organ Perfusion.										

Code	Course Name ‘/ bhGV	Pre-req.	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab.	Tut.	Sum	St. Act.	Mids	Exp.	Final
ELE 365	Kinematics and Kinetics of Human Movement	BES 022	3	2	2	1	5	10	30	20	40
Course Contents	Basic mechanical principles of physical activity and exercise. Quantitative and qualitative biomechanical analyses of human movement. The structure, composition, and behavior of basic skeletal and muscular tissue, pathomechanics of injury, adaptation to load and degenerative changes associated with aging are discussed within the scope of scholarly literature										
References	Smarter Workouts: The Science of Exercise Made Simple, Human Kinetics, Pete McCall, 2019. Latash, Mark L., Zatsiorsky, Vladimir M, 2016, Biomechanics and motor control : defining central concepts, Elsevier Academic Press										
Laboratory	1. Motion Capture. 2. Force Plate Analysis. 3. Inverse Dynamics. 4. Gait Analysis. 5. Ergonomics and Injury Biomechanics. 6. Modeling and Simulation.										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab	Tut	Sum	SA	MT	PE/OE	Final
ELE 367	Deep Learning in Medicine	ELE 254	3	2	2	1	5	10	30	20	40
Course Content	Foundations of Deep Learning, how to build neural networks, and how to lead successful machine learning projects. How to drive performance, effectively use the common neural network, including initialization, L2 and dropout regularization, Batch normalization, gradient checking.										
Laboratory	- Introduction to python/notebook and platforms like Tensor Flow, Keras, Pytorch and Colab - Data exploration, preparation, and analysis - Build data augmentation - Building DL model for 1D data set “forecasting models” - Building DL models computer vision - Diabetes classifier - Breast Cancer Classifier - Model validation - Model deployment										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab	Tut	Sum	SA	MT	PE/OE	Final
ELE 368	Medical Image Computing	ELE 355 &BES 114	3	2	2	1	5	10	30	20	40
Course Content	Application of new parallel processing platforms in solving biomedical engineering problems: introduction to programming parallel processing platform such as multi-core processors and GPUs; pitfalls in parallel computing; developing parallel algorithms for different biomedical applications such as image reconstruction, visualization, in silico methods in genomics and proteomics; advanced topics and applications.										
References	- Ananth Grama, Anshul Gupta, George Karypis, Vipin Kumar."Introduction to Parallel Computing", University of Oregon - Intel Parallel Computing Curriculum - https://ipcc.cs.uoregon.edu/curriculum.html - Norm Matloff, UC Davis"Programming on Parallel Machines" - Victor Eijkhout, TACC, Introduction to High Performance Scientific Computing"										
Laboratory	- Analyzing Parallel Program Performance on a Quad-Core CPU - Scheduling Task Graphs on a Multi-Core CPU - A Simple Renderer in CUDA - Big Graph Processing in OpenMP - Implement Matrix Multiplication as Fast as You Can - Biomedical projects , reconstruction of medical images{ CT, Ultrasound, Doppler ultrasound or 3d reconstruction} - Distrusted computing project {Jolia, MPA, ….}										

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec	Lab	Tut	Sum	SA	MT	PE/OE	Final
ELE 371	Power System Analysis	ELE 272	3	2	0	2	4	30	30	0	40
Course Contents	Equivalent circuits of power system elements, Per unit representation, Formulation of network matrices, Symmetrical fault analyses, Symmetrical components and unsymmetrical fault analyses, Load flow solutions and control: Load flow equations, The Gauss-Seidel method, Newton-Raphson method and approximations, De-coupled methods, Regulating transformers, Optimal dispatch of generation, Power system stability, Control in voltage stabilizers, Generatorspeedcontrol.										
References	• Hadi Saadat, Power System Analysis, PSA Publishing, Third Edition, 2010. • J. D. Glover, M. S. Sarma and T. J. Overbye, Power System Analysis and Design, • Cengage Learning, Fifth Edition, 2012. • Gross, C.A., Power System Analysis, John Wiley, 1980. • Elgerd, O., Electric Energy System Theory: An Introduction, McGraw Hill, 1991.										

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec	Lab	Tut	Sum	SA	MT	PE/OE	Final
ELE 373	Renewable Energy	ELE 278	3	2	0	2	4	30	30	-	40
Course Contents	Sources of renewable energy - solar thermal energy - Solar radiation measurements - photovoltaic sources - Applications of solar energy - Energy from oceans, wind energy, tidal wave energy ,geothermal energy - Biomass and bio-fuels - Power from satellite stations - Hydrogen energy, hydro and other common electrical renewable generation schemes - Selection and sizing of systems components - Detailed design of a typical photovoltaic inverter battery system - Renewable energy integration with existing grid connected power.										
References	•A.A.M. Saigh (Ed): Solar Energy Engineering, Academic Press, 1977 •Abbasi S. A. and N. Abbasi, Renewable Energy Sources and Their Environmental Impact,Prentice Hall of India, 2001.. •G.N. Tiwari: Solar Energy-Fundamentals, Design, Modelling and Applications, arosaPublishers, 2002 •Sawhney G. S., Non-Conventional Energy Resources, PHI Learning, 2012. •Tiwari G. N., Solar Energy- Fundamentals, Design, Modelling and Applications, CRC Press, 2002. •Khan B. H., Non-Conventional Energy Resources, Tata McGraw Hill, 2009. •Earnest J. and T. Wizelius, Wind Power Plants and Project Development, PHI Learning, 2011.										

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec	Lab	Tut	Sum	SA	MT	PE/OE	Final
ELE 375	Electrical Drive	ELE 278	3	2	0	2	4	30	30	-	40
Course Contents	Criteria for selecting drive components, DC motor drives, regenerative braking and four quadrantoperation, Induction motor drives, slip power recovery, Doubly Fed Induction Motor drive (DFIM),synchronous motor drives, Permanent Magnet Synchronous Machine drive (PMSM): motor andgenerator applications, Stepper motor drives.										
References	• Dave Polka, "Motors and Drives A Practical Technology Guide", The Instrumentation, Systems, and Automation Society, 2003. • R. Krishnan, " Electric Motor Drives modeling analysis and control", Virginia Tech. Blacksburg. VA, 2001. • Phipps, Clarence A., Variable Speed Drive Fundamentals, The Fairmont Press, Inc., Lilburn, GA, p. 22–28, 1994.										

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec	Lab	Tut	Sum	SA	MT	PE/OE	Final
ELE 376	Power Systems Distribution	ELE 272	3	2	1	1	4	10	30	20	40
Course Contents	Power handling equipment: Medium voltage switchgear, Ring main unit, Automatic transfer switch, Distribution boards; Wiring and raceways: Cables, Conductors, Bus duct, Cable trays, Conduits, Ducts; Protective devices of distribution system: Circuit breakers, fuses, Overcurrent relays, Differentional Relays, Ground fault circuit beakers; Control and utilization equipment: Static and dynamic loads, Contactors, Dimmers, Sockets, Different types of switches, Light current; Load estimation methods, Interior and exterior lighting design based on codes and standards, Sizing of cables, protection devices, Distribution transformer, etc; Calculations of short circuit, losses, voltage drop.										
References	• Stokes, G. (Ed.), Handbook of electrical installation practice, John Wiley & Sons, 2008. •Egyptian Building Codes and Regulations; International Electrotechnical Commission (IEC); Egyptian Standard Specifications (ES); National Electrical Code (NEC). • Atkinson, B., Lovegrove, R., & Gundry, G., Electrical Installation Designs, John Wiley & Sons, 2012.										
Laboratory	Design and implement automatic transfer switches. Design, implementation and testing of protection circuits for different loads. Design and implementation of ground protection circuits. Designing lighting circuits using the Deluxe program Designing socket circuits using AutoCAD analysis of short circuit and voltage drop for power circuit ETAP program										

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec	Lab	Tut	Sum	SA	MT	PE/OE	Final
ELE 377	Special Machines	ELE 278	2	2	1	0	3	10	30	20	40
Course Contents	• introduction , universal motor, Two phase induction motors, Single phase induction motors, Linear induction motor, Stepper motor, DC and AC servo motors, Sensors and actuators										
References	• Vinott., Fractional Horsepower Motors, McGraw Hill. 1980. -- • Fitzgerald, A.E.; Kingsley, C. and Umans, S.D., Electrical Machinery-fifth edition, • McGraw Hill Co, 1990. -Chapman, S. J., Electrical Machinery fundamentals, • Nagrth Kothari "electric machine"										
Laboratory	• Test and examine components, equipment and systems of electrical power and control • Designing components in electric power systems such as: electric machines, transmission and distribution system, power electronic circuits, control systems, measuring instruments, insulators, relays, circuit breakers, ...etc										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab	Tut	Sum	ST	MT	PE/OE	Final
ELE 372	Power System Protection	ELE 371	3	2	0	2	4	30	30	-	40
Course Content	Effects of short-circuits on power systems, Basic elements of protective gear, Current and potential transformers, Protective relays, Electromechanical and static relays, Different types of electromechanical relays, Microprocessor-based relays, Differential protection of power systems, Protection of transmission lines (carrier protection), Impedance Relays, Types of circuit breakers, Bus-bars protection, Transformers protection, Generators protection, AC motors protection, Design the primary and backup protection systems, Coordination of protective devices										
References	Horowitz, S. H. and Phadke, A. G., Power system relaying, John Wiley & Sons, 2014. • Ravindranath, B. and Chander, M., Power system protection and switchgear, New Age International, 1977. • Bakshi, U. A. and Bakshi, M. V, Switchgear and Protection, Technical Publications, 2020. • Deshpande, M. V., Switchgear and Protection, Tata McGraw Hill Co., 1991.										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab	Tut	Sum	SA	MT	PE/OE	Final
ELE 392	Senior Design Project I	70 % of Total Hrs.	2	0	4	0	4	50	--	50	--
Course Content	The student is assigned, among a team of students and one or more faculty professors, the design of an applied project which simulates the real working condition to which the student will be exposed after graduation. The project should be comprehensive and includes all the necessary preliminary studies. At the end of the semester, there will be a seminar held for the working team of students to present the details of the project. The working team will be orally examined and evaluated based on the presentation.										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
ELE 441	Image Processing	ELE 211, ELE 245	3	Lec.	Lab	Tut	Sum	SA	MT	PE/OE	Final
				2	2	1	5	10	30	20	40
Course Content	Introduction-digital image representation-mathematical tools for image processing-image enhancement-image processing in frequency domain-image denoising-image segmentation - Image formation-image processing-feature detection-segmentation-feature based alignment-structure from motion-stereo correspondence-3D reconstruction- Image Enhancement, Image Restoration, Wavelets and Multiresolution Processing, Image Compression, Morphological Image Processing, Image Segmentation, Representation and Description, and Object Recognition										
References	• H. Singh, "Practical Machine Learning and Image Processing: For Facial Recognition, Object Detection, and Pattern Recognition Using Python," New York, A press, 2019										
Laboratory	• Handling Image File input and Outputs. • Viewing and Printing Image Numbers. • Implementation of image Histogram and Equalization • Simulation of Edge Detections • Realization of Special Frequency Filtering. • Realization of Image Operations.										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
ELE 450	Computational Methods for Medical Image Analysis	ELE 355	3	Lec.	Lab	Tut	Sum	SA	MT	PE/OE	Final
				2	2	1	5	10	30	20	40
Course Content	Comprehensive overview on the mathematical techniques and methods used in the image processing science. Inverse problems in image processing, regularization methods for ill-posed problems and solutions to large scale inverse problems. Stochastic image analysis, modeling of image intensity distribution, local smoothing filters, wiener filters, image segmentation, and shape analysis. Practical implementation and numerical case studies of real image processing problems.										
References	- Solutions of Ill-posed Problems, Tikhonov, A.N. ,Tkhonov, A.N. and Tikhonov, A.N. - Stochastic Image Processing, Chee Sun WonRobert M. Gray - Advanced Techniques for Image Segmentation: Image Processing, Sultan H. Aljahdali, Mohammad Junedul Haque.										
Laboratory	- Image deblurring as and example of ill-posed problem - Stochastic image denoising - Segmentation based on greyscale, CT/MRI images - Segmentation based on texture, ultrasound images - Clustering Segmentation										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab	Tut	Sum	SA	MT	PE/OE	Final
ELE 451	Advanced Image Processing Techniques	ELE 359	3	2	2	1	5	10	30	20	40
Course Content	This course explores a few major areas of digital image processing at an advanced level, with primary emphasis on medical applications. Discussing the treatment of geometrical correction of common distortions. Covering ways of classifying different areas and textures in images. Image segmentation, image registration, and image processing using Image Processing Toolbox in MATLAB, Python, and 3D Slicer.										
References	- M. Haidekker, "Advanced Biomedical Image Analysis," John Wiley & Sons, 2011. - G. Shengrong et al., "Advanced Image and Video Processing Using MATLAB," Springer - International Publishing, 2018. - J. Hajnal et al., "Medical Image Registration," CRC Press, Boca Raton, 2001.										
Laboratory	- Image restoration - Image distortion correction - Texture based classification - Segmentation with different techniques - Image registration										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab	Tut	Sum	SA	MT	PE/OE	Final
ELE 452	RF (Radiofrequency) Medical Devices	ELE 256	3	2	2	1	5	10	30	20	40
Course Content	Applications of electromagnetics and RF in medicine and in other devices that can cause thermal safety hazards. Topics such as Maxwell Equations, Wave Equations, Transmission Lines, Electromagnetic Theorems, Introduction to Antennas, and Introduction to Computational Electromagnetics will be presented. The class will include analyses of several RF devices used in medical applications and/or have electromagnetic safety implications such as magnetic resonance imaging (MRI), biological sensors (brain machine interface), RF ablation, and cell phones. Upon completing the course, the student should be able to describe how to apply fundamental electromagnetic principles to set up and solve problems in RF devices used in medical applications.										
References	Bijan Elahi, Safety Risk Management for Medical Devices D. Smith, Electromagnetic Theory for Complete Idiots (Electrical Engineering for Complete Idiots) Constantine A. Balanis, Antenna Theory: Analysis and Design, 4th Edition Amira S. Ashour, Yanhui Guo and Waleed S. Mohamed, Thermal Ablation Therapy										
Laboratory	- Using modeling/simulation tools Ex:Comsol, Electromagnetic field simulation, Antenna simulation, Tissue Electrical effect simulation, Simulation driven modeling of radiofrequency, Ablation modeling										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
ELE 453	Biomedical Optical Microscopy	ELE 141	3	Lec.	Lab	Tut	Sum	SA	MT	PE/OE	Final
				2	2	1	5	10	30	20	40
Course Content	Fundamental background of tissue optics; Understanding of physics, strengths, and limitations of various existing bio-optical imaging technologies. Optical properties of tissue, and photon-tissue interactions. Monte Carlo simulation. Sensing of optical properties and spectroscopy. Ballistic imaging. Wide-field and dark-field microscopy. Polarization, phase contrast, and differential interference contract microscopy (DIC) microscopy. Fluorescence microscopy. Confocal microscopy. Two-photon microscopy. Optical coherence tomography. Super-resolution imaging										
References	Fundamentals of Light Microscopy and Electronic Imaging, Douglas B. Murphy, Wiley-Liss, ISBN: 0-471-25391-X										
Laboratory	Comsol simulation, Tissue optical characterization, Wide/dark Field power calculation, OCT model										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
ELE 454	Bioinstrumentation: Bio-signals and Biosensors	ELE 256	3	Lec.	Lab	Tut	Sum	SA	MT	PE/OE	Final
				2	2	1	5	10	30	20	40
Course Content	Measurement principles of sensors found in health technologies, ranging from medical devices used in hospitals to wearables for fitness monitoring. Bio-potential amplifiers, record and interpret bioelectrical data (e.g. heart activity, muscle activity). Principles underlying the instrumentation for measuring respiratory and cardiovascular function such as blood pressure, blood flow as well as biochemical sensors and neuro-stimulators.										
References	- Webster, Medical Instrumentation Application and Design, Wiley, 4th edition, 2009 - Schreiner, Bronzino, Peterson, Medical Instruments and Devices: Principles and Practices, CRC Press, 1st Edition, 2015										
Laboratory	- Instrumentation amplifier, ECG amplifier circuits and simulation - Ground loops., EEG , EMG - Blood pressure instrument - Respiratory measurements										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
ELE 455	Clinical Engineering Fundamentals	ELE 256	3	Lec.	Lab	Tut	Sum	SA	MT	PE/OE	Final
				2	2	1	5	10	30	20	40
Course Content	Equipment control concepts and techniques and their application in hospitals and in the medical profession; device evaluation specifications; codes & standards; preventive maintenance and service; calibration and medical product liability.										
References	- WORLD HEALTH ORGANIZATION, MEDICAL DEVICE REGULATIONS Global overview and guiding principles - P. Derrico, M. Ritrovato, F. Nocchi, Clinical Engineering - FDA Report on the Quality, Safety, and Effectiveness of Servicing of Medical Devices										
Laboratory	- Hospital design model - ICU design considerations - Hemodialysis unit design										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
ELE 456	Clinical Equipment Management	ELE 256	3	Lec.	Lab	Tut	Sum	SA	MT	PE/OE	Final
				2	2	1	5	10	30	20	40
Course Content	Structure within a Hospital: Clinical Departments, Administration and Accounting, Nursing, Information Handling, Support Services - Quality Control: Equipment Acquisition and Maintenance, Codes, Regulations and Standards -Biomedical Engineering Department: Interaction with Administration, Physicians, Nursing and Plant Services, Responsibilities, Equipment Specifications, Preventive-Maintenance and Maintenance, Equipment Calibration, Training -Clinical Engineering Program Functions, Structure, Personnel Facilities for Implementing a Program - Equipment Control Programs: Inventory Control, Hazard Control, Cost Control, Quality Assurance and Management - Equipment Acquisition: Clinical Requirements, Survey of Environment and Equipment, Specifications, Equipment Evaluation, Contracts, Requisition and Control of Acquisition Process - Medical Gases System Design.										
References	- Stuart Showalter, The Law of Healthcare Administration, Ninth Edition, National Safety and Quality Health Service Standards - Ronda G. Hughes.Tools and Strategies for Quality Improvement and Patient Safety										
Laboratory	- Hospital visit “biomedical department” - Design of medical gasses from real hospital - Egypt standard, FDA and CE - Interview with hospital management administration - Interview with biomedical device company management. - Review of actual medical devices contracts and tender process										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab	Tut	Sum	SA	MT	PE/OE	Final
ELE 457	Medical Instrumentation in the Hospital	ELE 256	3	2	2	1	5	10	30	20	40
Course Content	Basics of Therapeutic and Prosthetic Devices – Implementable Devices – Lithotripsy Types and Instrumentation – Artificial Kidney and Dialysis Machines – Heart-Lung Machines – Surgical Instrumentation – Electrical Safety in Medical Devices. Data Acquisition and Distribution System: Principles, Review of Sampling Theory, Analog to Digital Converters, Digital to Analog Converters, Sample and Hold Circuits, and Analog Multiplexers, Biomedical Measurements: Respiratory System Measurements (Air Flow and Flow Rate), Cardiac Measurements (Blood Flow, Blood Pressure and Cardiac Output). Ultrasound Imaging Instrumentation – X-Ray Instrumentation. Computed Imaging: CT, PET, and SPECT – Magnetic Resonance Imaging.										
References	- R. S. Khandpur, HANDBOOK OF BIOMEDICAL INSTRUMENTATION, 3rd Edition - Emilio, Data Acquisition Systems 2013th Edition - Signal Conditioning and Pc-Based Data Acquisition Handbook: A Reference on Analog and Digital Signal Conditioning for Pc-Based Data Acquisition" by Steve Lekas - Peter Hoskins BA, MSc, PhD, DSc, FIPEM, FInstP , Diagnostic Ultrasound Physics and Equipment - Handbook on calibration of radiation protection monitoring instruments. (=Technical reports series / International Atomic Energy Agency ; 133)										
Laboratory	- Understand the full functionality of digital Oscilloscope as an example - Data acquisition design board, lab test boards - Hands-on lab for blood pressure, spo2, icu, - Hands-on lab for respiratory system measurements. Air flow meter										

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab.	Tut.	Sum	St. Act.	Mids	Exp.	Final
ELE 458	Engineering Problems in the Hospital	ELE 256	3	2	2	1	5	10	30	20	40
Course Contents	Covers engineering solutions to problems that are found in the healthcare environment. Includes a wide variety of topics such as electrical power quality of and the reliable operation of high tech medical equipment, electrical safety in the patient care environment, electromagnetic compatibility of various medical devices and electromagnetic interference, radiation shielding and radiation protection, medical gas systems, medical ventilation systems and indoor air quality, fire protection systems required in the hospital, project management, functionality and design implications of emerging technologies, and hospital architecture and the design of patient care facilities.										
References	Clinical Engineering. A Handbook for Clinical and Biomedical Engineers, Academic Press Azzam Taktak, Paul Ganney, David Long and Paul White (Eds.), 2014										
Laboratory	1. Hospital Workflow Analysis Lab: 2. Medical Device Usability Lab: 3. Hospital Information Systems Lab: 4. Lean Six Sigma for Healthcare Lab: 5. Medical Instrumentation and Sensor Integration Lab: 6. Hospital Facility Design Lab:										

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab.	Tut.	Sum	St. Act.	Mids	Exp.	Final
ELE 459	Clinical Systems Engineering	ELE 256	3	2	2	1	5	10	30	20	40
Course Contents	Introduction to clinical Engineering – ethical issue related to clinical research – medical devices regulations & standard – hospital risk management – types of hospital hazards - Purchasing methods- technical specs – technical evaluation of offered equipment. Medical engineering processes and plans- Preventive maintenance plan and procedures.										
References	Clinical Engineering. A Handbook for Clinical and Biomedical Engineers, Academic Press Azzam Taktak, Paul Ganney, David Long and Paul White (Eds.), 2014										
Laboratory	1. Medical Device Integration Lab: Implement communication protocols (e.g., HL7, DICOM, IEEE 11073) for data exchange 2. Clinical Workflow Optimization Lab: 3. Biomedical Sensor Development Lab: 4. Medical Imaging and Visualization Lab: 5. Health Information Systems Integration Lab: 6. Privacy in Healthcare Lab:										

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab.	Tut.	Sum	St. Act.	Mids	Exp.	Final
ELE 460	Medical Device Cybersecurity	ELE 256	3	2	2	1	5	10	30	20	40
Course Contents	Introduction to cybersecurity primitives and algorithms. Key requirements for marketing medical device software, medical device software life cycle processes, vulnerabilities, Software Safety Classification. Cybersecurity requirements. Software life cycle process with cybersecurity. State-of-the-Art of Cybersecurity for IoT applied to medical industry. Threat Analysis and Risk Assessment (TARA). Demonstrating Confor										
References	Arnab Ray, 2021, Cybersecurity for Connected Medical Devices, Academic Press										
Laboratory	1. Vulnerability Assessment Lab: 2. Secure Communication Lab: 3. Access Control and Authentication Lab: 4. Incident Response and Forensics Lab: 5. Threat Modeling and Risk Assessment Lab: 6. Secure Software Development Lab:										

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab.	Tut.	Sum	St. Act.	Mids	Exp.	Final
ELE 461	Computer Applications in Bioengineering	ELE 143	3	2	2	1	5	10	30	20	40
Course Contents	LabVIEW programming is taught in the context of real-world tasks that engineering students will likely encounter in future academic or industrial work. Practical applications of signal processing tools and software design specification development are especially relevant. The fundamentals of LabVIEW, data flow programming concepts, programming with graphical user interfaces, modular programming structures, and data acquisition and control concepts are covered.										
References	Computer Applications in Engineering and Management, CRC Press, Taylor & Francis Group, 2022 Computer Applications in Engineering and Management, CRC Press, Taylor & Francis Group, 2022 Milos Kojic, Nenad Filipovic, Boban Stojanovic, Nikola Kojic, 2008, Computer modeling in bioengineering: theoretical background, examples and software, John Wiley & Sons Andreas Öchsner, Holm Altenbach (eds.), 2015, Applications of Computational Tools in Biosciences and Medical Engineering, Springer International Publishing										

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab.	Tut.	Sum	St. Act.	Mids	Exp.	Final
ELE 462	Biomedical Applications of Signal Processing	ELE 354	3	2	2	1	5	10	30	20	40
Course Contents	The fundamentals of digital signal processing of time series are developed, via applied exercises and projects with a focus on medical and biological signal analysis and interpretation. Biomedical applications are selected from a variety of areas, such as cardiovascular, gait and balance, electrophysiological (EEG, EKG, EOG, etc.) and neural signal processing, among others.										
References	Falk, Tiago H., Sejdic, Ervin, Signal processing and machine learning for biomedical big data, Taylor & Francis, 2018										

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab.	Tut.	Sum	St. Act.	Mids	Exp.	Final
ELE 464	Digital Communication Systems	ELE 352	3	2	2	1	5	10	30	20	40
Course Contents	Introduction of digital communication systems. Mathematical foundation of decomposing the systems into separately designed source codes and channel codes. Principles of commonly used algorithms to convert continuous time waveforms into bits, and vice versa. Comprehensive introduction to the basics of information theory, treatment of Fourier transforms and the sampling theorem, and an overview of the use of vector spaces in signal processing.										
References	• B. P. Lathi, Zhi Ding , "Modern Digital and Analog Communication Systems", Oxford University Press, 2009. • Krzysztof Wesolowski , "Introduction to Digital Communication Systems", John Wiley and Sons, 2009										
Laboratory	Amplitude Modulation (AM) and Demodulation, Frequency Modulation (FM) and Demodulation, Pulse Amplitude Modulation (PAM) and Demodulation, Fourier Transform and Signal Processing										

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab.	Tut.	Sum	St. Act.	Mids	Exp.	Final
ELE 465	Digital and Analog Filters Design	ELE 352	3	2	2	1	5	10	30	20	40
Course Contents	Analysis, design, and realization of digital filters. Discrete Fourier Transform algorithms, digital filter design procedures, coefficient quantization. Design of Infinite Impulse Response (IIR) digital filters by transformation from analog filters: Impulse Invariance, Bilinear Transformation. Design of Finite Impulse Response (FIR) digital filters by Windowing, Frequency Sampling. Computer Aided Design of FIR and IIR digital filters by Criterion Minimization. Implementation aspects: quantization of parameters, finite word length, and filter structure.										
References	• Les Thede, "Practical Analog And Digital Filter Design", Artech House Publishers, 2004. • Steve Winder, "Analog and Digital Filter Design" Second Edition, 2011										
Laboratory	Design of IIR Filters using Impulse Invariance and Bilinear Transformation, Design of FIR Filters using Windowing and Frequency Sampling, Computer-Aided Design of FIR and IIR Filters: Criterion Minimization, Implementation Aspects of Digital Filters: Quantization and Finite Word Length.										

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab.	Tut.	Sum	St. Act.	Mids	Exp.	Final
ELE 466	Vision Sensors	ELE 256	3	2	2	1	5	10	30	20	40
Course Contents	Fundamentals of vision cameras and other sensors. Mirror-based and solid-state devices (CCD, CMOS). Use of sensors and understand, model and deal with the uncertainty (noise) in measurements. Conventional "single viewpoint" or "perspective" cameras. Recent "multi-viewpoint" or "multi-perspective" cameras that includes a host of lenses and mirrors.										
References	Ling Shao, Jungong Han, Pushmeet Kohli, Zhengyou Zhang (eds.), 2014, Computer Vision and Machine Learning with RGB-D Sensors, Springer International Publishing. Kevin Ashley, 2020, Applied Machine Learning for Health and Fitness: A Practical Guide to Machine Learning with Deep Vision, Sensors and IoT A press.										
Laboratory	Camera Calibration and Lens Distortion Correction, Object Detection and Tracking, Depth Sensing with Stereo Vision, Multi-Viewpoint Imaging and 3D Scene Reconstruction										

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab.	Tut.	Sum	St. Act.	Mids	Exp.	Final
ELE 467	Advanced Random Signals and Information Technology	BES 114	3	2	2	1	5	10	30	20	40
Course Contents	Signal Analysis – Review of Probability Theory – Characterization of Random Signals – Transmission and Filtering of Random Signals – Analog Data Communication: Modulation – Digital Data Communication: Signal Detection – Introduction to Information Theory and Coding.										
References	Boaz Porat, 2008, Digital Processing of Random Signals: Theory and Methods										
Laboratory	Histogram and Probability Density Estimation, Autocorrelation Function Analysis, Power Spectral Density Estimation, Digital Modulation and Signal Detection.										

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab.	Tut.	Sum	St. Act.	Mids	Exp.	Final
ELE 468	Neural Networks in Medical Fields	BES 114	3	2	2	1	5	10	30	20	40
Course Contents	Brief Introduction to Neural Networks – Historical Background – How Neural Networks Work – How Neural Networks Learn – Linear Separability – Back propagation of Errors – Interpretation of Neural Network Results – Supervised Learning – Unsupervised Learning – Hybrid Models – Divide-and-Conquer in Neural Networks – Hierarchical Architectures – Bottom-up Hierarchical Architectures and Top-down Hierarchical Architectures. Application of Neural Networks for Medical Research: Applications in Clinical Medicine – Applications in Signal Processing and Interpretation – Applications in Image Processing – Evaluating Neural Network Applications in Medicine – Neural Networks as Diagnostic Tests – Hierarchical Neural Networks for Diagnosis.										
References	R. N. G. Naguib, G. V. Sherbet, 2001, Artificial Neural Networks in Cancer Diagnosis, Prognosis, and Patient Management (Biomedical Engineering), CRC Press										
Laboratory	1. Medical Image Analysis Lab: Implement convolutional neural networks (CNNs) for tasks such as image classification, segmentation, or detection 2. Apply CNNs to analyze medical images (e.g., X-rays, CT scans, MRI) for disease diagnosis or tissue identification 3. Predictive Modeling Lab: 4. Time Series Analysis Lab: Explore the use of recurrent neural networks (RNNs), such as LSTMs or GRUs, for analyzing time-series medical data 5. Clinical Decision Support Lab: 6. Medical Natural Language Processing Lab: 7. Generative Modeling Lab:										

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab.	Tut.	Sum	St. Act.	Mids	Exp.	Final
ELE 469	Quantum for Information and Encoding	BES 114	3	2	2	1	5	10	30	20	40
Course Contents	Quantum Theory for Information and Computation – Review of Classical Information Theory – Quantum Information Transmission through Noisy Channels – Classical Complex Theory Quantum of Complex Components – Efficient Quantum Algorithm – Correction Code for Error Quantum.										
References	Mark M. Wilde, 2017, Quantum Information Theory, 2nd Edition										
Laboratory	Qubit Manipulation, Quantum Arithmetic, Quantum Error Correction, Quantum Cryptography, Quantum Algorithm Design, Quantum Simulation.										

Code	Course Name	Pre-req.	CH	Ct. Hr.				Assessment			
				Lec	Lab	Tut	Sum	SA	MT	PE/OE	Final
ELE 471	High Voltage Engineering	ELE 272	3	2	0	2	4	30	30	0	40
Course Contents	Electric fields, Electrical breakdown in gases, solid materials and dielectric fluids, Corona discharge, Generation of high voltages and high currents, Measurement of high voltages and currents, Wave propagation over lines and equipment, Theory of travelling waves and standing waves, Electrical overvoltages, testing procedures and insulation coordination, Single and three-core cables, Electrical stresses in cables, Thermal properties of cables, Grounding systems.										
References	•Wadhwa, C. L., High voltage engineering, New Age International, 2006. •Kuffel, J. and Kuffel, E., High voltage engineering fundamentals, Elsevier, 2000. •Naidu, M. S., High voltage engineering, Tata McGraw-Hill Education, 2013. •Abdel Salam, M.; Anis, H.; El-Morshedy, A. and Radwan, R., High-voltage engineering: theory and practice, revised and expanded, CRC Press, 2018.										

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec	Lab	Tut	Sum	SA	MT	PE/OE	Final
ELE 472	Advanced Power Electronics	ELE 274	3	2	0	2	4	30	30	-	40
Course Contents	Advanced Switch Mode Power Converters: Cuk dc-dc converter, Full bridge dc-dc converter, Half-bridge converter Forward converter, Flyback converter, Push-pull converter, Resonant Converters: Introduction, classification of resonant converters, series and parallel resonant inverters, load resonant converters, resonant switch converters, zero voltage and zero current switching resonant converters, Multilevel Inverters: Concept, types of multilevel inverters, diode-clamped, flying-capacitor, and cascaded multilevel inverters, applications, comparison; FACTS: Principles of shunt and series compensation, compensators: TCR, TCS, SVC, TSSC, TCSC, UFC, comparison, Matrix converters: Basic principles and analysis, applications.										
References	•M. H. Rashid, “Power Electronics: Circuits, Device and Applications”, 2nd Ed. 1993, Prentice-Hall, Inc. •N. Mohan, T. M. Undeland, and W. P. Robbins, “Power Electronics: Converters, Application and Design”, 3rd. Ed., John Wiley, 2003 • A. M. Trzynadlowski, “Introduction to Modern Power Electronics” John Wiley, 1998.										

Code	Course Name	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec	Lab	Tut	Sum	SA	MT	PE/OE	Final
ELE 473	Electrical Power Quality	ELE 272	3	2	0	2	4	30	30	-	40
Course Contents	Brief review of various power quality (PQ) problems: Source of generation and their impacts on equipment and systems, need of monitoring, international power quality standards, Passive Filters: Control of harmonics using passive L-C filters, tuned and de-tuned filters, their design criterion and implementation, Active Power Filters: Power factor improvement, reactive power compensation, mitigation of harmonics and voltage sag compensation using active power filters. Study of various active power filters viz., static shunt compensators (STATCOM), dynamic voltage restorer (DVR), unified power quality conditioner (UPQC), etc. Suitability of type of active filters for mitigation of various power quality problems, Design of active power filters, various topologies and control schemes.										
References	• A. Ghosh and Gerard Ledwich 'Power Quality Enhancement Using Custom Power Devices (Power Electronics and Power Systems)', Springer; 2002. •S. Santoso, H. W. Beaty, R. C. Dugan, and M. F. McGranaghan, 'Electrical Power Systems Quality', McGraw-Hill Professional, 2002. • B33 M. H. Bollen 'Understanding Power Quality Problems: Voltage Sags and Interruptions', Wiley-IEEE Press, 1999. • N. G. Hingorani and L. Gyugy 'Understanding FACTS: Concepts and Technology of Flexible AC Transmission Systems', Wiley-IEEE Press, 1999.										

Code	Course Name	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec	Lab	Tut	Sum	SA	MT	PE/OE	Final
ELE 475	Industrial Instrumentation	ELE 132	3	2	0	2	4	30	30	-	40
Course Contents	Introduction to Instrumentation system; Static and Dynamic characteristics of Instrument; Pressure measurement: Elastic transducers (Bourdon Gauge, Bellow and Diaphragm Gauge); Temperature measurement: Thermocouple, Resistance Temperature Detector (RTD), Thermistor, Radiation Pyrometer; Flow and pressure measurements: Differential Pressure flow meter, Variable area flow meter, Variable reluctance transducer, Turbine flow meter, Ultrasonic flow meter (Both transit time and Doppler Shift), Electromagnetic flow meter and Mass flow meter; Measurement of level: Capacitance based and Float based method; Measurement of strain: Strain Gauge; Position sensor: Linear Variable Differential Transformer (LVDT), Synchro; Load and torque cell; pH probe and viscosity measurement; Piezoelectric sensors; Ultrasonic sensors; Pollution measurement; Smart sensors; Actuators and Control valves; Signal conditioning; Pneumatic and Hydraulic Instrumentation system.										
References	•D. Patranabis, 'Principles of Industrial Instrumentation', Tata Mcgraw-Hill, 2001. •W. C. Dunn, 'Fundamentals of Industrial Instrumentation and Process Control', Mcgraw-Hill, 2005. •N. A. Anderson, 'Instrumentation for process measurement and control', CRC press, 1998. •E. Doebelin 'Measurement Systems: Application and Design', Mcgraw-Hill, 2003.										

Code	Course Name	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec	Lab	Tut	Sum	SA	MT	PE/OE	Final
ELE 476	Power System Operation	ELE 371	3	2	0	2	4	30	30	-	40
Course Contents	Load Flow Studies in power systems, Network model formulation, Bus-Admittance Matrix, Gauss-Siedel, Newton Raphson and decoupled load flow studies, Line Flow and Losses, Load flow with power electronics control, AC-DC analysis; State estimation: static and dynamic. Optimal system operation: Optimal operation of generators on bus bar, optimal unit commitment, optimal generation scheduling, Unit commitment and Scheduling of Hydro thermal systems, Power system security: System state classification, security analysis, contingency analysis, sensitivity factors; State estimation of power system: LSQ, static state estimation and tracking state estimation of power systems, computational considerations, Reliability considerations in power system operation; Load forecasting : forecasting methodology, time series and Kalman filter based approach, long term load forecasting; Introduction to power system restructuring, deregulation and market operations.										
References	•D. P. Kothari, I J Nagrath 'Modern Power System Analysis', Tata McGraw-Hill Education, 2011. • H. Sadat 'Power system analysis', Tata Mcgraw Hill Education, 2002. • Grainmger and Stevenson 'Modern Power system Analysis', Tata McGraw-Hill Education, 1994. • L. L. Lai, 'Power System Restructuring and Deregulation: Trading, Performance and Information Technology', John Wiley & Sons, 2001.										

Code	Course Name	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec	Lab	Tut	Sum	SA	MT	PE/OE	Final
ELE 477	Advanced Power Systems	ELE 272	3	2	0	2	4	30	30	-	40
Course Contents	Load Flow Studies: Introduction, Network model formulation and Bus Impedance matrix, Power flow Equations, Gauss Siedel Power flow solution, Line-Flow and losses, Newton Raphson power flow solution, Fast decoupled power flow solution, Economic Dispatch of Generation: Non-linear function optimization: constrained parameter optimization, equality and inequality constraints, Operating cost of a thermal plant, Economic dispatch neglecting losses without and with generator limit, Economic dispatch including losses, Economic dispatch of Hydro-thermal system, Compensation in Power system: Loading capability, compensation, Flexible AC transmission systems, Shunt Compensators: SVC and STATCOM, Series Compensator: TCSC and SSSC, Combined series and shunt controller: UPFC, Comparison between STATCOM and SVC, Performance of FACTs devices. Power System Security & Reliability: System state classification, security analysis, contingency analysis, sensitivity factors. Basic reliability concepts, reliability function, Reliability models generating capacity, loss of load and loss of energy indices, Transmission systems reliability evaluation.										
References	•H. Sadat, "Power System Analysis", TATA-McGraw Hill Edition. •G. Grainger and W. D. Stevenson, Jr. "Power System Analysis", TATA- McGraw Hill Edition. •Roy Billinton, "Reliability Evaluation of Power Systems", Advanced Publications.										

Code	Course Name	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec	Lab	Tut	Sum	SA	MT	PE/OE	Final
ELE 478	Smart Grid Technology	ELE 373	3	2	0	2	4	30	30	-	40
Course Contents	Review of basic elements of electrical power systems, desirable traits of a modern grid, principal characteristics of the smart grid, key technology areas; Smart grid communication: Two way digital communication paradigm, network architectures, IP-based systems, Power line communications, advanced metering infrastructure; Renewable Generation: Renewable Resources: Wind and Solar, Microgrid Architecture, Tackling Intermittency, Distributed Storage and Reserves; Wide Area Measurement: Sensor Networks, Phasor Measurement Units, Communications Infrastructure, Fault Detection and Self-Healing Systems, Application and Challenges; Security and Privacy: Cyber Security Challenges in Smart Grid, Defense Mechanism, Privacy Challenges.										
References	•J. Momoh 'Smart Grid: Fundamentals of Design and Analysis' Wiley-IEEE Press, 2012. •P. F. Schewe 'The Grid: A Journey through the Heart of our Electrified World' Joseph Henry Press, 2006.										

Code	Course Name	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec	Lab	Tut	Sum	SA	MT	PE/OE	Final
ELE 479	HVDC and Flexible AC Transimission Systems	ELE 274	3	2	0	2	4	30	30	-	40
Course Contents	Description and application of HVDC transmission, DC System components and their functions, Converter configuration, Principles of DC Link control and Converter control characteristics, Firing angle, Current and extinction angle control, DC link power control, Reactive power control and VAR sources, MTDC system types; Power flow in AC Systems, Definition of FACTS, Constraints of maximum transmission line loading. Benefits of FACTS, Uncompensated line, shunt and series compensation, Phase angle control. SVC and STATCOM, Operation and Control of TSC, TRC and STATCOM, Compensator Control; TSSC, SSSC, Static voltage and phase angle regulators TCVR and TCPAR. Operation and Control applications, Unified Power Flow Controller, Circuit Arrangement, Basic Principle of P and Q Control, independent real and reactive power flow control, Applications; Introduction to interline power flow controller, Compensation Devices, STS, SSC, SVR, Backup energy supply devices, Special purpose FACTS controllers, Thyristor controlled voltage limiter and voltage regulator, Thyristor controlled braking resistor and current limiter.										
References	• N.G Hingorani, L. Gyugyi, "Understanding FACTS: Concepts and Technology of Flexible AC Transmission Systems", IEEE Press Book, Standard Publishers and Distributors, Delhi, 2001. Padiyar K.R., "HVDC Power Transmission System", Wiely Eastern PVT Limited.										

Code	Course Name	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec	Lab	Tut	Sum	SA	MT	PE/OE	Final
ELE 480	Grid Integration of Renewable Energy Systems	ELE 373	3	2	0	2	4	30	30	-	40
Course Contents	Control of frequency and voltage of distributed generation in Stand-alone and Grid-connected mode, use of energy storage and power electronics interfaces for the connection to grid and loads. Design and optimization of size of renewable sources and storages. Concept of microgrid, operation of microgrid in grid-connected as well as isolated mode, power quality problems and fault-ride through capability of microgrid. Integration of large capacity renewable sources to grid: Operation and control, present trends, challenges, future technological needs viz., advanced characteristics of renewable energy generating units and plants, improved flexibility in conventional generation, transmission technology.										
References	• M. J. Bollen, F. Hassan 'Integration of Distributed Generation in the Power System', IEEE Press, 2011. • S. Heier and R. Waddington 'Grid Intergration of Wind Energy Conversion Systems', Wiley, 2006. • L. Lei Lai and T. Fun Chan 'Distributed Generation: Induction and Permanent Magnet Generators', Wiley-IEEE Press, 2007.										

Code	Course Name	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec	Lab	Tut	Sum	SA	MT	PE/OE	Final
ELE 481	Switchgear Engineering and substations	ELE 272	3	2	0	2	4	30	30	-	40
Course Contents	Switchgear equipment, Main switchgear schemes, Circuit Interrupters: Fuses: Types and Applications, Circuit breakers: Types (Air, Air-blast, Oil, SF6 and Vacuum), Construction, Performance and ratings, Interruption of fault currents and arcs in circuit breakers. Switching transients and their control.Functions of substation. Voltage levels in HVAC and HVDC substations. Types and essential features of substations. Substation equipment, Substation layout, Busbar schemes, Busbar materials and ratings, Busbar clamp and connectors, Substation structure, Insulators and surge arresters. Protective systems in substations. Clearances and creepage distance, power line carrier. Substation earthing system. Special requirement of EHVAC and HVDC substations, Testing and commissioning at site, Protection, monitoring and control by microprocessors and computers.										
References	1. BAKSHI, Uday A.; BAKSHI, Mayuresh V. Switchgear & Protection. Technical Publications, 2020. 2. RAVINDRANATH, B.; CHANDER, M. Power system protection and switchgear. New Age International, 1977. 3. STEWART, Stan. Distribution switchgear. IET, 2004. 4. RAM, Badri. Power system protection and switchgear. Tata McGraw-Hill Education, 2011.										

Code	Course Name	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec	Lab	Tut	Sum	SA	MT	PE/OE	Final
ELE 482	Advanced Electric Machines	ELE 278	3	2	0	2	4	30	30	-	40
Course Contents	Analysis of electrical machines using reference frame theory; two axial-model; Transient models and behaviors of DC, Induction machines and synchronous machines, wind generators, self-excited induction generators, doubly fed induction generators, permanent magnet synchronous generators, field-oriented control, and direct torque control techniques. Simulation of different types of electric machines										
References	1. D. P. Kothari and I. J. Nagrth, Electric machines, 4th edition, 2010. 2. Chee-MUN ONJ, Dynamic simulation of electric machinery using Matlab/Simulink, 1998. 3. J. F. Gieras , Advancements in electric machines										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab	Tut	Sum	SA	MT	PE/OE	Final
ELE 483	Power Electronics	ELE 213	3	2	2	1	5	10	30	20	40
Course Content	Introduction; Overview of power semiconductor devices, characteristics. Diode (Uncontrolled) rectifiers. Controlled AC-DC rectifiers. Non-Isolated and isolated DC - DC converters, Control issues. DC - AC Converters (Inverters). Device losses and thermal design. Computer simulation of the given topics										
References	• R. Erickson and W. Maksimovic, "Fundamentals of Power Electronics", 3rd edition, Springer, 2020, ISBN No. 978-3-030-43881-4. • Mohan, Undeland, Robbins: "Power Electronics: Converters, Applications and Design." 3rd Edition. John Wiley & Sons, 2003. Lecture notes.										
Laboratory	• Buck DC-DC Converter • Boost DC-DC Converter • Single-phase Inverter • Three-phase inverter • Switching Characteristics: Diodes, MOSFETs and IGBTs										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab	Tut	Sum	SA	MT	PE/OE	Final
ELE 484	Special Electric Machines	ELE 276	3	2	2	1	5	10	30	20	40
Course Content	Construction, principle of operation, control and performance of stepping motors. Construction, principle of operation, control and performance of switched reluctance motors. Construction, principle of operation, control and performance of permanent magnet brushless D.C. motors. Construction, principle of operation and performance of permanent magnet synchronous motors.										
References	• Janardanan, E. G. “Special Electrical Machines”. PHI Learning Pvt. Ltd., 2014. • K. Venkataratnam, “Special Electrical Machines”, Universities Press (India) Private Limited, 2019. • Ratnam, K. Venkata. "Special Electrical Machine”, 2008.										
Laboratory	• Experimental setup of hybrid stepper motor. • Speed control of brushless D.C motors. • Control of Switched Reluctance Motor. • Experimental setup of permanent Magnet Synchronous Machine.										

Code	Course Name	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec	Lab	Tut	Sum	SA	MT	PE/OE	Final
ELE 485	Electrical Installations and Energy Utilization	ELE 376	3	2	0	2	4	30	30	-	40
Course Contents	Codes and standards of electrical installations, Installation of electrical components, Electrical hazards, Inspection and testing, Electrical maintenance, Earth leakage detection, Installation planning, Electromagnetic field compatibility, Illumination technologies, Industrial heating; Conduction, Convection, Forced Convection and radiation, resistance, arc, dielectric, induction, H.F eddy current heating. Ventilation.										
References	1. LINSLEY, Trevor. Basic electrical installation work. Routledge, 2013. 2. NEIDLE, Michael. Electrical installation technology. Elsevier, 2016. 3. DONNELLY, Eugene Lawrence. Electrical installation: Theory and practice. Nelson Thornes, 2014. 4. ATKINSON, Bill; LOVEGROVE, Roger; GUNDRY, Gary. Electrical Installation Designs. John Wiley & Sons, 2012.										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab	Tut	Sum	SA	MT	PE/ OE	Final
ELE 491	Senior Design Project II	ELE 392	3	1	4	0	5	50	-	50	--
Course Content	The second design experience course for the students. The students build\implement\ fabricate their design. They test and evaluate their design against the design specification. The students are asked to demonstrate a functional project to the discussion committee, make an oral presentation and deliver their final report that documents the project										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab	Tut	Sum	SA	MT	PE/O E	Final
ELE 3118	Digital Electronics	ELE 213	3	2	2	1	5	10	30	20	40
Course Content	Analysis of CMOS digital circuits: The CMOS logic gates (inverter, NAND, NOR, XOR, compound gates) - CMOS inverter and its dynamic operation - Delay (Timing optimization, delay models) - Effect of transistor sizing - Power dissipation (static and dynamics) - Digital Ices technologies and logic circuits families - NMOS, dynamic, bipolar logic circuits- Sequential circuit design (delay constraint, clock skew) CMOS implementation of Latches and flip-flop - semiconductor memories - Random access memory both SRAM and DRAM - Read only Memory. CMOS Fabrication process technology and Layout										
References	• David Money Harris, Neil Weste, "CMOS VLSI Design: A Circuits and Systems Perspective", 4th Edition, Pearson, 2011 • Jacob Baker, CMOS Circuit Design, Layout, and Simulation, 3rd Edition, Institute of Electrical and Electronics Engineers, 2010. • H. Kaeslin, “Top-Down Digital VLSI Design”, 2015										
Laboratory	PSPICE and HSPICE simulation for the course topics										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab	Tut	Sum	SA	MT	PE/OE	Final
ELE 3302	Robotics	ELE 232, ELE 245	ELE 3302	2	2	1	5	10	30	20	40
Course Content	Rigid Motions and Homogeneous Transformations, forward(configuration) Kinematics, Inverse Kinematics, Velocity Kinematics, Jacobian, Singularities, and Manipulability, Path planning, Trajectory Planning, Euler-Lagrange Method, Newton-Euler Formulation.										
References	Mark W. Spong, "Robot Modeling and Control", 2nd Edition, Wiley, 2020, ISBN-13: 978-1119523994										
Laboratory	Using MATLAB Robotics toolbox: • Rigid Motions and Homogeneous Transformations using MATLAB command • Get forward kinematics for Common serial robotics configuration • Get Jacobian and inverse Jacobian for Common serial robotics configuration • Trajectory generation using Robotics toolbox (half circle, straight line, quintic polynomial) In the sense of project-based learning, each student should submit a complete project that cover most of the intended outcomes										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab	Tut	Sum	SA	MT	PE/OE	Final
ELE 3304	Intelligent Control	ELE 232	3	2	2	1	5	10	30	20	40
Course Content	Concept of Artificial Intelligence. Foundations of Fuzzy Logic. Foundations of Fuzzy Control. Types of Fuzzy Controllers. Fuzzy Logic Toolbox. Creation of Fuzzy Inference System with Fuzzy Logic Toolbox. Creation of Fuzzy Controllers. Neural Networks. Neuron Model. Perceptron Model. Modeling of Basic Logic Functions using the Perceptron. Feedforward Neural Network with Backpropagation Error. Approximation of Functions by a Two-layer Feedforward Neural Network. Creation of a Neural Networks with Neural Network Toolbox.										
References	• Jinkun Liu, "Intelligent Control Design and MATLAB Simulation", Springer, 2018. • Li Xin Wang, 'A Course in Fuzzy Systems and Control,' 1st Edition, Pearson, 1997 • J. M. Zurada, 'Introduction to Artificial Neural Systems,' 1st edition, 1992. • Thrishantha Nanayakkara, Ferat Sahin, "Intelligent Control Systems with an Introduction to System of Systems Engineering ", CRC Press, 2009, ISBN-13: 978-1420079241										
Laboratory	• Fuzzy Logic toolbox in MATLAB • Neural network toolbox in MATLAB										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab	Tut	Sum	SA	MT	PE/OE	Final
ELE 3306	Modelling and Simulation	ELE 245	3	2	2	1	5	10	30	20	40
Course Content	Basic Concepts of Modeling. Two magnetically coupled coils. Reference Frame Theory. Small Signal Modeling. Modeling of Induction machines. Modeling of Synchronous Machine. Dynamic Analysis of Synchronous Machine.										
References	• Ahmed Masmoudi, "Control Oriented Modelling of AC Electric Machines", Springer, 2018. • Asif Mahmood Mughal, "Real Time Modeling, Simulation and Control of Dynamical Systems", Springer, 2016. • R. Krishnan, "Electric Motor Drives - Modeling, Analysis& control", Pearson Publications, First edition, 2002. • P.C. Krause, Oleg Wasynczuk, Scott D. Sudhoff, "Analysis of Electrical Machinery and Drive systems", 2nd Edition, IEEE Press, 2002.										
Laboratory	MATLAB/SIMULINK lab for • two magnetically coupled coils • three phase induction machines • three phase Synchronous machines • DC machines										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab	Tut	Sum	SA	MT	PE/OE	Final
ELE 3308	System Identification and Parameter Estimation	ELE 231	3	3	2	1	5	10	30	20	40
Course Content	Introduction to Estimation theory. Parameter estimation (online and offline). Minimum variance unbiased Estimation. Cramer- Rao lower bound. Linear estimators. Maximum likelihood. Least squares estimation. The method of moments. Bayesian Methods. Extension to Complex Data. Linear Kalman Filtering. Extended Kalman Filter.										
References	• Steven M. Kay, "Fundamentals of Statistical Signal Processing:Practical Algorithm Development", Pearson College Div, 2013, ISBN 13: 978-0132808033 • P. R. Kumar, Pravin Varaiya, "Stochastic Systems: Estimation, Identification, and Adaptive Control ", Society for Industrial and Applied Mathematics, 2016.										
Laboratory	• Computer labs with MATLAB. • State space Representation in MATLAB • Kalman Filters in MATLAB										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab	Tut	Sum	SA	MT	PE/OE	Final
ELE 3402	Advanced Topics in Computer Networks	ELE 246	3	2	2	1	5	10	30	20	40
Course Content	Spanning Tree Protocol(STP) - Spanning tree enhancements - PortFast technology - virtual LANs (VLANs) - 802.1Q Native VLAN - Dynamic trunking protocol - Implement VLAN trunking protocol - Implement Inter-VLAN Routing - Per VLAN Spanning Tree (PVST+) - IPv4 Static Routing - Dynamic Routing Protocols - Distance Vector Routing Protocols (RIP V1, RIP V2) - Network management: goals, standards, protocols including SNMP (v1,2,3), Remote Monitoring - Network Automation (Telnet Python Automation on Routers) - Network Programming (Sockets, IPv4, and Simple Client/Server Programming) - Software Defined Networking (SDN) - Wireless and Mobile Networks: (Wi-Fi, WiMAX, LTE Wireless LAN)										
References	• A.S. Tanenbaum, “Computer Networks”, 6th Edition, Pearson Education, 2021. • James F. Kurose, Keith W. Ross, "Computer Networking a Top-Down Approach", Pearson, 8th edition, 2021, ISBN-13: 978-0-13-285620-1 • Peter L Dordal, "An Introduction to Computer Networks", 2020 available in: https://intronetworks.cs.luc.edu/current2/html/ • PradeebanKathiravelu, Dr. M. O. FaruqueSarker, "Python Network Programming Cookbook", Packt Publishing, 2nd edition, 2017, ISBN 978-1-78646-399-9 • "'CCNP Enterprise Advanced Routing ENARSI 300-410 Official Cert Guide", Raymond Lacoste, Brad Edgeworth, 2020, ISBN-13: 978-1-58714-525-4, Published by: Cisco Press										
Laboratory	• Implementing Spanning Tree Protocol • Implementing VLANS • Inter-VLAN Routing • Static Route Configuration • RIP Configuration • Virtualization & VMware Installation & Windows Server 2019 Installation & Windows 10 Installation - Active Directory • Join Domain & Create Domain Users & User Automation • Remote access on server & NTFS Permissions &Sharing Permissions • DHCP server & DNS server on Windows Server • Telnet Python Automation on Cisco Routers • Network Simulation Tools (ex. Mininet, Omnet) • Preparing network for practical implementation SDN (Software Defined Network) • Configuring Wireless LAN Access										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab	Tut	Sum	SA	MT	PE/OE	Final
ELE 3404	Computer and Network Security	ELE 246	3	2	2	1	5	10	30	20	40
Course Content	Networking Security Concepts: (Attacks - Mitigation Techniques- Vulnerability - Threats - Risk - Exposure) - Cryptographic Technologies: Symmetric key, public key- DHCP Starvation Attack - DHCP Spoofing Attack - Mitigating DHCP Attacks - MAC Spoofing Attack - MAC Flood Attack - Switch Port Security - IP Spoofing Attack - IP Source Guard - ARP Spoofing Attack - Dynamic ARP Inspection - Mitigating STP Attacks - VLAN Switch spoofing Attack - VLAN Double Tagging Attack- Mitigating VLAN Attacks - Securing Routing Protocols - RIPv2 Authentication Keychain - Securing Devices Access - Secure Shell (SSH) - Securing wireless LAN - Router Password Recovery - Backup and Restore Configuration Files - Understanding Firewall Fundamentals										
References	• William Stallings, “Cryptography and Network Security: Principles and Practice”, 6th Edition, Pearson, 2013, ISBN-13: 978-0133354690 • James F. Kurose, Keith W. Ross, "Computer Networking a Top-Down Approach", Pearson, 8th edition, 2021, ISBN-13: 978-0-13-285620-1 • Jose Manuel Ortega, "Mastering Python for Networking and Security", Packt Publishing, 2018, ISBN-13: 978-1788992510 • "'CCNP and CCIE Security Core SCOR 350-701 Official Cert Guide", Omar Santos, 2020, ISBN: 9780135971833, Published by: Cisco Press • "'CCNA Security 210-260 Official Cert Guide", Omar Santos, John Stuppi, 2015, ISBN-13: 978-1-58720-566-8, Published by: Cisco Press										
Laboratory	• Installing Wireshark & Installing Kali Linux • DHCP Starvation Attack using Kali Linux • Mitigating DHCP Attacks (Configure DHCP Snooping on real Cisco Switches) • MAC Flood ATTACK On Kali Linux • configure port-security on real Cisco Switch • IP Source Guard & Integration Between IP Source Guard & Port Security on real Cisco Switch • Detect Fake packets from attackers & Detect ARP Spoof Attack by Duplicate Address Filter • Configuring Dynamic ARP Inspection on real Cisco Switch • Configuring Root Guard &Configuring BDPU Guard • RIPv2 Authentication Keychain • Securing Devices Access & Configure SSH • HTTP Protocol Sniffing & Sniffing File Transfer Protocol & Sniffing Email Protocols • Wireless security & python security (port scanner - network scanner - network sniffer)										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab	Tut	Sum	SA	MT	PE/OE	Final
ELE 3406	Software Engineering	ELE 144	3	2	2	1	5	10	30	20	40
Course Content	The principles and theory of programming-in-the-large. The phases of software development, requirements development, software design software coding, and module testing, and software verification and validation - Documents, rapid phototyping, top down, bottom up, successive refinement, functional and data abstraction. - Black and white box testing methods. Software quality. Hierarchical and democratic term organization structures and the effects of personalizing and group dynamics.										
References	• David Farley, “Modern Software Engineering”, Addison-Wesley Professional, 2021. • Rajib Mall, “Fundamentals of Software Engineering”, 4th Edition, PHI Learning, 2014 • Ian Sommerville, “Software Engineering”, 10th edition, Pearson, 2015, ISBN-13: 978-013703515										
Laboratory	Phases of the software development life cycle: • Identify the Requirements and prepare the problem statement • Analysis and design • Implementation, testing (Integration testing, Performance testing, regression testing, metrics) • Delivery, and maintenance • The Git environment										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab	Tut	Sum	SA	MT	PE/OE	Final
ELE 3408	Data Analytics	BES 211	3	2	2	1	5	10	30	20	40
Course Content	Project-based course focused on exploring and understanding how data are collected, represented, and stored, and computed/analyzed upon to arrive at appropriate and meaningful interpretation (gathering and wrangling the data), the ETL process - Set of algorithms for data analytics which include: hashing, indexes, caching; algorithms for structured datasets; streaming data modes; clustering algorithms; and case studies. Introduction to data mining: Concepts, techniques, and systems of data warehousing and data mining. Data visualization tools										
References	• Anil K. Maheshwari, "Data Analytics Made Accessible", 2021 • Mr Benjamin Smith, “DATA ANALYTICS: A Comprehensive Beginner’s Guide to Learn About the Realms Of Data Analytics From A-Z”, 2020, ISBN-13: 979-8640455267										
Laboratory	• Descriptive Statistics • Reading and writing different datasets • Visualization • Correlation and Covariance • Using Hadoop for Big data										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
ELE 3410	Web Engineering	ELE 143	3	Lec.	Lab	Tut	Sum	SA	MT	PE/OE	Final
				2	2	1	5	10	30	20	40
Course Content	Web developing basics - Website structure and hosting - HTML basics - HTML linking - HTML Forms- JavaScript programming - website with styles: CSS properties - Media specific styles - Layout Methods - Web design with Bootstrap - Typography - React - Database Integration - PHP Hypertext Processor - data interchange languages (JSON/XML)										
References	• Terry Felke-Morris, "Basics of Web Design: HTML5 & CSS3", Pearson, 3rd edition, 2016, ISBN-13: 978-0133970746 • Marty Stepp, Jessica Miller, and Victoria Kirst, "Web Programming Step by Step", LULU ENTERPRISES, 2nd Edition, 2012, ISBN13: 9781105578786 • Jon Ducket, "HTML and CSS: Design and Build Websites", Willey, 2011, ISBN: 978-1-118-00818-8 • Jon Ducket, "JavaScript and JQuery: Interactive Front-End Web Development", Willey, 2014, ISBN: 978-1-118-53164-8										
Laboratory	• Git Environment, Design using HTML, Design using CSS, Program using JavaScript, JSON/XML, Web Application										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
ELE 3412	Fault-Tolerant Computing	ELE 242, BES 211	3	Lec.	Lab	Tut	Sum	SA	MT	PE/OE	Final
				2	2	1	5	10	30	20	40
Course Content	Introduction to fault tolerant systems - Fault Models - Stuck-at Faults - Error Detection - Fault Tolerant Design Techniques Based on Hardware Redundancy, software, information Redundancy - Measures of Fault Tolerance and Reliability– Case Studies										
References	• Shooman, Martin, "Reliability of Computer Systems and Networks: Fault Tolerance, Analysis, and Design", Wiley Interscience, 2002. ISBN 9780471293422 • Israel Koren C. Mani Krishna, "Fault-Tolerant Systems" 2nd Edition, Morgan Kaufmann, 2020, ISBN: 9780128181058. • Parag K. Lala, "Fault Tolerant & Fault Testable Hardware Design", 2020, BSP Books, ISBN: 9789386819062										
Laboratory	Project based laboratory where the student along with the course will: • Design and implement a system • Apply Fault Tolerant Techniques to the system • implement fault injection techniques • Test and verify the design reliability										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
ELE 3414	Cloud Computing	ELE 246	3	Lec.	Lab	Tut	Sum	SA	MT	PE/OE	Final
				2	2	1	5	10	30	20	40
Course Content	Essential characteristics of cloud computing, the evolution of cloud computing, the emerging technologies supported by cloud, the different types of service and deployment models- Infrastructure-as-a-Service (IaaS), Platform-as-a-Service (PaaS), and Software-as-a-Service (SaaS). the three main deployment models available on the cloud—Public, Private, and Hybrid. various components of a cloud computing architecture: virtualization virtual machines, bare metal servers, and the difference between virtual machines and bare metal servers. the emergent trends in cloud computing: Hybrid Multi-cloud, Serverless Computing, and Microservices. Cloud Security and Monitoring.										
References	• Anand Nayyar , "Handbook of Cloud Computing", BPB Publication, 2019 • Lizhe Wang, Rajiv Ranjan, Jinjun Chen, Boualem Benatallah , "Cloud Computing", 2017										
Laboratory	• Building a Cloud using OwnCloud and WAMPServer • Transferring Cloud Data Using Secure Channel • Harvesting Cloud Credientials by Exploiting Java Vulnerability • Performing Cloud Vulnerability Assessment Using Mobile-Based Security Scanner										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
ELE 4111	Satellite Communication	ELE 312	3	Lec.	Lab	Tut	Sum	SA	MT	PE/OE	Final
				2	2	1	5	10	30	20	40
Course Content	Orbital Mechanics and Launchers, Satellites, Satellite Link Design, Modulation and Multiplexing Techniques for Satellite Links, Multiple Access Techniques, Error Control for Digital Satellite Links, Propagation Effects and their Impact on Satellite–Earth Links, VSAT SYSTEMS, Low Earth Orbit and Non-Geostationary Satellite Systems, Direct Broadcast Satellite Television and Radio, Satellite Navigation and the Global Positioning System.										
References	• Timothy Pratt, Charles W. Bostian and Jeremy E. Allnutt, Satellite Communications, John Wiley & Sons, second edition, 2003										
Laboratory	• Set up a Satellite Communication Link. • Study the generation of a Frequency Hopping Spread Spectrum Modulated signal. • To study radiation pattern & calculate beam width for Yagi uda& folded dipole antenna. • To study radiation pattern & calculate beam width for circular & triangular patch antenna. • To study GPS data like longitude, latitude using GPS receiver • Study of Minimum Shift Keying (MSK) Modulation and de-modulation Process										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab	Tut	Sum	SA	MT	PE/OE	Final
ELE 4112	Cellular Communication	ELE 312	3	2	2	1	5	10	30	20	40
Course Content	Elements of cellular radio system design, Different Specifications of world's cellular systems, Cell Coverage for Signal and Traffic, Cell-Site Antennas and Mobile Antenna. Co-channel Interference reduction, Frequency Management and Channel Assignment, Handoffs, Switching and Traffic, Data Links and Microwaves, Spectrum Efficiency Evaluation.										
References	• William C. Y. Lee, "Mobile Cellular Telecommunications Systems", McGraw-Hill Inc.										
Laboratory	• To study and analyze the behavior of the PSTN TST switch on Trainer kit. • To study and analyze the behavior of the CDMA Trainer kit designed to provide experimental knowledge of CDMA Direct Sequence Spread Spectrum Modulation/Demodulation technique. • To study and analyze the Mobile phone on its trainer kit. • To study and analyze the behavior of 3G network using cellular phone on the 3G mobile trainer kit. • To study and use the AT commands using GSM trainer kit to make voice call and send messages. • To study the VoIP implementation on VOIP Trainer kit.										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab	Tut	Sum	SA	MT	PE/OE	Final
ELE 4121	Antenna Theory and Wave Propagation II	ELE 316	3	2	2	1	5	10	30	20	40
Course Content	Aperture antennas. Horn antennas. Microstrip antennas. Parabolic antennas. Reflect array antennas. Base-station antennas. Propagation effects.										
References	• Antenna Theory, Wiley, 3th edition, C. Balanis. • Antenna Theory and Design, Wiley,2nd Edition, Warren L. Stutzman, Gary A. Thiele.										
Laboratory	• Aperture Antennas. • Horn Antennas. • The Rectangular Patch Antenna. • Microstrip Planar Array Antennas. • Parabolic Antennas. • Antenna Pattern Plotting.										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab	Tut	Sum	SA	MT	PE/OE	Final
ELE 4122	Microwave Circuits and Devices	ELE 316	3	2	2	1	5	10	30	20	40
Course Content	Electromagnetic and plane waves review, rectangular and cylindrical waveguides, Microstrip and strip line, Microwave Network analysis (Z, Y, S, ABCD matrices), Microwave resonators (cavities, dielectric), Misc. components (attenuators, terminations), Microwave Filters LPF and BPF, Active Microwave elements.										
References	• Microwave Engineering, David M.Pozar, Wiley, 4th edition.										
Laboratory	• Microstrip Impedance calculations. Microwave Network by Matlab. • Microstrip Coupler. Microstrip LPF. Microstrip BPF.										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab	Tut	Sum	SA	MT	PE/OE	Final
ELE 4131	Forward Error Correction Codes	ELE 313	3	2	2	0	4	10	30	20	40
Course Content	Cyclic Codes, Encoding of Cyclic Codes, Decoding of cyclic Codes, Shortened Cyclic Codes, Binary BCH Codes, Decoding of BCH codes, RS Codes, Majority-Logic decodable and finite geometry codes, Convolutional Code, Viterbi decoder, Soft-output Viterbi algorithm, BCJR algorithm, Turbo-codes, LDPC codes, Reliability based soft-decision decoding algorithm for linear block codes.										
References	• Simon Haykin, Communication Systems, Wiley, 4th edition • Shu Lin, Daniel Castello, Error Control Coding, Pearson, 2nd edition										
Laboratory	• Simulation of the encoder and decoder of cyclic code. • Simulation of the encoder and decoder of BCH code. • Simulation of the encoder and decoder of RS code. • Simulation of the encoder of Convolutional code. • Simulation of the Viterbi decoder. • Simulation of the soft-output Viterbi decoder. • Simulation of the BCJR decoder. • Simulation of LDPC decoder.										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab	Tut	Sum	SA	MT	PE/OE	Final
ELE 4151	Digital Signal Processing II	ELE 314	3	2	2	0	4	10	30	20	40
Course Content	course covers advanced topics of DSP that provide the student solid theoretical and practical understanding of: system solution with initial conditions using UZT, multi-rate signal processing, quadrature-mirror filters, LTI system analysis, advanced filter design and spectral analysis.										
References	• Discrete-Time Signal Processing, Oppenhiem, Schafer Pearson, 3rd edition • Digital Signal Processing: Principles, Algorithms and Applications, J. Proakis, D. Manolakis, Prentice-Hall, 2006 (4-th edition) • Applied Digital Signal Processing, Theory and Practice. Dimitris G. Manolakis, Vinay K. Ingle, Cambridge University Press, 1st edition.										
Laboratory	• Discrete-Time Convolution using MATLAB. • Sample rate conversion of audio files using MATLAB. • Design of IIR and FIR digital filters using "Filter Design and Analysis" tool of MATLAB. Evaluation of finite-word precision on filter response and stability. • DTMF Generation and Detection using IFFT and FFT. • Project: Voice Compression using double-band multi-rate Quadrature Mirror Filters.										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab	Tut	Sum	SA	MT	PE/OE	Final
ELE 4152	Detection and Estimation Theory	ELE 311	3	2	2	0	4	10	30	20	40
Course Content	Fundamentals of detection theory, Single sample detection of binary hypotheses, Bays criterion, Minimax criterion, Neyman-Pearson criterion, Receiver operating characteristics, Multiple sample detection of binary hypotheses, Fundamentals of estimation theory, relation between detection and estimation theory, Types of estimation problems, Properties of estimators, Bayes estimation, Maximum-likelihood estimation, Cramer-Rao inequality.										
References	• Harry L. Van Trees, Detection, Estimation, and Modulation Theory, Part I. • Thomas A. Schonhoff, Detection and Estimation Theory and its Applications, Pearson Prentice Hall, 2006										
Laboratory	• Simulation of M-ary PSK receiver. • Simulation of M-ary FSK receiver. • Frequency offset estimation in digital receivers. • Symbol time estimation in digital receivers. • Simulation of Radar transmitter and receiver.										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab	Tut	Sum	SA	MT	PE/OE	Final
ELE 4301	Advanced Robotics	ELE 3302	3	2	2	1	5	10	30	20	40
Course Content	Introduction to parallel robots, Flying robots (construction, dynamic, and control), Mobile robotics (construction, dynamic, and control), Static force and compliance, trajectory planning, robot control, robot sensing. Environmental perception applying sensors and computer vision										
References	• Siciliano, Bruno, Khatib, Oussama, "Springer Handbook of Robotics", (Eds.),2016 • Mark W. Spong, "Robot Modeling and Control", 2nd Edition, Wiley, 2020, ISBN-13: 978-1119523994										
Laboratory	Using MATLAB Robotics toolbox: • use MATLAB Robotics toolbox for flying robot modeling and control • use MATLAB Robotics toolbox for mobile robot modeling and control • Trajectory generation for prespecified tasks (case study) • Getting start with computer vision in robotics field. In the sense of project-based learning, each student should submit a complete project that cover most of the intended outcomes										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab	Tut	Sum	SA	MT	PE/OE	Final
ELE 4303	Autonomous Systems	ELE 3302	3	2	2	1	5	10	30	20	40
Course Content	This course introduces autonomous systems including the architecture of autonomous systems. The Basics of Autonomy (Motion and Vision), design of agents, models and knowledge representations, robot navigation (localization and mapping. The lectures and exercises of this course introduce several types of robots such as wheeled, flight, and underwater robots, self-deriving cars).										
References	• R.Seigwart, I. R.Nourbakhsh, D. Scaramuzza, "Introduction to Autonomous Mobile Robots", 2nd Edition, MIT Press, 2011. • Gerardus Blokdyk, "Autonomous System AS", 2nd Edition, 5STARCooks, 2022, ISBN-13: 978-0655342304.										
Laboratory	• MATLAB virtual lab: Modelling and simulating autonomous robotics systems • Using different computer's program such as V-REP for simulating the dynamics of different robots. • Other useful simulating programs may be included (GACEEPO, MSC ADAMS). • Laboratory experiments will be set based on the course selected topics and robots.										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab	Tut	Sum	SA	MT	PE/OE	Final
ELE 4305	Advanced Control Systems	ELE 333	3	2	2	1	1	10	30	20	40
Course Content	Basic principles of control systems engineering, Modeling of sampled-data systems, sampling rate selection, Controller design with continuous systems, Direct digital design, Design considerations for robust control, Feedforward control, State space methods for control and estimation, Optimal feedback, and long-range predictive control, Adaptive, learning, fuzzy, and variable structure control										
References	• Eduardo Garcia Jaimes,"Advanced Control Systems: Theory and Practice",Our Knowledge Publishing, 2021, ISBN-13: 978-6202831758 • Hassan K. Khalil, "Nonlinear Control", 1st edition, Pearson, 2014, ISBN: 978-0133499261 • K. Ogata, "Modern Control Engineering", 5th edition, Pearson, 2009, ISBN: 978-0136156734 • G. F. Franklin, J. David Powel, M.L. Workman, "Digital Control of Dynamic Systems", 3rd edition, Adison Wesley, 1997, ISBN: 978-0201820546										
Laboratory	Project based laboratory where the student along with the course will: • Design, build, simulate, and test control systems and strategies using both MATLAB and Simulink • Work on a controls-based project related to graduate thesis work. If graduate thesis is not controls-related, a relevant project will be assigned										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab	Tut	Sum	SA	MT	PE/OE	Final
ELE 4307	Advanced Industrial Automation Systems	ELE 331	3	2	2	1	5	10	30	20	40
Course Content	Introduction to industry 4.0. Sensors and transducers: Temperature, displacement, force, pressure, displacement sensors – Actuators: Hydraulic, Pneumatic, and Electric actuators – Digital PI, PID controller – Industrial Process Control examples: Continuous Casting process, rolling process, Winding, and unwinding process, drawing process, Mixing Process, basics of machine safety, process safety. Industrial Communications, Protocols, networks. Examples on media converters. Protocol converters.										
References	• Geoffrey Williamson, "Industrial Automation: Systems and Engineering", States Academic Press, 2022 • L. A. Bryan, E. A. Bryan, 'programmable controllers' theory and implementation', 2nd Edition, Amer Technical Pub, 2003. • Dag H. Hanssen," Programmable logic controllers a Practical approach to IEC 61131-3 Using CoDeSys", Wiley, 2015.										
Laboratory	• Process Simulator labs • Drive Control through network • Protocol Examples • WinCC SCADA										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab	Tut	Sum	SA	MT	PE/OE	Final
ELE 4309	Selected Topics in Control Systems		3	2	2	1	5	10	30	20	40
Course Content	This course would cover selected contemporary topics in control systems engineering. The course content must take approval from the Electrical Engineering Department Council before students' registration.										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab	Tut	Sum	SA	MT	PE/OE	Final
ELE 4401	Parallel and Distributed Systems	ELE 3402	3	2	2	1	5	10	30	20	40
Course Content	The use of parallelism to achieve high performance - parallelism within the central processing unit – parallel processing in multiprocessors environment - physical components of the data flow machines – new parallel architectures - the new advances in parallel processing - models and structures parallel data - examples of applications of the current in parallel and distributed systems- Distributed Systems, MapReduce, Clusters - Distributed File Systems, Security - Distributed Shared Memory, Peer-to-Peer										
References	• Arun Kulkarni, Nupur Prasad Giri, Nikhilesh Joshi, Bhushan Jadhav, "Parallel and Distributed Systems ",Wiley, 2016, ISBN: 9788126565825 • Peter Kacsuk, Thomas Fahringer, "Distributed and Parallel Systems: From Cluster to Grid Computing", Springer 2007, ISBN-13: 978-0387698571 • F. Xhafa, F. Leu, M. Ficco, and C. Yang, "Advances on P2P, Parallel, Grid, Cloud and Internet Computing," Proceedings of the 13th International Conference on P2P, Parallel, Grid, Cloud, and Internet Computing (3PGCIC-2018).										
Laboratory	• Virtual Machines and Virtualization of Clusters and Data Centers • Implementation of Service Oriented Architecture for Distributed Computing. • Cloud Programming and Software Environment • grid Computing, Systems, and Resource Management.										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab	Tut	Sum	SA	MT	PE/OE	Final
ELE 4403	Digital Forensics	ELE 3404	3	2	2	1	5	10	30	20	40
Course Content	Introduction to Digital Forensics, Types of cybercrimes, electronic evidence and handling, electronic media, collection, searching and storage of electronic media, internet crimes, hacking and cracking. Data Acquisition and Authentication Process, Windows Systems, UNIX file Systems, mac file systems, computer artifacts, Internet Artifacts, OS Artifacts, and their forensic applications. Forensic Tools, Usage of Slack space, tools for Disk Imaging, Data Recovery, Vulnerability Assessment Tools, FTK tools, Anti Forensics and probable counters, process of computer forensics and digital investigations, processing of digital and multimedia evidence.										
References	• C. Altheide and H. Carvey, “Digital Forensics with Open-Source Tools”, Syngress, 2011. ISBN: 9781597495868. • Rama Chandra Malayanur, “Forensics2022: Digital Forensics and Cyber Crime", 2022 • Preston Miller, Chapin Bryce, “Python Digital Forensics Cookbook: Effective Python recipes for digital investigations, Packt Publishing, 2017.										
Laboratory	• Live Case Studies • Open-Source Forensic Tools • Disk Forensics and Data Recovery • Steganography • Key loggers • Network monitors										
Used in Program	Computer and Control Systems (Computer Concentration)						Semester	9			

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab	Tut	Sum	SA	MT	PE/OE	Final
ELE 4405	Software Project Management	ELE 3406	3	2	2	1	5	10	30	20	40
Course Content	Introduction to Software Project Management - Project Analysis: strategic assessment, technical assessment, economic analysis - Activity Planning and Scheduling: Objectives of activity planning, Work breakdown structure, Bar chart, Network planning model: Critical path method, Program evaluation and review technique, Precedence diagramming method, shortening project duration, Identifying critical activities. - Risk Management - Resource allocation - Monitoring and control - Software quality assurance and testing - Software Configuration Management										
References	• Adolfo Villafiorita, "Introduction to Software Project Management", Auerbach Publications, 2014,ISBN 9781466559530 • Robert K. Wysocki, "Effective Software Project Management", Wiley, 2006,ISBN: 978-0-470-44653-9										
Laboratory	Students should prepare a project report using different concepts of software project management. The project can be done in groups. Each group can select a case study and apply the concepts of software project management focusing on project analysis, scheduling, risk analysis, resource allocation, testing.										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab	Tut	Sum	SA	MT	PE/OE	Final
ELE 4407	Compilers	ELE 144	3	2	2	1	5	10	30	20	40
Course Content	Introduction to Compiling; Lexical analysis: specification and recognition of tokens, finite automata; Syntax analysis: grammars, top-down and bottom-up passing; Syntax-directed translation; Semantic routines; Storage-allocation strategies; Code generation; Error recovery.										
References	• Keith D. Cooper, Linda Torczon, "Engineering a Compiler", 3rd Edition, Morgan Kaufmann, 2022. • AlfredAho, et al, "Compilers. Principles, Techniques and Tools", Addison Wesley,2006.										
Laboratory	• Lexical Analysis • Symbol Table • Type Checking and Semantic Analysis • Optimization										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab	Tut	Sum	SA	MT	PE/OE	Final
ELE 4409	Internet of Things	ELE 342	3	2	2	1	5	10	30	20	40
Course Content	Overview of IoT and High-level Architecture, Setting up IoT workflow. Programming with Advanced C / Embedded C. Micro-controller programming using Arduino. Programming with Python. Building IoT Applications using Raspberry Pi IoT Protocols: HTTP, CoAP, MQTT, AMQP, 6LoWPAN. IoT Cloud Infrastructure Performance and Security in IoT										
References	• John Soldatos, "Building Blocks for IOT Analytics", River Publishers, 2017, ISBN: 978-87-93519-03-9. • Marco Schwartz, "Internet of Things with Arduino Cookbook", Packt Publishing, 2016, ISBN-13: 978-1785286582 • Othmar Kyas, "How to Smart Home a Step-by-Step Guide to Your Personal Internet of Things", 3rd edition, Key concept Press										
Laboratory	• reading digital input through Wi-Fi • Reading analog input through Wi-Fi • NodeRed platform intro • Using MQTT broker in sending messages • Raspberry Pi interface for IoT										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab	Tut	Sum	SA	MT	PE/OE	Final
ELE 4411	RTL design	ELE 242	3	2	2	1	5	10	30	20	40
Course	Introduction - FPGA Architecture - Overview of FPGA/ASIC Design Flow- RTL Coding - Digital Design with HDL (VHDL/Verilog) - Design modelling with examples - Test Bench Development - Simulation and Synthesis- Timing Analysis - Chip Scope - RTL Optimization - System Design with Finite and Algorithmic State Machine.										
References	• Frank Vahid, " Digital Design with RTL Design, VHDL and Verilog", Second Edition A John Willey Sons Publications, 2011 • Sanjay Churiwala · Sapan Garg, "Principles of VLSI RTL Design a Practical Guide", Springer New York Dordrecht Heidelberg London, ISBN 978-1-4419-9295-6, 2011 • A. Arockia Bazil Raj, "FPGA-Based Embedded System Developer's Guide",Taylor & Francis Group, LLC, 2018										
Laboratory	• Arithmetic Operations: Adders/ Subtractors - Multipliers – Dividers • Trigonometric Computations: CORDIC • Memory Design and Implementation: ROM - RAM • Peripheral Interfacing										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab	Tut	Sum	SA	MT	PE/OE	Final
ELE 4413	Selected Topics in Computer Engineering		3	2	2	1	5	10	30	20	40
Course	As the development of computer engineering is fast, this course would cover selected contemporary topics in computer engineering. The course content must take approval from the Electrical Engineering Department Council before students' registration.										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab	Tut	Sum	SA	MT	PE/OE	Final
ELE 4425	VLSI Design	ELE 4411	3	2	2	1	5	10	30	20	40
Course Content	This course covers Principles, analysis, and design of CMOS Radio frequency (RF) integrated circuits for wireless communication systems. Noise performance and limitations of devices, RF Circuits, Design of RF Filter design. Basic blocks in RF systems and their VLSI implementation, Low noise Amplifier design, Design of Mixers, Various mixers working and implementation. VCO and definition of phase noise, Noise power and trade off. PLL frequency Synthesizers. Frequency dividers. Cadence SpectreRF for circuit simulations.										
References	• Thomas H. Lee , Design of CMOS RF Integrated Circuits, Cambridge University press, June 2012. • Jacob Baker, CMOS Circuit Design, Layout, and Simulation, 3rd Edition, Institute of Electrical and Electronics Engineers, 2010. • Razavi, PHI, RF Microelectronics, Pearson, 2nd edition.										
Laboratory	• Gilbert Mixer Simulation (Cadence SpectreRF). • LNA simulation using Cadence SpectreRF.										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab	Tut	Sum	SA	MT	PE/OE	Final
ELE 4427	ASIC Design	ELE 4411	3	2	2	1	5	10	30	20	40
Course Content	Course covers Fundamentals of ASIC digital Design Flow, Advanced register-transfer level RTL design using HDL language. RTL Verification, Synopsys design compiler, logic synthesis tool for mapping RTL onto Gate-Level, Netlist Generation, Essential Level system on chip SOC designing, ASIC physical design flow, Floor planning, Automatic Place the Functional blocks, Optimization and timing analysis techniques, Clock tree synthesis CTS, and Routing Algorithms, ASIC verification and post Synthesis Algorithms. virtuoso GDS file. DRC & LVS calibration.										
References	• Digital ASIC Group, Digital ASIC Design, A Tutorial on the Design Flow, Lund Institute of Technology, October 20, 2005. • Michael John Sebastian Smith, Application-Specific Integrated Circuits, 1997. • Golshan, Khosrow, Physical Design Essentials, springer, 2007.										
Laboratory	• Design and implement a FIR filter by VHDL and perform the following steps: • Verification from your code. • Logic synthesis. • Import Design to SOC Encounter. • Floor Planning. • Placement. • Optimization and timing analysis. • Pre-CTC Timing. • Clock Tree Synthesis. • Post-CTS timing. • Routing the Design. • Post synthesis gate level simulation. • Generating final GDS File.										

Code	Course Title	Pre-req	Cr. Hrs.	Ct Hrs				Assessment			
				Lec	Lab	Tut	Tot	SA	MT	PE/OE	Final
BES 111	Differential Equations	BES 012	3	2	0	2	4	30	30	-	40
Course Content	Ordinary differential equations (ODEs): Classification and types of solutions of ODEs. Solution of first order ODEs - Applications of ODEs (Newtons law of cooling, electric circuits) - Solution of nth order ODEs (homogeneous and non-homogeneous) - System of first order linear differential equations - Series solution of differential equations- Laplace transforms and inverse Laplace transforms with applications - Fourier series with applications. Gamma and Beta functions Partial Differential Equations (PDEs): Classification and types of solutions of PDEs. Applications of PDEs. Solution of linear PDEs with constant coefficients, solution of some initial-boundary value problems. Solution of PDEs by Laplace Transforms.										
References	• Morris Tenenbaum, Harry Pollard, "Ordinary Differential Equations: An Elementary Textbook for Students of Mathematics, Engineering, and the Sciences", Dover Publications, Last Edition. • Wei-Chau Xie, Differential Equations for Engineers, CAMBRIDGE UNIVERSITY PRESS, 2010.										

Code	Course Title	Pre-req	Cr. Hrs.	Ct Hrs				Assessment			
				Lec.	Lab	Tut	Tot	SA	MT	PE/OE	Final
BES 112	Numerical Analysis	BES 111	3	2	2	0	4	10	30	20	40
Course Content	Numerical in general: Errors, norms, Numerical solution of a system of linear and nonlinear equations. matrix eigenvalues, least square method (Curve fitting), Interpolations, Numerical differentiation and integration. Numerical ODEs and PDEs: methods for the solution of initial value problems in 1st order ODEs and higher order ODEs, Finite difference methods for boundary value problems in ODEs and initial-boundary value problems for PDEs (Elliptic and parabolic PDEs)- Lab simulations of engineering applications										
References	• R W Hamming, "Numerical Methods for Scientists and Engineers", Courier Dover Publications, Last Edition. • Steven C. Chapra, "Applied Numerical Methods with MATLAB for Engineers and Scientists", Mcgraw-Hill, 3rd edition. • Nita H. Shah, Numerical Methods with C++ Programming, PHI Learning, 2008.										
Laboratory	Lab simulations by software's as (C++, Matlab, Python,…)- Simulating practical technical problems- linear equations due to electric circuits , truss and spring mass systems. - Electric charge calculations- Nonlinear structural problems- Deflection of nonlinear springs- Calculating the shrinkage of a trunnion- Finding the longitudinal Young's modulus -Estimating voltage drop on a resistor- Calculating the work done by stretching a string- Simulating equations due to the fluid continuum problems, DC motor speed control problems- interpolation and fitting for signals and voltage current relations- population growth calculations- Fluid flow rate calculations- Distributed wind force problems										

Code	Course Title	Pre-req	Cr. Hrs.	Ct Hrs				Assessment			
				Lec.	Lab	Tut	Tot	SA	MT	PE/OE	Final
BES 113	Mathematics III	BES 012	3	2	0	2	4	30	30	-	40
Course Content	Complex Functions: Complex plane, Polar form of complex number, Powers and roots, Cauchy-Riemann equations, Conformal transformations. Some elementary transformations (linear function, rational and bilinear functions, irrational functions, the exponential function, trigonometric functions). Complex integration. Multivariable Calculus (B): Multiple integrals: double integrals, areas, moments, double integrals in polar form, triple integrals, masses and moments in three dimensions, triple integrals in cylindrical and spherical coordinates, substitution in multiple integrals, line and surface integrals, Green, Gauss and Stock's theorems.										
References	• Erwin Kreyszig, "Advanced Engineering Mathematics", / Paperback / Wiley, John & Sons, Last Edition. George B. Thomas, Jr., Maurice D. Weir, Joel Hass, THOMAS' CALCULUS Multivariable (Twelfth Edition), 2010.										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab	Tut	Sum	SA	MT	PE/OE	Final
BES 214	Discrete Mathematics and Linear Algebra	BES 011	3	2	0	2	3	30	30	-	40
Course Content	**Discrete Mathematics:** Proofs - Recursion - Sets - Combinatorics - Number theory - Relations - Functions and matrices - Graphs and Trees - Algebraic structures (Groups-Rings-Fields)- Introduction to modelling computations. **Linear Programming:** Definitions, Maximization and Minimization problems, Graphical solutions of linear programming problems, Simplex and Big – M method. - Graphs and Digraphs: shortest path, spanning tree.										
References	• Susanna S. EPP, Discrete mathematics with application, Fourth Edition, 2011, Brooks/Cole Cengage Learning. • Gass, S. I. Linear Programming: Methods and Applications, 5th ed. McGraw-Hill, 1985, New York										

Code	Course Title	Pre-req	Cr. Hrs.	Ct Hrs				Assessment			
				Lec	Lab	Tut	Tot	SA	MT	PE/OE	Final
BES 211	Engineering Statistics and Probability	BES 012	3	2	1	1	4	10	30	20	40
Course Content	Probability: Obtaining Data - Probability models: mathematical, deterministic model. Probability theory concepts. - Discrete Distributions: Binomial and Poisson distribution. Continuous Distributions: Normal and Exponential Distribution. - Joint distributions. Statistics and Estimation: central point theorem, Single and multiple confidence interval, Prediction interval, tolerance interval - Hypothesis testing, - Inferences on the mean and variance of Normal distribution, Inference of two samples. – Simple and multiple Linear Regression and Correlation. - Applications involving uniform, Gaussian. Markov chains - Queueing Theory - Course examples are drawn from signal processing, system reliability, data science, wireless communications, civil engineering, and mechanical engineering - Lab simulations of engineering applications.										
References	• R. E Walpole, R. H. Myers, "Probability and Statistics for Engineers and Scientists", Macmillan Publishing, Last Edition. • David Levine, Patricia Ramsey , Robert Smidt, "Applied Statistics for Engineers and Scientists: Using Microsoft Excel & Minitab", First Edition, 2000.										
Laboratory	Lab simulations by software's as (Excel, Matlab, Python,…)- Exploratory data analysis and data transformation (Tabulated data summaries and statistics, Histograms, Box and Correlation plots, Computation of means, variances, etc, Missing data imputation)- Simple random sampling with and without replacement- Stratified random sampling- Simulating Bernoulli process and Poisson distribution - Simulating Markov chains applications-Binary and sequential hypothesis testing and gambler's ruin -Gaussian Mixture Models, clustering and anomaly detection- Regression models and inference- Time series forecasting and ARIMA models.										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab	Tut	Sum	SA	MT	PE/OE	Final
BES 131	Modern physics	BES 031 BES 032	2	2	1	1	4	10	30	20	40
Course Content	Quantization theory and photoelectric effect and, Wave-particle duality, Schrodinger equation, Particle in a box, Quantum tunneling, Band theory of solids, intrinsic and extrinsic semiconductors, energy band diagrams, drift and diffusion currents, Carrier generation and recombination, continuity equations, pn junction, Bipolar Junction Transistor, Field-Effect Transistors, solar cells, properties of dielectric materials.										
References	• R. A. Serway and J. W. Jewett, Physics for scientists and engineers: Cengage learning, 2018. • Neamen, *Semiconductor Physics and Devices-Basic Principles*, 4th Ed, McGraw-Hill, 2012. • Robert F. Pierret, *Semiconductor Device Fundamentals*, 2nd Ed, Addison Wisely, 1996.										
Laboratory	• Photoelectric effect, • Line spectrum, • Hall Effect, • p-n junction diode characteristics, • Solar cell characteristics										
Used in Program	Electrical power Engineering						Semester	3			

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment Criteria			
				Lec.	Lab	Tut	Sum	ST	MT	PE/OE	Final
MEC 131	Computer Applications	ELE 042	2	1	2	0	3	10	30	20	40
Course Content	Developing basic concepts of algorithmic thinking to solve problems of relevance in engineering practice and implementing these algorithms MATLAB. Loops, control structures, functions, arrays. Create MATLAB programs that solve real-world problems in engineering and the sciences. Numerical methods, solution of nonlinear equations, plotting, logic operations, and graphical user interfaces to design, test, and debug numerical algorithms.										
References	• Simin Nasseri, "Solving Mechanical Engineering Problems with MATLAB", Linus Publications										
Laboratory	Student's programs of tasks and problems are carried out in the engineering Computer Labs.										
Used in Program	All Mechanical Department Programs						Semester	3			