جـــــــــامـــعة بنـــهـا

كـــــلية الهندســـــــة ببنـــــــها

البرامج متعددة التخصصات

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.

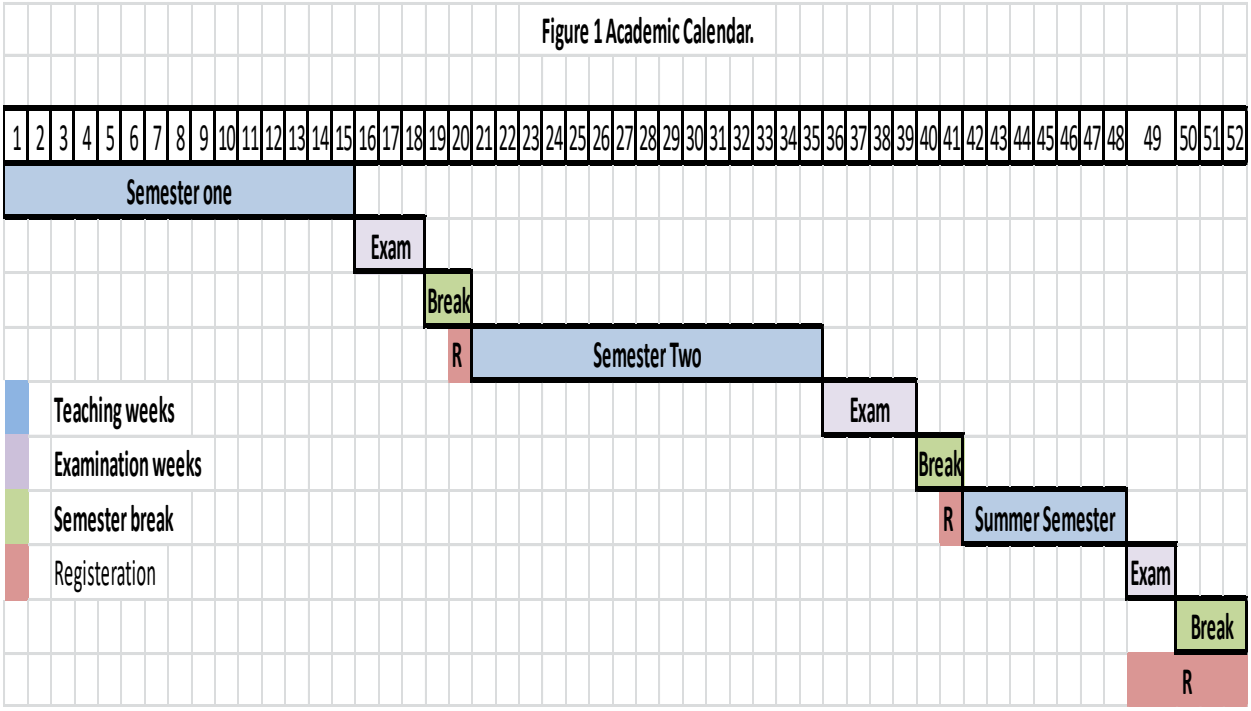
مادة(20) مواعيد الدراسة

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 ، و 96 ساعة من الساعات المعتمدة 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 متعددة التخصصات ، 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 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 (7).

جدول رقم (7) 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 (8) 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 للجدول رقم (8).
- 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^+.

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.

جدول رقم (8) 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

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 (9) 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 (9) تقسيم الساعات المعتمدة بين المتطلبات الأربعة.

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

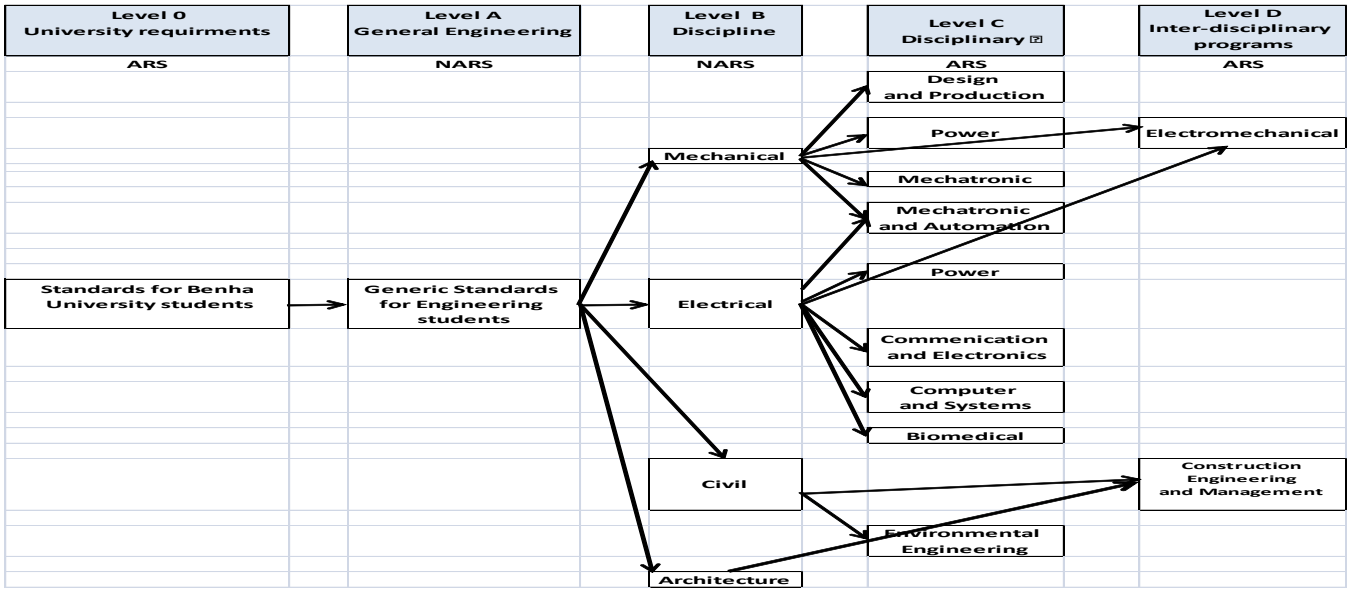


Figure 2 Different Levels of Competencies as per NARS 2018, as published by NAQAAE

ملخص البرامج الدراسية:

Table 10 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	MT1	MT2	SA	Final
UHS 101	Foreign Language	-	2	2	-	-	2	30%	20%	10%	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	MT1	MT2	SA	Final
UHS 102	Information and Communication Technology	-	2	2	-	-	2	30%	20%	10%	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	MT1	MT2	SA	Final
UHS 103	Societal Issues	-	2	2	-	-	2	30%	20%	10%	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	MT1	MT2	SA	Final
UHS 104	Professional Ethics	-	2	2	-	-	2	30%	20%	10%	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	MT1	MT2	SA	Final
UHS 201	Principles of Entrepreneurship and Project Management	-	2	2	-	-	2	30	20	10	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	MT1	MT2	SA	Final
UHS 203	Human Resources Management		2	2	-	-	2	30	20	10	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	MT1	MT2	SA	Final
UHS 301	Communication & Presentation Skills	-	2	2	-	-	2	30%	20%	10%	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	MT1	MT2	SA	Final
UHS 302	Leadership Skills	-	2	2	-	-	2	30%	20%	10%	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	MT1	MT2	SA	Final
UHS 801	Research Methodology	-	2	2	-	-	2	30%	20%	10%	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	MT1	MT2	SA	Final
UHS 803	Thinking Skills	-	2	2	-	-	2	30%	20%	10%	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

Inter-displinary 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.

List of Faculty requirements courses for Inter-disciplinary Programs

Code	Course	Pre-requisites	Credit Hours	Ct. Hrs.			
				Lec.	Lab.	Tut	Sum
FRB 001	Analytical geometry & Linear Algebra	-----	3	2	0	2	4
FRB 002	Integration & Multivariable functions	FRB 001	3	2	0	2	4
FRB 003	Statics	-----	3	2	0	2	4
FRB 004	Dynamics	FRB 003	3	2	0	2	4
FRB 005	Waves and Heat	-----	3	2	2	1	5
FRB 006	Electricity and Magnetism	-----	3	2	2	1	5
FRB 007	Chemistry for Engineers	-----	4	3	2	1	6
FRM 008	Production Systems Engineering	-----	2	1	3	0	4
FRM 009	Engineering Drawing	-----	2	0	0	4	4
FRM 010	Engineering Drawing by Computer	FRM 009	2	1	2	0	3
FRE 012	Computer Programming	-----	2	0	2	2	4
FRB 103 *	Environmental Pollution and Industrial Safety	FRB 007	2	2	1	0	3
FT 103	Field Training I	Completion of 65 CR. HRS.	0	0	0	0	0
FT 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 Discipline Department.

Course Coding

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.

FRB XXX	Courses offered by Basic Engineering Science Department
FRM XXX	Course offered by Mechanical Engineering Department for Faculty Requirement
FRE XXX	Course offered by Electrical Engineering Department for Faculty Requirement

The following abbreviations are the legend for the courses:

Pre-req	Prerequisite	**Cr. Hrs.**	Credit Hours	**Std. Act.**	Student Activity
Lec	Lectures	**Tut**	Tutorials	**Lab**	Laboratory
MT1	First Midterm Exam	**MT2**	Second Midterm Exam	**Final**	Final Exam

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hrs.				Assessment			
				Lec	Lab.	Tut.	Sum	MT1	MT2	Std. Act.	Final
FRB 001	Analytical geometry & Linear Algebra	-	3	2	0	2	4	30	20	10	40
Course Contents	**Analytical geometry:** Functions (Lines, Circles, Parabolas, Piecewise-Functions, Power Functions, Polynomials, Rational Functions, Algebraic Functions, Trigonometric Functions, Hyperbolic Functions, Exponential Functions and Logarithmic Functions) and their properties, their graphs and their inverses. Limits and continuity. Differentiation rules of real functions of one variable. Applications of derivatives (maxima, minima and inflection points, curve tracing, optimization problems). Taylor's and Maclaurin's series of functions of one variable. **Linear Algebra:** Matrices and their properties, types, ranks and their inverses (Adjoint of matrix, Eigen equation and Gauss elimination). Existence and uniqueness of solutions. Solving system of linear equations by Matrices (Gauss elimination, Gauss – Jordan elimination, LU factorization). Eigenvalues and eigenvectors. Complex numbers. Elements of mathematical logic with applications.										
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 Name	Pre-req.	Cr. Hrs.	Ct. Hrs.				Assessment			
				Lec	Lab.	Tut.	Sum	MT1	MT2	Std. Act.	Final
FRB 002	Integration & Multivariable functions	FRB 001	3	2	0	2	4	30	20	10	40
Course Contents	Integration: Techniques of integration (Basic Integration Formulas, Integration by Parts, Integration of Rational Functions by Partial Fractions, Trigonometric Integrals and Substitutions). Applications of indefinite integrals. Applications of definite integrals (areas, volumes of revolution, lengths of curves and surface areas of revolution). Multivariable functions: Curves and surfaces in three dimensions. Limits, continuity and partial derivatives of functions of several variables. Chain Rule. Directional and total derivatives. Applications (tangent planes and normal lines, Taylor series of functions of two variables, Extreme values and conditional extreme values of functions of two variables).										
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	Cr. Hrs.	Ct. Hr.				Assessment				
				Lec.	Lab	Tut	Sum	SA	MT 1	MT 2	PE/ OE	Final
FRB 003	Statics	0	3	2	0	2	4	10	30	20	0	40
Course Content	Vector algebra and applications to mechanics, Statics of particles in three dimensions, Moment of a forces about a point and a line and moment of couples, Equivalent systems of forces, Equilibrium of rigid bodies, Centroids and centers of gravity, Analysis of structures, Friction and its applications, Moments of inertia of areas and masses.											
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 Name	Pre-req.	Cr. Hrs.	Ct. Hrs.				Assessment			
				Lec	Lab.	Tut.	Sum	MT1	MT2	Std. Act.	Final
FRB 004	Dynamics	FRB 003	3	2	0	2	4	30	20	10	40
Course Contents	Kinematics of particles (rectilinear and curvilinear motion), Kinetics of particles (Newton's second law – principle of work and energy – principle of impulse and momentum - impact), Kinematics of rigid bodies (translation, rotation about a fixed axis and general plane motion), Kinetics of rigid bodies (force and acceleration method).										
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	Cr. Hrs.	Ct. Hrs.				Assessment			
FRB 005	Waves and Heat	-	3	Lec.	Lab	Tut	Tot	SA	MT	PE/ OE	Final
				2	2	1	5	10	30	20	40
Course Content	Simple harmonic motion, Wave motion, Sound waves, Superposition of waves, Interference of light waves, Diffraction 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	Cr. Hrs.	Ct. Hrs				Assessment			
FRB 006	Electricity and Magnetism	-	3	Lec.	Lab	Tut	Tot	SA	MT	PE/ OE	Final
				2	2	1	5	10	30	20	40
Course Content	Electric field, Gauss law and applications, Electric potential, Capacitors and dielectrics, Current and resistance, Magnetic field and magnetic force, Sources of magnetic field, Ampere's law, 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	Cr. Hrs.	Ct. Hrs.				Assessment			
FRB 007	Chemistry for Engineers	-	4	Lec.	Lab	Tut	Tot	SA	MT	PE/ OE	Final
				3	2	1	6	10	30	20	40
Course Content	Gaseous state: ideal & real gas laws, kinetic molecular theory - Liquid state: intermolecular forces, properties of liquids, phase rule – Solids: arrangement of atoms, metallic solids, alloys - Chemical kinetics: reaction rates & order, catalysis – Electrochemistry: electrochemical cells, standard potential, corrosion – Polymers: Characterization and Properties of Polymers, Functional Polymers.										
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	Cr. Hrs.	Ct. Hr.				Assessment			
FRM 008	Production Systems Engineering	-	2	Lec.	Lab	Tut	Tot	SA	MT	PE/ OE	Final
				1	3	0	4	10	30	20	40
Course Content	Introduction, Casting processes: Main steps of sand casting, Pattern design, melting of metals, Metal forming techniques: Forging, Rolling, Extrusion, Drawing, Bending Processes: Temporary and permanent joints, welding techniques, cutting techniques: Principles and elements of cutting processes, Basic cutting, and machining (Turning, Drilling, Milling, etc.,). Production planning and control principles, Fundamentals of 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	• Measurement operations and tools • Sand-casting workshop • welding techniques; electric arc welding, gas welding and cutting, and electric resistance welding • Machining workshop; turning, shaping, drilling, milling, and grinding • Metal forming workshop; rolling, bending, drawing, and extrusion • Carpentry workshop • Forging workshop										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment				
FRM 009	Engineering Drawing	-	2	Lec.	Lab	Tut	Tot	SA	MT 1	MT 2	PE/ OE	Final
				0	0	4	4	10	30	20	--	40
Course Content	Principles and skills of Engineering drawing. Conventional lettering and dimensioning. Geometric constructions. Orthographic projection of engineering bodies. Theories of view derivation. 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	Cr. Hrs.	Ct. Hr.				Assessment			
FRM 010	Engineering Drawing by Computer	-	2	Lec.	Lab	Tut	Tot	SA	MT 1	MT 2	PE/OE
				1	2	0	3	10	30	20	40
Course Content	Introduction to Computer Aided Drawing, Benefits of computer-aided drawing. Graphics/CAD involves the visualization, sketching, and geometric construction of mechanical components. Industry standard for drawing. Layout and creation of 2D working industrial drawings. Illustrate CAD drawing construction techniques, implementation of graphical communication using the alphabet of lines, orthographic projection, section views, auxiliary views and the creation of assembly and detail mechanical components. 3D drawing of 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	• Students practice engineering sketches and drawings in Computer Labs.										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
FRE 012	Computer Programming	-	2	Lec.	Lab	Tut	Tot	SA	MT 1	MT 2	PE/OE
				0	2	2	4	10	30	20	40
Course Content	Introduction to Computer Programming, Basics of C++ language, Problem Solving and Algorithm Design, Pseudo-codes and Flow charts, Arithmetic Operators and Variables, Exploring input and output statements, Control Structure (Selection and iterative), Functions, Primary data structure of Arrays and its multi – dimensional behavior, Concepts of Pointers, Introductory knowledge of Structures.										
References	• Paul Deitel, Harvey Deitel, “C++ How to Program”, 10th Edition, Pearson; (February 29, 2016) • Jery Hanly, Elliot Koffman, “Problem Solving and Program Design in C”, 8th edition, Pearson, 2015, ISBN-13: 978-0134014890 • R. Sedgweck, K. Wayne, "Introduction to Programming in Java: An Interdisciplinary Approach”, 2nd Edition, Addison-Wesley Professional, 2017, ISBN-13: 978-0672337840 • W. Savitch, "Problem Solving with C++", 10th Edition, Pearson, 2018, ISBN-13: 978-0134448282 • Nell Dale, Chip Weems, “Programming and Problem Solving with C++”, 5th, Jones & Bartlett Learning; (May 14, 2009)										
Laboratory	Problem solving labs using high level language (C, or C++) to apply explained topics in each lecture including: Flowcharts Data Types Declaration of Variables and Constants Conditioning Statements (if -- Then, switch -- case) Iteration Statements (For -- Next, Do -- while) Arrays Predefined Functions - User Defined Functions Strings and string functions										

Code	Course Title	Pre-req	Cr. Hrs.	Ct Hrs				Assessment			
				Lec.	Lab	Tut	Tot	SA	MT	PE/ OE	Final
FRB 103	Environmental Pollution and Industrial Safety	FRB 007	2	2	1	-	3	10	30	20	40
Course Content	- Air pollution-Adverse effects -ozone depletion – green house effects- Acid rain and global warming - measurement and control methods. - Water pollution- constituents of wastewater- primary treatment: various pre-treatment methods - Advanced Treatment: chemical oxidation, precipitation, air stripping **Construction Engineering and Managment 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. **Electromechanical 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. 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 Name	Pre-req.	Cr. Hrs.	Ct. Hrs.				Assessment			
				Lec	Lab.	Tut.	Sum	MT1	MT2	Std. Act.	Final
FT 103	Field Training I	Completion of 65 CR. HRS.	0	0	0	0	0	-	-	-	Pass
Course Contents	For 6 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.	Cr. Hrs.	Ct. Hrs.				Assessment			
				Lec	Lab.	Tut.	Sum	MT1	MT2	Std. Act.	Final
FT 203	Field Training II	Completion of 96 CR. HRS.	0	0	0	0	0	-	-	-	Pass
Course Contents	For 6 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.										

Program # 10 Electromechanical Engineering Program

Program Description

Electromechanical Engineering Program is a scientific and professional field specializing in designing, implementing, and managing mechanical and electrical systems projects in various buildings and establishments. The study in this program focuses on:

- Professionalism in engineering design.
- Understand legal and professional practice related to government approvals for mechanical and electrical systems projects.
- Understand implementation methods, coordination, systems, equipment, planning, scheduling, and occupational safety.
- Understand management topics such as economics and business, accounting, law, statistics, ethics, and leadership.
- Study and analysis of disasters and risks.
- Decision-making and development methods.

Program Mission

Electromechanical Engineering Program is committed to graduate engineers with an outstanding knowledge, keeping up with the rapid developing trends, and providing research to serve society and the community.

Basic Information

Preparing Electromechanical Engineers at the level of cognitive distinct and processions to the rapid development of new developments in this field and a commitment to professional ethics in the field of work and society.

Program Objectives

The main objectives of the program are to:

1. Apply a wide spectrum of engineering knowledge, science and specialized skills with analytic, critical and systemic thinking to identify and solve engineering problems in real life situation.
2. Behave professionally and adhere to engineering ethics and standards and work to develop the profession and the community and promote sustainability principles.
3. Work in and lead a heterogeneous team and display leadership qualities, business administration, and entrepreneurial skills.
4. Master self-learning and life -long learning strategies to communicate effectively in academic/professional fields.
5. Solve problems in the areas of integrated mechanics, electronics, computers, and software systems.
6. Capable of analyzing and investigating the inter-disciplinary characteristics of mechanical, electrical, and hydraulic systems.

Graduates Attributes

Graduate attributes are the academic abilities, personal qualities, and skills which Electromechanical 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, Electromechanical Engineering graduate should be able to:

11. Communicate effectively with experience to the use of computer applications in various electromechanical engineering disciplines.
12. Produce a design system that satisfies a given specification in electromechanical system.
13. Evaluate the sustainability and environmental issues related to electromechanical systems.
14. Solve problems in the areas of integrated mechanics, electronics, computers, and software systems, and analyze and investigate the inter-disciplinary characteristics of mechanical, electrical, and hydraulic systems.

Program Learning Outcomes

Level A Learning Outcomes:

According to NARS2018, 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 competences for all Engineering Programs (A-Level), the Electromechanical Engineering Program graduate must be able to (D-Level):

PLO11. Model, analyze and design physical systems applicable to the specific discipline by applying the concepts of: Thermodynamics, Heat Transfer, Fluid Mechanics, solid Mechanics, Material Processing, Material Properties, Measurements, Instrumentation, Control Theory and Systems, Mechanical Design and Analysis, Dynamics, and Vibrations.
PLO12. Plan, manage and carry out designs of mechanical systems and machine elements using appropriate materials both traditional means and computer-aided tools and software contemporary to the mechanical engineering field.
PLO13. select and purchase electromechanical equipment, components, and systems according to the required performance that fulfill job requirements and functional specifications.
PLO14. Adopt suitable national and international standards and codes; and integrate legal, economic, and financial aspects to design, build, operate, inspect, and maintain mechanical equipment and systems, electrical / electronic / digital equipment, systems, and services.
PLO15. Select, model, and analyze electrical power systems applicable to the specific discipline by applying the concepts of generation, transmission, and distribution of electrical power systems.
PLO16. Design, model and analyze an electrical / electronic / digital system or component for a specific application; and identify the tools required to optimize this design.
PLO17. Design and implement elements, modules, sub-systems, or systems in electrical engineering using technological and professional tools.
PLO18. 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.

Career opportunity

Why does the labor market need an electromechanical engineer؟

- Meet the need for these systems to coordinate among themselves.
- Minimize the number of engineers working in these systems within the establishment. So one engineer will work in a facility and work in all electrical and mechanical systems.
- Provide graduates engineers with the knowledge of these systems as most of the traditional programs in the faculties of engineering do not cover in their study the knowledge needed to work in most of these systems.

What will graduate of this program be؟

Following are some of the job opportunities that can be pursued by the program graduates:

Design Engineer: Develops the basics and details of many electrical and mechanical systems projects.
Site Engineer (supervision or implementation): Implements and coordinates electrical and mechanical systems projects at the site.

Operation and Maintenance Engineer: Responsible for the process and maintenance of all electrical and mechanical systems at the sites.

Survey engineer: perform surveying activities for all types of electromechanical projects.

Cost estimator: develops itemized costs and budgets for design and implementation based upon knowledge and pre-design of operations, materials, and resources requirements.

Project manager: oversees all aspects of a project, coordinates subcontractors, and provides primary contact to the client as well as to the company's leaders.

Division head or vice president, president, chief executive officer: manage overall site operations.

Features of electromechanical Engineer:

In addition to the general features of the engineer, Features of an electromechanical engineer.

- Application of analytical and experimental techniques.
- Design and management of electrical and mechanical engineering systems.
- Coordination with each other and the use of modern tools.
- Understand the profession's global, ethical, and social applications in terms of safety and overall sustainability issues.
- Collecting, benefiting, communicating, and possessing personal leadership skills.
- Ability to work cooperatively in a multidisciplinary team.
- Continuous outstanding work and lifelong learning.

Faculty Mission vs. Program Mission Matrix

Faculty Mission		Program Mission		
		Electromechanical Engineering Program is committed to graduate engineers with an outstanding knowledge, keeping up with the rapid developing trends, and providing research to serve society and the community.		
		Program is committed to graduate engineers with an outstanding knowledge	Keeping up with the rapid developing trends	Providing research to serve society and community.
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,		√	
	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
Electromechanical Engineering Program is committed to graduate engineers with an outstanding knowledge, keeping up with the rapid developing trends, and providing research to serve society and the community.	Program is committed to graduate engineers with an outstanding knowledge	√				√	√
	Keeping up with the rapid developing trends		√	√	√	√	√
	Providing research to serve society and community.				√		√

Competencies vs. Program Objectives Matrix

	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
PO1	√	√							√		√	√	√	√	√	√	√	
PO2			√				√											
PO3							√	√	√		√	√		√				
PO4					√			√		√			√		√			
PO5			√	√			√	√	√							√	√	√
PO6	√	√				√					√	√	√		√			√

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							√					√		√

Requirements of Program Courses

In order to get a Bachelor of Science Degree in this program, and to satisfy the Program competencies, the following set of courses need to be completed.

Program Requirements

Requirement		Cr. Hrs.	Contact Hours			
			Lec.	Lab.	Tut.	Sum
University Requirements		14	14	0	0	14
Faculty Requirements		**32**	**19**	**14**	**17**	**50**
Program Requirements	From Basic Science	12	8	0	8	16
	Compulsory Courses (Program Specialized)	**84**	**60**	**17**	**45**	**122**
	Elective Courses	18	12	0	12	24
Total		160	113	31	82	226

University Requirements of Electromechanical Engineering Program

Lists of Main Humanities Courses of Electromechanical Engineering Program

Code	Course	Pre-requisites	Cr. Hrs.	Ct. Hrs.			
				Lec	Lab.	Tut.	Sum
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 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**

Lists of Electives Humanities of Electromechanical Engineering Program

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

Faculty Requirements of Electromechanical Engineering Program

Code	Course	Pre-requisites	Cr. Hrs.	Ct. Hrs.			
				Lec.	Lab.	Tut	Sum
FRB 001	Analytical geometry & Linear Algebra	-----	3	2	0	2	4
FRB 002	Integration & Multivariable functions	FRB 001	3	2	0	2	4
FRB 003	Statics	-----	3	2	0	2	4
FRB 004	Dynamics	FRB 003	3	2	0	2	4
FRB 005	Waves and Heat	-----	3	2	2	1	5
FRB 006	Electricity and Magnetism	-----	3	2	2	1	5
FRB 007	Chemistry for Engineers	-----	4	3	2	1	6
FRM 008	Production Systems Engineering	-----	2	1	3	0	4
FRM 009	Engineering Drawing	-----	2	0	0	4	4
FRM 010	Engineering Drawing by Computer	FRM 009	2	1	2	0	3
FRE 012	Computer Programming	-----	2	0	2	2	4
FRB 103	Environmental Pollution and Industrial Safety	FRB 007	2	2	1	0	3
FT 103	Field Training I	Completion of 65 CR. HRS.	0	0	0	0	0
FT 203	Field Training II	Completion of 96 CR. HRS.	0	0	0	0	0
Total			**32**	**19**	**14**	**17**	**50**

Basic Science Requirements of Electromechanical Engineering Program

CODE	Course Name	Pre-requisites	Cr. Hrs.	Ct. Hrs.			
				Lec	Lab.	Tut.	Sum
FRB 001	Analytical geometry & Linear Algebra	-----	3	2	0	2	4
FRB 002	Integration & Multivariable functions	FRB 001	3	2	0	2	4
FRB 101	Engineering Differential Equations	FRB 002	3	2	0	2	4
FRB 104	Engineering Numerical Analysis	FRB 101	3	2	2	0	4
FRB 201	Applied Engineering Probability and Mathematical Statistics	FRB 002	3	2	2	0	4
FRB 206	Multiple Integrals & Complex Analysis	FRB 002	3	2	0	2	4
FRB 007	Chemistry for Engineers	-----	4	3	2	1	6
FRB 103	Environmental Pollution and Industrial Safety	FRB 007	2	2	1	0	3
EMM 202*	Vibrations and System Dynamics	EMM 103, EMM 107	3	2	0	2	4
FRB 005	Waves and Heat	-----	3	2	2	1	5
FRB 006	Electricity and Magnetism	-----	3	2	2	1	5
Total			**33**	**23**	**11**	**13**	**47**

Program Requirements

Lists of Compulsory Courses (96 Credit Hours)

Code	Course Title	Pre-requisites	Cr. Hrs.	Contact Hours			
				Lec	Lab	Tut	Sum
FRB 101	Engineering Differential Equations	FRB 002	3	2	0	2	4
FRB 104	Engineering Numerical Analysis	FRB 101	3	2	2	0	4
FRB 201	Applied Engineering Probability and Mathematical Statistics	FRB 002	3	2	2	0	4
FRB 206	Multiple Integrals & Complex Analysis	FRB 002	3	2	0	2	4
Total from Basic Science			**12**	**8**	**4**	**4**	**16**
EMM 101	Fluid Mechanics I	FRB 004	2	2	0	1	3
EMM 103	Mechanics of Machinery	FRB 004	3	2	0	2	4
EME 105	Electric Circuits Analysis	FRB 006	3	2	1	2	5
EMM 107	Strength and properties of Materials	FRB 004	2	2	0	1	3
EMM 109	Thermodynamics I	FRB 005	2	2	0	1	3
EMM 102	Fluid Mechanics II	EMM 101	2	2	0	1	3
EMM 104	Manufacture Technology	FRM 008	3	2	2	0	4
EME 106	Electrical Machines	EME 105	3	2	0	2	4
EMM 108	Measurements and Instrumentation	FRB 006	3	2	0	2	4
EMM 110	Solid Mechanics	EMM 107	2	2	0	1	3
EMM 112	Thermodynamics II	EMM 109	2	2	0	1	3
EME 201	Logic Circuits and Micro processors	EME 105	3	2	1	2	5
EMM 203	Heat Transfer	EMM 109	3	2	0	2	4
EMM 205	Projects Management	-----	2	2	0	1	3
EME 207	Electrical Power Systems	EME 106	3	2	0	2	4
EMM 209	Design of Machine Elements	EMM 104 &EMM 110	3	2	1	2	5
EMM 202	Vibrations and System Dynamics	EMM 103, EMM 107	3	2	0	2	4
EMM 204	Plumbing Systems	EMM 102	3	2	0	2	4
EME 206	Electronic Devices and Circuits	EME 201	3	2	0	2	4
EMM 208	Fluid Machinery	EMM 102	3	2	0	2	4
EME 210	Electric Power Distribution Systems	EME 207	3	2	1	2	5
EMM 301	Refrigeration	EMM 112	2	2	0	1	3
EMM 303	Air Conditioning Systems	EMM 112	3	2	0	2	4
EME 305	Low Current Distribution Systems	EME 210	3	2	0	2	4
EMM 307	Fire Fighting Systems	EMM 102	3	2	0	2	4
EMM 309	Combustion	EMM 112	3	2	0	2	4
EMM 302	Refrigeration and AC Systems/Components	EMM 301 &EMM 303	3	2	1	1	4
EME 304	Automatic Control	EME 106	2	2	0	1	3
EMM 390	Senior Design Project I	*	2	0	4	0	4
EMM 401	Computer Applications in El/Mec System	EME 305 & EMM 303	2	1	2	0	3
EMM 403	Process Control and Building	EME 304	2	2	0	1	3

	management System						
EMM 490	Senior Design Project II	EMM 390	3	1	4	0	5
Total Main Specialized Courses			**84**	**60**	**17**	**45**	**122**
Total Compulsory Courses			**96**	**68**	**17**	**53**	**138**

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

Lists of Elective Courses (18 Credit Hours)

CODE	Course Name	Pre-requisites	Cr. Hrs.	Ct. Hrs.			
				Lec	Lab.	Tut.	Sum
Elective I							
EMM 312	Renewable Energy	EME 106 &EMM 109	3	2	0	2	4
EMM 314	Elevators and Escalators	EMM 209	3	2	0	2	4
EMM 316	Solar Thermal and PV Systems	EMM 203	3	2	0	2	4
Elective II							
EME 322	Advanced Industrial Electronics	EME 206	3	2	0	2	4
EME 324	Electrical Protection	EME 305	3	2	0	2	4
EME 326	Electrostatic and Electromagnetic Fields	EME 106	3	2	0	2	4
Elective III							
EMM 332	Internal Combustion Engines	EMM 309	3	2	0	2	4
EMM 334	Essentials of Energy Management	EMM 205	3	2	0	2	4
EMM 336	Wind Energy System Design	EMM 208 &EMM 309	3	2	0	2	4
Elective IV							
EMM 411	Cold Stores and Industrial Refrigeration	EMM 301	3	2	0	2	4
EMM 413	Automotive Engineering	EMM 309	3	2	0	2	4
EMM 415	Power Stations	EMM 112	3	2	0	2	4
Elective V							
EME 421	Electro-Hydraulic Circuits	EME 304	3	2	0	2	4
EME 423	Codes and Specifications of El/Mec Systems	EMM 302 &EME 305	3	2	0	2	4
EME 425	Computer Networks	EME 105	3	2	0	2	4
Elective VI							
EME 431	Modern Control System	EME 304	3	2	0	2	4
EME 433	Power System Analysis	EME 305	3	2	0	2	4
EME 435	Electrical Drives	EME 106 &EME 304	3	2	0	2	4
Total			18	12	0	12	24

Matching Electromechanical Engineering Program Courses with ABET Requirements

ABET criteria for Electromechanical Engineering Program

Lead Society: American Society of Mechanical Engineers

Electromechanical Engineering Program Courses Required to Cover ABET Criteria				
ABET Criteria		**CODE**	**Course Name**	Cr. Hrs.
A minimum of 30 semester credit hours (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.	FRB 001	Analytical geometry & Linear Algebra	3
		FRB 002	Integration & Multivariable functions	3
		FRB 101	Engineering Differential Equations	3
		FRB 206	Multiple Integrals & Complex Analysis	3
	At least one additional area of basic science; apply probability and statistics to address uncertainty	FRB 104	Engineering Numerical Analysis	3
		FRB 201	Applied Engineering Probability and Mathematical Statistics	3
	Chemistry	FRB 007	Chemistry for Engineers	4
		FRB 103	Environmental Pollution and Industrial Safety	2
	Calculus-based physics	FRB 005	Waves and Heat	3
		FRB 006	Electricity and Magnetism	3
Total				**30**
ABET Criteria		**CODE**	**Course Name**	Cr. Hrs.
A minimum of 45 semester credit hours (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 mechanical and electrical processes and systems in a electromechanical engineering specialty field.	EMM 103	Mechanics of Machinery	3
		EMM 104	Manufacture Technology	3
		EME 106	Electrical Machines	3
		EMM 209	Design of Machine Elements	3
		EMM 202	Vibrations and System Dynamics	3
		EMM 307	Fire Fighting Systems	3
		EME 206	Electronic Devices and Circuits	3
		EMM 302	Refrigeration and AC Systems/Components	3
	Apply knowledge of methods, materials, equipment, planning, scheduling, safety, and cost analysis; to explain basic	EMM 107	Strength and properties of Materials	3
		EME 105	Electric Circuits Analysis	3
		EMM 101	Fluid Mechanics I	3
		EMM 109	Thermodynamics I	3

	legal and ethical concepts and the importance of professional engineering licensure in the construction industry	EMM 110	Solid Mechanics	3
	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	EMM 205	Projects Management	2
		EMM 403	Process Control and Building management System	3
	Integrating management systems into a series of different technological environments	EMM 3XX	Elective I	3
		EMM 3XX	Elective III	3
Total				**56**

Proposed Study Plan

Level 0- 1													
CODE	Course Name	Pre-requisites	Cr. Hrs.	Ct. Hrs.				Final Exam Time	Assessment					
				Lec	Lab.	Tut.	Sum		Mid 1	Mid 2	St. Act.	PE/OE	Final	sum
FRB 001	Analytical geometry & Linear Algebra	-----	3	2	0	2	4	2 hrs.	30	20	10	--	40	100
FRB 003	Statics	-----	3	2	0	2	4	2 hrs.	30	20	10	--	40	100
FRB 005	Waves and Heat	-----	3	2	2	1	5	2 hrs.	30	--	10	20	40	100
FRB 007	Chemistry for Engineers	-----	4	3	2	1	6	2 hrs.	30	--	10	20	40	100
FRM 009	Engineering Drawing	-----	2	0	0	4	4	2 hrs.	30	20	10	--	40	100
UHS 101	Foreign Language	-----	2	2	0	0	2	2 hrs.	30	20	10	--	40	100
UHS 102	Information and Communication Technology	-----	2	2	0	0	2	2 hrs.	30	20	10	--	40	100
			19	13	4	10	27							700

Level 0- 2													
CODE	Course Name	Pre-requisites	Cr. Hrs.	Ct. Hrs.				Final Exam Time	Assessment					
				Lec	Lab.	Tut.	Sum		Mid 1	Mid 2	St. Act.	PE/OE	Final	sum
FRB 002	Integration & Multivariable functions	FRB 001	3	2	0	2	4	2 hrs.	30	20	10	--	40	100
FRB 004	Dynamics	FRB 003	3	2	0	2	4	2 hrs.	30	20	10	--	40	100
FRB 006	Electricity and Magnetism	-----	3	2	2	1	5	2 hrs.	30	--	10	20	40	100
FRM 008	Production Systems Engineering	-----	2	1	3	0	4	2 hrs.	30	20	10	40	--	100
FRM 010	Engineering Drawing by Computer	FRM 009	2	1	2	0	3	2 hrs.	30	--	10	20	40	100
UHS 103	Societal issues	-----	2	2	0	0	2	2 hrs.	30	20	10	--	40	100
FRE 012	Computer Programming	-----	2	0	2	2	4	2 hrs.	30	20	10	40	--	100
			17	10	9	7	26							700

Level 1- 1														
CODE	Course Name	Pre-requisites	Cr. Hrs.	Ct. Hrs.				Final Exam Time	Assessment					
				Lec	Lab.	Tut.	Sum		Mid 1	Mid 2	St. Act.	PE/OE	Final	sum
FRB 101	Engineering Differential Equations	FRB 002	3	2	0	2	4	2 hrs.	30	20	10	--	40	100
EMM 101	Fluid Mechanics I	FRB 004	2	2	0	1	3	2 hrs.	30	20	10	--	40	100
EMM 103	Mechanics of Machinery	FRB 004	3	2	0	2	4	2 hrs.	30	20	10	--	40	100
EME 105	Electric Circuits Analysis	FRB 006	3	2	1	2	5	2 hrs.	30	--	10	20	40	100
EMM 107	Strength and properties of Materials	FRB 004	2	2	0	1	3	2 hrs.	30	20	10	--	40	100
EMM 109	Thermodynamics I	FRB 005	2	2	0	1	3	2 hrs.	30	20	10	--	40	100
FRB 103*	Environmental Pollution and Industrial Safety	FRB 007	2	2	1	0	3	2 hrs.	30	--	10	20	40	100
			17	14	2	9	25							700

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

Level 1- 2														
CODE	Course Name	Pre-requisites	Cr. Hrs.	Ct. Hrs.				Final Exam Time	Assessment					
				Lec	Lab	Tut.	Sum		Mid 1	Mid 2	St. Act.	PE/OE	Final	sum
FRB 104	Engineering Numerical Analysis	FRB 101	3	2	2	0	4	2 hrs.	30	--	10	20	40	100
EMM 102	Fluid Mechanics II	EMM 101	2	2	0	1	3	2 hrs.	30	20	10	--	40	100
EMM 104	Manufacture Technology	FRM 008	3	2	2	0	4	2 hrs.	30	--	10	20	40	100
EME 106	Electrical Machines	EME 105	3	2	0	2	4	2 hrs.	30	20	10	--	40	100
EMM 108	Measurements and Instrumentation	FRB 006	3	2	0	2	4	2 hrs.	30	20	10	--	40	100
EMM 110	Solid Mechanics	EMM 107	2	2	0	1	3	2 hrs.	30	20	10	--	40	100
EMM 112	Thermodynamics II	EMM 109	2	2	0	1	3	2 hrs.	30	20	10	--	40	100
			18	14	4	7	25							700

Field Training I													
CODE	Course Name	Pre-requisites	Cr. Hrs.	Ct. Hrs.				Final Exam Time	Assessment				
				Lec	Lab	Tut.	Sum		Mid 1	Mid 2	St. Act.	Final	sum
FT 103	Field Training I	Completion of 65 CR. HRS.	0	0	0	0	0	--	--	--	--	--	Pass / Fail

Level 2- 1													
CODE	Course Name	Pre-requisites	Cr. Hrs.	Ct. Hrs.				Final Exam Time	Assessment				
				Lec	Lab.	Tut.	Sum		Mid 1	Mid 2	St. Act.	PE/OE	Final	sum
FRB 201	Applied Engineering Probability and Mathematical Statistics	FRB 002	3	2	2	0	4	2 hrs.	30	--	10	20	40	100
EME 201	Logic Circuits and Micro processors	EME 105	3	2	1	2	5	2 hrs.	30	--	10	20	40	100
EMM 203	Heat Transfer	EMM 109	3	2	0	2	4	2 hrs.	30	20	10	--	40	100
EMM 205	Projects Management	-----	2	2	0	1	3	2 hrs.	30	20	10	--	40	100
EME 207	Electrical Power Systems	EME 106	3	2	0	2	4	2 hrs.	30	20	10	--	40	100
EMM 209	Design of Machine Elements	EMM 104 &EMM 110	3	2	1	2	5	2 hrs.	30	--	10	20	40	100
			17	12	4	9	25							600

Level 2- 2														
CODE	Course Name	Pre-requisites	Cr. Hrs.	Ct. Hrs.				Final Exam Time	Assessment					
				Lec	Lab.	Tut.	Sum		Mid 1	Mid 2	St. Act.	PE/OE	Final	sum
FRB 206	Multiple Integrals & Complex Analysis	FRB 002	3	2	0	2	4	2 hrs.	30	20	10	--	40	100
EMM 202	Vibrations and System Dynamics	EMM 103, EMM 107	3	2	0	2	4	2 hrs.	30	20	10	--	40	100
EMM 204	Plumbing Systems	EMM 102	3	2	0	2	4	2 hrs.	30	20	10	--	40	100
EME 206	Electronic Devices and Circuits	EME 201	3	2	0	2	4	2 hrs.	30	20	10	--	40	100
EMM 208	Fluid Machinery	EMM 102	3	2	0	2	4	2 hrs.	30	20	10	--	40	100
EME 210	Electric Power Distribution Systems	EME 207	3	2	1	2	5	2 hrs.	30	--	10	20	40	100
			18	12	1	12	25							600

Field Training II													
CODE	Course Name	Pre-requisites	Cr. Hrs.	Ct. Hrs.				Final Exam Time	Assessment				
				Lec	Lab	Tut.	Sum		Mid 1	Mid 2	St. Act.	Final	sum
FT 203	Field Training II	Completion of 96 CR. HRS.	0	0	0	0	0	--	--	--	--	--	Pass / Fail

Level 3- 1														
CODE	Course Name	Pre-requisites	Cr. Hrs.	Ct. Hrs.				Final Exam Time	Assessment					
				Lec	Lab.	Tut.	Sum		Mid 1	Mid 2	St. Act.	PE/OE	Final	sum
EMM 301	Refrigeration	EMM 112	2	2	0	1	3	2 hrs.	30	20	10	--	40	100
EMM 303	Air Conditioning Systems	EMM 112	3	2	0	2	4	2 hrs.	30	20	10	--	40	100
EME 305	Low Current Distribution Systems	EME 210	3	2	0	2	4	2 hrs.	30	20	10	--	40	100
EMM 307	Fire Fighting Systems	EMM 102	3	2	0	2	4	2 hrs.	30	20	10	--	40	100
EMM 309	Combustion	EMM 112	3	2	0	2	4	2 hrs.	30	20	10	--	40	100
UHS XXX	Humanities Elective I	-----	2	2	0	0	2	2 hrs.	30	20	10	--	40	100
UHS XXX	Humanities Elective II	-----	2	2	0	0	2	2 hrs.	30	20	10	--	40	100
			18	14	0	9	23							700

Level 3- 2														
CODE	Course Name	Pre-requisites	Cr. Hrs.	Ct. Hrs.				Final Exam Time	Assessment					
				Lec	Lab.	Tut.	Sum		Mid 1	Mid 2	St. Act.	PE/OE	Final	sum
EMM 302	Refrigeration and AC Systems/Components	EMM 301 &EMM 303	3	2	1	1	4	2 hrs.	30	--	10	20	40	100
EME 304	Automatic Control	EME 106	2	2	0	1	3	2 hrs.	30	20	10	--	40	100
EMM 3XX	Elective I	*	3	2	0	2	4	2 hrs.	30	20	10	--	40	100
EME 3XX	Elective II	*	3	2	0	2	4	2 hrs.	30	20	10	--	40	100
EMM 3XX	Elective III	*	3	2	0	2	4	2 hrs.	30	20	10	--	40	100
EMM 390	Senior Design Project I	**	2	0	4	0	4	2 hrs.	--	--	50	--	50	100
UHS 104	Professional Ethics	-----	2	2	0	0	2	2 hrs.	30	20	10	--	40	100
			18	12	5	8	25							700

* According to the Course Name

**The student can register for the Senior Design Project course after passing 70% of the program cr. hrs, i.e., 112 Credit. Hours

	Level 4- 1													
CODE	Course Name	Pre-requisites	Cr. Hrs.	Ct. Hrs.				Final Exam Time	Assessment					
				Lec	Lab.	Tut.	Sum		Mid 1	Mid 2	St. Act.	PE/OE	Final	sum
EMM 401	Computer Applications in El/Mec System	EME 305 & EMM 303	2	1	2	0	3	2 hrs.	30	--	10	20	40	100
EMM 403	Process Control and Building management System	EME 304	2	2	0	1	3	2 hrs.	30	20	10	--	40	100
EMM 3XX	Elective IV	*	3	2	0	2	4	2 hrs.	30	20	10	--	40	100
EME 3XX	Elective V	*	3	2	0	2	4	2 hrs.	30	20	10	--	40	100
EMM 3XX	Elective VI	*	3	2	0	2	4	2 hrs.	30	20	10	--	40	100
UHS XXX	Humanities Elective III	-----	2	2	0	0	2	2 hrs.	30	20	10	--	40	100
EMM 490	Senior Design Project II	EMM 390	3	1	4	0	5	2 hrs.	--	--	50	--	50	100
			18	12	6	7	25							700

* According to the Course Name

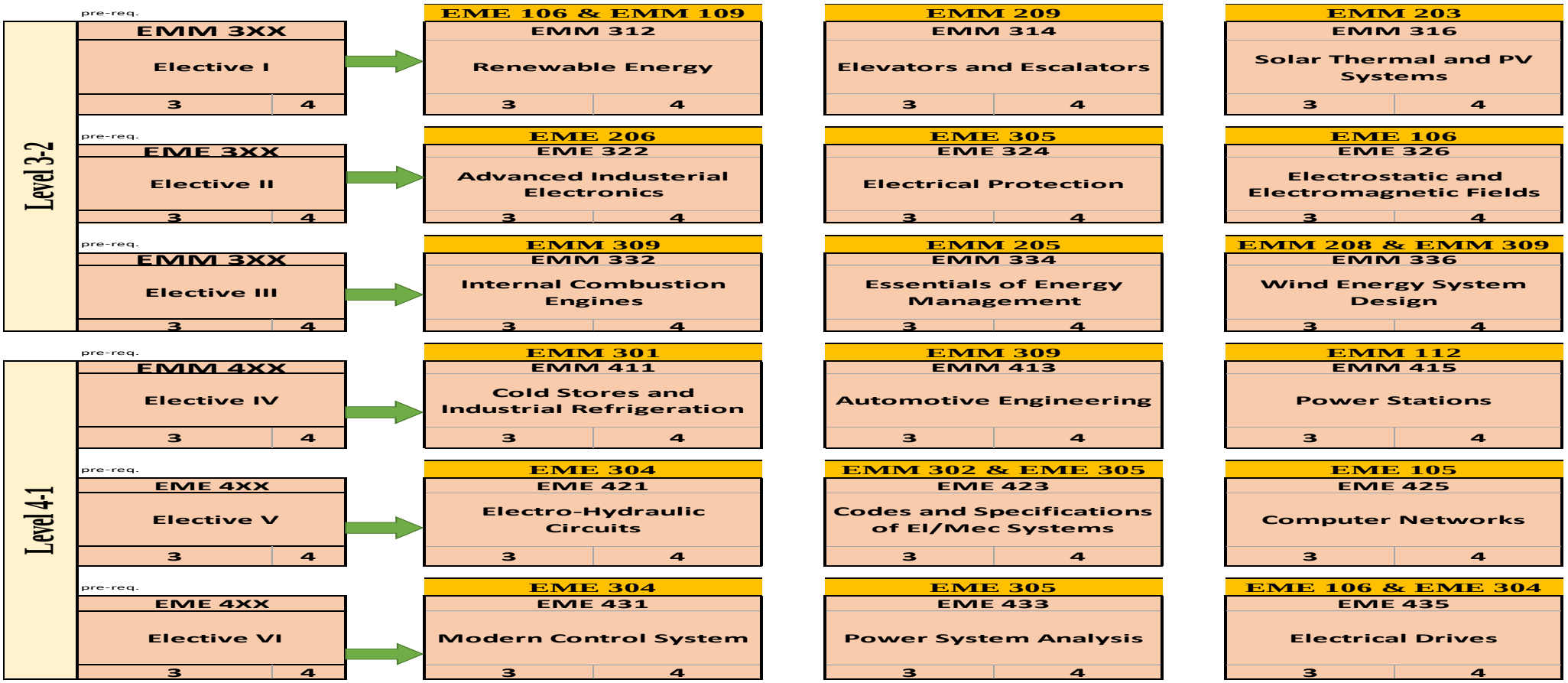
Electromechanical Engineering Program Map

EM Engineering Program Map

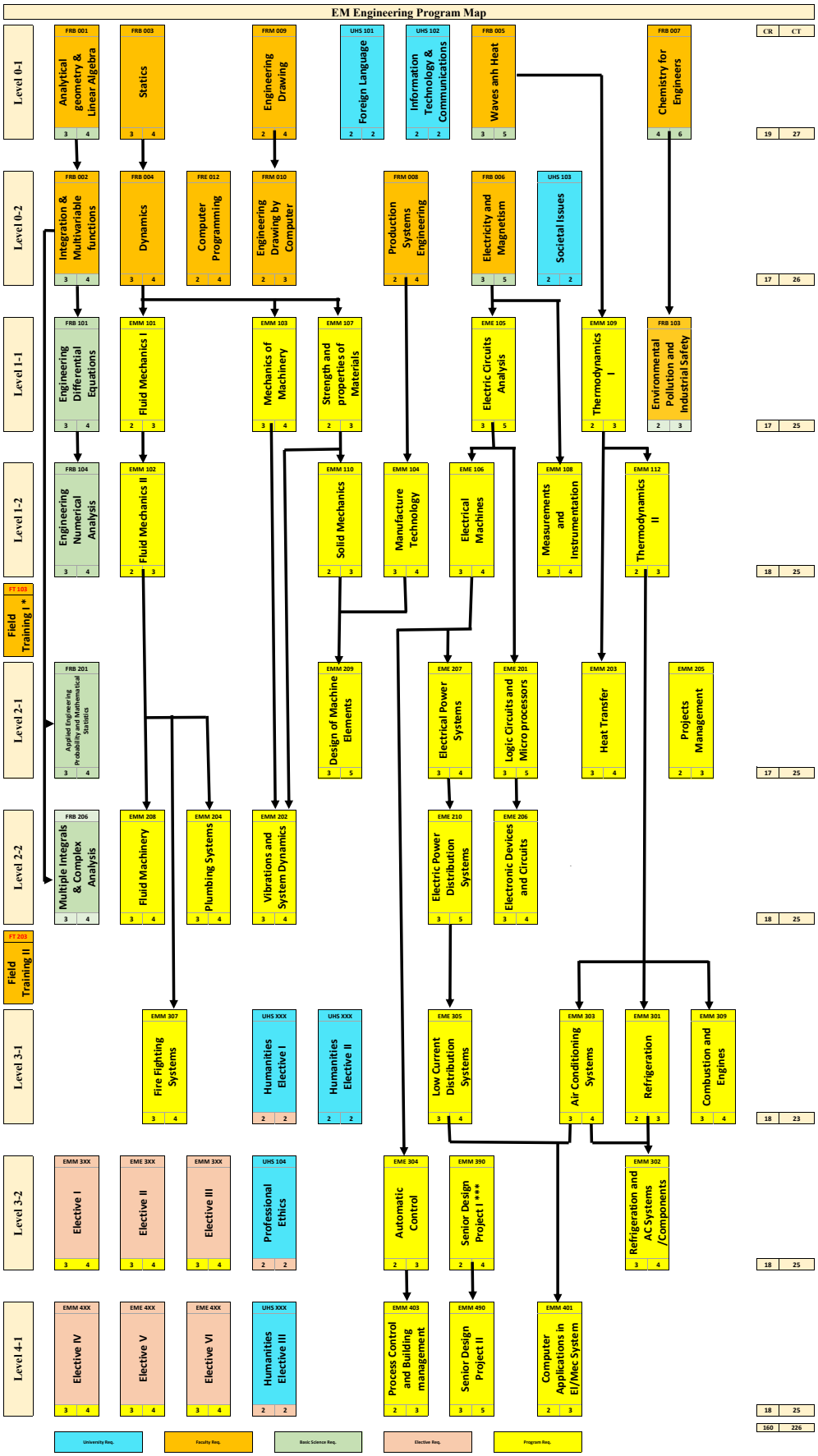
								CR	CT
Level 0-1	FRB 001 Analytical geometry & Linear Algebra 3 4	FRB 003 Statics 3 4	FRB 005 Waeves and Heat 3 5	FRB 007 Chemistry for Engineers 4 6	FRM 009 Engineering Drawing 2 4	UHS 101 Foreign Language 2 2	UHS 102 Information Technology & Communications 2 2	19	27
Level 0-2	FRB 002 Integration & Multivariable functions 3 4	FRB 004 Dynamics 3 4	FRB 006 Electricity and Magnetism 3 5	FRM 008 Production Systems Engineering 2 4	FRM 010 Engineering Drawing by Computer 2 3	UHS 103 Societal Issues 2 2	FRE 012 Computer Programming 2 4	17	26
Level 1-1	FRB 101 Engineering Differential Equations 3 4	EMM 101 Fluid Mechanics I 2 3	EMM 103 Mechanics of Machinery 3 4	FRB 103 Environmental Pollution and Industrial Safety 2 3	EME 105 Electric Circuits Analysis 3 5	EMM 107 Strength and properties of Materials 2 3	EMM 109 Thermodynamics I 2 3	17	25
Level 1-2	FRB 104 Engineering Numerical Analysis 3 4	EMM 102 Fluid Mechanics II 2 3	EMM 104 Manufacture Technology 3 4	EME 106 Electrical Machines 3 4	EMM 108 Measurements and Instrumentation 3 4	EMM 110 Solid Mechanics 2 3	EMM 112 Thermodynamics II 2 3	18	25
	FT 103 Field Training I								
Level 2-1	FRB 201 Applied Engineering Probability and Mathematical Statistics 3 4	EME 201 Logic Circuits and Micro processors 3 5	EMM 203 Heat Transfer 3 4	EMM 205 Projects Management 2 3	EME 207 Electrical Power Systems 3 4	EMM 209 Design of Machine Elements 3 5		17	25
Level 2-2	FRB 206 Multiple Integrals & Complex Analysis 3 4	EMM 202 Vibrations and System Dynamics 3 4	EMM 204 Plumbing Systems 3 4	EME 206 Electronic Devices and Circuits 3 4	EMM 208 Fluid Machinery 3 4	EME 210 Electric Power Distribution Systems 3 5		18	25
	FT 203 Field Training II								
Level 3-1	EMM 301 Refrigeration 2 3	EMM 303 Air Conditioning Systems 3 4	EME 305 Low Current Distribution Systems 3 4	EMM 307 Fire Fighting Systems 3 4	EMM 309 Combustion 3 4	UHS XXX Humanities Elective I 2 2	UHS XXX Humanities Elective II 2 2	18	23
Level 3-2	EMM 302 Refrigeration and AC Systems/Components 3 4	EME 304 Automatic Control 2 3	EMM 3XX Elective I 3 4	EME 3XX Elective II 3 4	EMM 3XX Elective III 3 4	EMM 390 Senior Design Project I 2 4	UHS 104 Professional Ethics 2 2	18	25
Level 4-1	EMM 401 Computer Applications in EI/Mec System 2 3	EMM 403 Process Control and Building management System 2 3	EMM 4XX Elective IV 3 4	EME 4XX Elective V 3 4	EME 4XX Elective VI 3 4	EMM 490 Senior Design Project II 3 5	UHS XXX Humanities Elective III 2 2	18	25
								160	276

Elective Courses Map:

EM Engineering Program - Elective Courses Map



Electromechanical Engineering Flowchart



6.3 Matrix of Program Learning Outcomes and Courses

Level	Code	Title	PL O1	PL O2	PL O3	PL O4	PL O5	PL O6	PL O7	PL O8	PL O9	PL O10	PL O11	PL O12	PL O13	PL O14	PL O15	PL O16	PL O17	PL O18
Level 0-1	FRB 001	Analytical geometry & Linear Algebra	•		•															
	FRB 003	Statics	•	•																
	FRB 005	Waves and Heat	•	•																
	FRB 007	Chemistry for Engineers	•	•																
	FRM 009	Engineering Drawing						•		•										
	UHS 102	Information and Communication Technology										•								
	UHS 101	Foreign Language								•		•								
Level 0-2	FRB 002	Integration & Multivariable functions	•		•															
	FRB 004	Dynamics	•	•																
	FRB 006	Electricity and Magnetism	•	•																
	FRM 008	Production Systems Engineering				•		•												
	FRM 010	Engineering Drawing by Computer				•				•										
	FRE 012	Computer Programming	•		•						•									
	UHS 103	Societal issues				•						•								

Level	Code	Title	PL O1	PL O2	PL O3	PL O4	PL O5	PL O6	PL O7	PL O8	PL O9	PL O10	PL O11	PL O12	PL O13	PL O14	PL O15	PL O16	PL O17	PL O18
Level 1-1	FRB 101	Engineering Differential Equations	•	•																
	EMM 101	Fluid Mechanics I		•									•							
	EMM 103	Mechanics of Machinery			•					•				•		•				
	FRB 103	Environmental Pollution and Industrial Safety	•	•		•														
	EME 105	Electric Circuits Analysis	•	•														•	•	
	EMM 107	Strength and properties of Materials		•									•							
	EMM 109	Thermodynamics I	•	•									•	•						
Level 1-2	FRB 104	Engineering Numerical Analysis	•	•																
	EMM 102	Fluid Mechanics II	•	•									•		•					
	EMM 104	Manufacture Technology						•					•							
	EME 106	Electrical Machines					•									•	•			
	EMM 108	Measurements and Instrumentation		•												•	•			•
	EMM 110	Solid Mechanics		•									•							
	EMM 112	Thermodynamics II	•	•									•	•						
	FT 103	Field Training I							•			•								

Level	Code	Title	PL O1	PL O2	PL O3	PL O4	PL O5	PL O6	PL O7	PL O8	PL O9	PL O10	PL O11	PL O12	PL O13	PL O14	PL O15	PL O16	PL O17	PL O18
Level 2-1	FRB 201	Applied Engineering Probability and Mathematical Statistics	●	●																
	EME 201	Logic Circuits and Micro processors		●	●												●	●		
	EMM 203	Heat Transfer	●	●									●		●					
	EMM 205	Projects Management								●	●									
	EME 207	Electrical Power Systems															●	●		
	EMM 209	Design of Machine Elements			●					●				●		●				
Level 2-2	FRB 206	Multiple Integrals & Complex Analysis	●	●																
	EMM 202	Vibrations and System Dynamics	●	●									●	●						
	EMM 204	Plumbing Systems	●	●									●		●					
	EME 206	Electronic Devices and Circuits		●									●					●	●	●
	EMM 208	Fluid Machinery	●	●									●		●					
	EME 210	Electric Power Distribution Systems														●	●			
	FT 203	Field Training II							●			●								
Level 3-1	EMM 301	Refrigeration	●	●									●	●						
	EMM 303	Air Conditioning Systems	●	●									●	●						

Level	Code	Title	PL O1	PL O2	PL O3	PL O4	PL O5	PL O6	PL O7	PL O8	PL O9	PL O10	PL O11	PL O12	PL O13	PL O14	PL O15	PL O16	PL O17	PL O18
	EME 305	Low Current Distribution Systems														●	●			
	EMM 307	Fire Fighting Systems	●	●									●		●					
	EMM 309	Combustion	●	●									●	●						
	UHS XXX	Humanities Elective I	Refer to the next two courses																	
Humanities Elective I	UHS 201	Principles of Entrepreneurship and Project Management						●			●									
	UHS 203	Human Resources Management						●			●									
Level 3-1	UHS XXX	Humanities Elective II	Refer to the next two courses																	
Humanities Elective II	UHS 301	Communication and Presentation Skills								●	●									
	UHS 302	Leadership Skills								●	●									
Level 3-2	EMM 302	Refrigeration and AC Systems/Components	●	●									●	●						
Level 3-2	EME 304	Automatic Control	●		●								●	●					●	●
Level 3-2	EMM 3XX	Elective I	Refer to the next three courses																	
Elective I	EMM 312	Renewable Energy											●	●			●			
	EMM 314	Elevators and Escalators											●	●			●			
	EMM 316	Solar Thermal and PV Systems											●	●			●			
Level	EME	Elective II	Refer to the next three courses																	

Level	Code	Title	PL O1	PL O2	PL O3	PL O4	PL O5	PL O6	PL O7	PL O8	PL O9	PL O10	PL O11	PL O12	PL O13	PL O14	PL O15	PL O16	PL O17	PL O18
3-2	3XX																			
Elective II	EME 322	Advanced Industrial Electronics														•		•	•	
	EME 324	Electrical Protection														•		•	•	
	EME 326	Electrostatic and Electromagnetic Fields														•		•	•	
Level 3-2	EMM 3XX	Elective III	Refer to the next three courses																	
Elective III	EMM 332	Internal Combustion Engines	•	•									•	•	•					
	EMM 334	Essentials of Energy Management	•	•									•	•	•					
	EMM 336	Wind Energy System Design	•	•									•	•	•					
Level 3-2	EMM 390	Senior Design Project I					•	•	•	•	•	•								
Level 3-2	UHS 104	Professional Ethics				•						•								
Level 4-1	EMM 401	Computer Applications in El/Mec System											•				•	•		
Level 4-1	EMM 403	Process Control and Building management System											•	•					•	•
Level 4-1	EMM 4XX	Elective IV	Refer to the next three courses																	
Elective IV	EMM 411	Cold Stores and Industrial Refrigeration	•	•									•	•	•					
	EMM 413	Automotive Engineering	•	•									•	•	•					
	EMM 415	Power Stations	•	•									•	•	•					

Level	Code	Title	PL O1	PL O2	PL O3	PL O4	PL O5	PL O6	PL O7	PL O8	PL O9	PL O10	PL O11	PL O12	PL O13	PL O14	PL O15	PL O16	PL O17	PL O18
Level 4-1	EME 4XX	Elective V	Refer to the next three courses																	
Elective V	EME 421	Electro-Hydraulic Circuits				•							•	•		•				
	EME 423	Codes and Specifications of El/Mec Systems				•							•	•		•				
	EME 425	Computer Networks				•							•	•		•				
Level 4-1	EME 4XX	Elective VI	Refer to the next three courses																	
Elective VI	EME 431	Modern Control System															•	•	•	
	EME 433	Power System Analysis															•	•	•	
	EME 435	Electrical Drives															•	•	•	
Level 4-1	EMM 490	Senior Design Project II					•	•	•	•	•	•								
Level 4-1	UHS XXX	Humanities Elective III	Refer to the next two courses																	
Humanities Elective III	UHS 801	Research Methodologies					•					•								
	UHS 803	Thinking Skills					•					•								

Courses Coding System

The course coding system is composed of three letters that denotes the department which offers the course, followed by 3 digits: where:

- the first digit from left represents the course level (from 1 to 5),
- the next two digits represent the course sequence (odd for Fall Semesters and even for Spring Semesters).

The coding system is demonstrated in the following table:

UHS XXX	University Requirement Courses
FRB XXX	Courses offered by Basic Engineering Science Department
FRM XXX	Course offered by Mechanical Engineering Department for Faculty Requirement
FRE XXX	Course offered by Electrical Engineering Department for Faculty Requirement
EMM XXX	Course offered by Mechanical Engineering Department
EME XXX	Course offered by Electrical Engineering Department

Pre-req	Prerequisite	**Cr. Hrs.**	Credit Hours	**Std. Act.**	Student Activity
Lec	Lectures	**Tut**	Tutorials	**Lab**	Laboratory
MT1	First Midterm Exam	**MT2**	Second Midterm Exam	**Final**	Final Exam

Program Requirements

Compulsory Courses

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hrs.				Assessment			
				Lec	Lab.	Tut.	Sum	MT1	MT2	Std. Act.	Final
FRB 101	Engineering Differential Equations	FRB 002	3	2	0	2	4	30	20	10	40
Course Contents	**Basic Concepts of Ordinary and Partial differential equations (ODEs & PDEs):** Oder, Degree, Linearity, Formation, Geometric and physical applications (Newtons law of cooling, electric circuits), Types of solutions, Existence and uniqueness of solutions. **ODEs:** Solution of first order ODEs (Separable, Homogeneous, Exact, Integrating factor, Linear and Bernoulli equations). Orthogonal trajectories. Solution of nth order ODEs (homogeneous and non-homogeneous). System of first order linear differential equations. Laplace transforms and inverse Laplace transforms with applications. Fourier series with applications. Gamma and Beta functions **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 Name	Pre-req.	Cr. Hrs.	Ct. Hrs.				Assessment			
				Lec	Lab.	Tut.	Sum	MT1	PE/OE	Std. Act.	Final
FRB 104	Engineering Numerical Analysis	FRB 101	3	2	2	0	4	30	20	10	40
Course Contents	**Numeric in General:** Solution of linear systems by iterative methods (Jacobi Iteration, Gauss–Seidel Iteration Method, Convergence and Matrix Norms). Solution of nonlinear equations (Fixed-Point Iteration, Newton–Raphson's method, Sufficient Convergence Condition). Curve fitting (Least square method). Interpolations (Lagrange Interpolation, Newton's Forward and Backward Interpolations). Numerical differentiation. Numerical integration (Rectangular Rule, Trapezoidal Rule, Simpson's Rule). **Numeric for ODEs and PDEs:** Solution of first-order ODEs (Euler's method, Runge–Kutta Methods). Solution of higher order ODEs. Boundary and initial-boundary value problems for ODEs, Elliptic and parabolic PDEs (Finite difference methods, Explicit method, Crank–Nicolson Method). 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 Name	Pre-req.	Cr. Hrs.	Ct. Hrs.				Assessment			
				Lec	Lab.	Tut.	Sum	MT1	PE/OE	Std. Act.	Final
FRB 201	Applied Engineering Probability and Mathematical Statistics	FRB 002	3	2	2	0	4	30	20	10	40
Course Contents	**Probability:** Basic Theorems of Probability. Conditional Probability. Independent Events. Discrete and Continuous Random Variables. Mean and Variance of Distributions. Discrete Distributions (Binomial, Poisson and Hypergeometric Distribution). Continuous Distributions (Normal and Exponential Distribution). Distributions of Several Random Variables (Discrete and Continuous Two-Dimensional Distributions). **Mathematical Statistics:** Random Sampling. Sample mean and variance. Point Estimation of Parameters. Confidence Intervals. Simple and multiple Linear Regression and Correlation. Testing of Hypotheses. Markov chains. Quality Control. Engineering Applications. 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. Hrs.				Assessment			
EMM 101	Fluid Mechanics I	FRB 004	2	Lec.	Lab	Tut	Sum	MT1	MT2	Std. Act.	Final
				2	0	1	3	30	20	10	40
Course Content	Fundamental notions; Physical properties of Fluids, Fluid viscosity and its importance's, viscous and non-viscous flow, compressibility and surface tensions and their applications on practical problems, fluid statics, buoyancy and stability of floating and immersed bodies, fluid in rigid body motion, fluid kinematics and Foundations of flow analysis; basic laws for finite systems and finite control volumes, differential forms of the basic laws, dimensional analysis and similitude analysis; Types of Flow (steady, uniform, Incompressible viscous flow, General viscous flows , Potential flow).										
References	• Frank M white "Fluid Mechanics", 8th edition 2015 • Munson, Young, and Okiishi, 2009, "Fundamentals of Fluid Mechanics", 7th Ed., Wiley. • T. C. Clayton, F. E. Donald, and A. R. John, 2006,"Engineering Fluid Mechanics", John Wiley & Sons, Inc., 8th Ed.										
Laboratory	• Determination of fluid properties • Hydrostatic pressure measurement • Determination of pressure force on submerged surface • Application of continuity equation for the flow through pipes • Apparatus of impact water jet										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hrs.				Assessment			
FRB 206	Multiple Integrals & Complex Analysis	FRB 002	3	Lec.	Lab	Tut	Sum	MT 1	MT 2	Std. Act.	Final
				2	0	2	4	30	20	10	40
Course Content	**Multiple Integrals:** Double integrals (Areas, Volumes, Moments, Double integrals in polar form). Triple integrals (Volumes, Masses and Moments in three dimensions, Triple integrals in cylindrical and spherical coordinates). Substitution in multiple integrals. line and surface integrals, Green, Stock's and Divergence theorems. **Complex Analysis:** Complex Numbers, Complex plane, Polar form of complex number, Powers and roots, Complex Function, Limit, Continuity, Derivative, Cauchy-Riemann equations, Laplace's Equation, Complex integration. Taylor and Laurent Series. Residue Integration. Conformal Mapping (linear function, Linear Fractional Transformations (or Möbius transformations), irrational functions, the exponential function, trigonometric functions).										
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. Hrs.				Assessment			
EMM 102	Fluid Mechanics II	EMM 101	2	Lec.	Lab	Tut	Sum	MT1	MT2	Std. Act.	Final
				2	0	1	3	30	20	10	40
Course Content	Introduction to the theory and application of continuum fluid mechanics, Fluid properties and state relations. Incompressible laminar and turbulent flow using control volume, Reynolds Transport Theorem, and momentum and energy equations. Navier-Stokes Equations, Dimensional analysis, Buckingham Pi Theorem, and modeling. Flow rate, pipe sizing and minor losses in pipe systems. Compressible flow and gas dynamics in boundary layer theory, mach number, stagnation properties and shock waves.										
References	• Frank M white "Fluid Mechanics", 8th edition 2015 • Munson, Young, and Okiishi, 2009, "Fundamentals of Fluid Mechanics", 7th Ed., Wiley. • T. C. Clayton, F. E. Donald, and A. R. John, 2006,"Engineering Fluid Mechanics", John Wiley & Sons, Inc., 8th Ed.										
Laboratory	• Satisfying of the Bernoulli's theorem • Demonstration of the flow through orifice and free jet • Determination of the friction losses through pipes • Determination of the minor losses through pipe connections										

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hrs.				Assessment			
				Lec	Lab	Tut	Sum	MT1	MT2	Std. Act.	Final
EMM 103	Mechanics of Machinery	FRB 004	3	2	0	2	4	30	20	10	40
Course Contents	A study of the fundamental concepts underlying the study of velocity, acceleration, and force analysis of machines; linkages, cams, gears, and flywheels; balancing of rotating and reciprocating machine elements.										
References	• R.S. Khurmi and J K Gupta "Theory of Machines", S Chand & Co Ltd; 14th edition, 2005. • John J. Uicker, Jr., Gordon R. Pennock, Joseph E. Shigley "Theory of Machines and Mechanisms", Oxford University Press, 2017.										

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hrs.				Assessment				
				Lec	Lab	Tut	Sum	MT 1	MT 2	Std. Act.	PE/ OE	Final
EMM 104	Manufacture Technology	FRM 008	3	2	2	0	4	30	--	10	20	40
Course Contents	Metal Casting Technology: solidification process, metals and alloys, production of primary metals, production of shaped casting, sand casting (moulding, melting, pouring, solidification, cleaning, defects, and inspection). Contemporary casting processes (metallic mould, electro-slag, precision, and centrifugal casting). Metal Forming Technology: Hot and cold working of metals, metal forming processes (rolling, forging, drawing, extrusion and spinning), pipe and tube manufacturing, joining technology (fastening, riveting, soldering, and brazing, welding, and adhesive bonding). Welding: submerged arc welding, spot and seam welding, plasma welding, cold pressure welding, adhesive welding, testing of welded joints. Welding operations for ferrous metals – thermal welding – Oxy-Acy welding Metal cutting technology: Cutting tools, metal cutting machine tools (turning, drilling, boring, milling, shaping, planning, broaching, grinding, special purpose, gear and thread cutting and super finishing machine tools).											
References	Andrew Y. C. Nee, 2015, “Handbook of Manufacturing Engineering and Technology,” Springer-Verlag London. Rajender Singh, 2006, " Introduction to basic manufacturing processes and workshop technology ", New age international publishers.											
Laboratory	Students make different mechanical models in all the following workshops: • Casting workshop • Metal forming technology • Welding • Metal cutting workshop											

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hrs.				Assessment				
				Lec	Lab	Tut	Sum	MT 1	MT 2	Std. Act.	PE/ OE	Final
EME 105	Electric Circuits Analysis	FRB 006	3	2	1	2	5	30	--	10	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”, 2020. Pearson Education Limited.
Laboratory	Verify laws and theorems in the course using experiments, project construction and simulation, the topics include: • Ohm’s Law • Series/parallel connection circuit for resistance • Kirchhoff’ • Wheats • Capacitance Circuit • Inductance Circuit • RC & RL Circuit • LC Resonance Circuit

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hrs.				Assessment			
				Lec.	Lab	Tut	Sum	MT1	MT2	Std. Act.	Final
EME 106	Electric Machines	EME 105	3	2	0	2	4	30	20	10	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, Operation, Applications, Adjustment, and Control-Second Edition, 2002. • Sen, P.C., Introduction to Electrical Machines and Power Electronics - First edition, Pitman										
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. Hrs.				Assessment			
				Lec	Lab	Tut	Sum	MT1	MT2	Std. Act.	Final
EMM 107	Strength and Properties of Materials	FRB 004	2	2	0	1	3	30	20	10	40
Course Contents	Introduction to engineering materials, Mechanics of deformable bodies: stress/strain, strain gages, material property relationships, classification of material behaviour, generalized Hooke's law. Engineering applications: axial loads, torsion of circular rods and tubes, bending and shear stresses in beams, deflection of beams, combined stresses, stress and strain transformation, Microstructure of solid materials, Strengthening mechanisms, Types of Steel and their alloys, Materials selection. Phase diagram, Mechanical properties of materials, Electrical and magnetic properties of materials, Optical properties of materials.										
References	R. C. Hibbeler “Mechanics of Materials” Prentice Hall; 8th edition, 2010.										
Laboratory	• Tensile Test • Fatigue Test • Application of Mechanical Load Cell • Shear Test • Impact Test • Creep Test • Hardness Test • Compression Test • Examination of Material Microstructure. • Torsion Test										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hrs.				Assessment			
EMM 108	Measurements and Instrumentation	FRB 006	3	Lec.	Lab	Tut	Sum	MT 1	MT 2	Std. Act.	Final
				2	0	2	4	30	20	10	40
Course Content	Introduction, Error analysis and accuracy, Operating principles of sensors and transducers- Analog measuring instruments. General consideration for selection and evaluation of measurement equipment. Measuring of mechanical quantities (Temperatures, Pressures static and dynamic, Flow, and velocity, stress and strain,) Measurement of Electric quantities (currents, voltage, resistance, power). Comparisons methods for measurements. Active and reactive power measurements. Oscilloscopes. Digital millimeters- Uncertainty analysis.										
References	• Alan S. Morris, 2001, "Measurement and instrumentation principles", 3rd edition, Alan S Moris Publisher: Butterworth-Heinemam. • Richard S. Figliola and Clemson University, "Theory and Design for Mechanical Measurements", 5th edition, John Wiley & Sons, Inc., 2011.										
Laboratory	• Measuring Temperature (Mechanical Methods) • Measuring Temperature (Electrical Methods) • Measuring Pressure (Mechanical Methods) • Measuring Pressure (Electrical Methods) • Flow Measuring Instruments: Orifice Meter, Venturi Meter, Flow Nozzle, Pitot Tube, Movable Vane, ultrasonic										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hrs.				Assessment			
EMM 109	Thermodynamics I	FRB 005	2	Lec.	Lab	Tut	Sum	MT 1	MT 2	Std. Act.	Final
				2	0	1	3	30	20	10	40
Course Content	Definitions and basic concepts of thermodynamic systems, Properties of pure substances, phase change process, ideal gas. Work and Heat, First law of thermodynamics (closed system, unsteady and steady flow open systems, applications). Second law of thermodynamics (Heat engines and refrigerators, reversible and irreversible process, Carnot cycle). Entropy (Clausis inequality, entropy, increase of entropy principles, entropy change of pure substances, solids and liquids, entropy changes of ideal gases, adiabatic efficiency of process). Refrigeration Cycles (Refrigerators and Heat Pumps, The Reversed Carnot Cycle)										
References	• Yunus A.Cengel Michael A.Boles, 2014, "Thermodynamics An Engineering Approach", McGraw Hill Education; 8th edition.										
Laboratory	• Identification and recognition of the application of work and heat • Identification and recognition of the application of the first law • Identification and recognition of the application of the second law • Computer controlled expansion processes of a perfect gas unit										

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hrs.				Assessment			
				Lec	Lab	Tut	Sum	MT1	MT2	Std. Act.	Final
EMM 110	Solid Mechanics	EMM 107	2	2	0	1	3	30	20	10	40
Course Contents	Fundamental principles and methods of structural mechanics: static equilibrium, force resultants, support conditions, analysis of determinate planar structures (beams, trusses, frames), stresses and strains in structural elements, states of stress (shear, bending, torsion), statically indeterminate systems, displacements and deformations, introduction to matrix methods, elastic stability, and approximate methods. Design exercises to encourage creative student initiative and systems thinking.										
References	Professor Louis L. Bucciarelli, "Engineering Mechanics for Structures", Courier Dover Publications, 2009 - Technology & Engineering										
Laboratory	• Cable Structures • Uniaxial Tension • Truss Structures • Concrete Failure • Beam Bending • Buckling										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hrs.				Assessment			
EMM 112	Thermodynamics II	EMM 109	2	Lec.	Lab	Tut	Sum	MT 1	MT 2	Std. Act.	Final
				2	0	1	3	30	20	10	40
Course Content	Vapor and Combined Power Cycles (The Carnot Vapor Cycle, Rankine Cycle). Gas power cycles (air standard assumptions, Otto and Diesel cycles, Striling and Ericsson cycles, Brayton cycle, Brayton cycle with intercooling, reheating and regeneration, ideal jet prolusion cycle). Gas Mixtures (Composition of a Gas Mixture: Mass and Mole Fractions, P-v- T Behavior of Gas Mixtures: Ideal and Real Gases). Chemical Reactions (Fuels and Combustion, Theoretical and Actual Combustion Processes, Enthalpy of Formation and Enthalpy of Combustion, First-Law Analysis of Reacting Systems, Adiabatic Flame Temperature. Heat of combustion, fuel heating values, constant volume combustion and constant pressure combustion,										
References	• Yunus A.Cengel Michael A.Boles, 2014, "Thermodynamics An Engineering Approach", McGrawHill Education; 8th edition.										
Laboratory	investigate the thermodynamics components such as turbine, compressor, pump, boiler, condenser, etc.										

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hrs.				Assessment				
				Lec	Lab	Tut	Sum	MT 1	MT 2	Std. Act.	PE/ OE	Final
EME 201	Logic Circuits and Micro processors	EME 105	3	2	1	2	5	30	--	10	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	• Floyd, Thomas L, "Digital Fundamentals", Pearson Education 11ED • M. Morris R. Mano, Michael D. Ciletti, "Digital Design: With an Introduction to the Verilog HDL, VHDL, and System Verilog" 6th Edition • John Wakerly, "Digital Design: Principles and Practices", 5th Edition
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. Hrs.				Assessment			
				Lec.	Lab	Tut	Sum	MT 1	MT 2	Std. Act.	Final
EM M 202	Vibrations and System Dynamics	EMM 103, EMM 107	3	2	0	2	4	30	20	10	40

Course Content	Foundation of mechanical systems, mathematical models of mechanical systems, systems modeling, electromechanical systems. Explore necessary algorithms to solve equations of motion, Laplace transform, matrix method, computer generated solutions. Dynamic response and evaluation of first and second order systems, oscillating motion with single DOF, measuring and analysis methods, damping of free motion. Isolation of vibration, vibration of two DOF, vibration of multi-degree of freedom system. Numerical methods for evaluation of natural frequency and patterns, design of frequency absorbers.
References	• Ahmed A. Shabana, "Theory of Vibration, An Introduction", Springer, 3rd edition, 2019 • Rao, S.S., and A. Weiley, "Mechanical vibrations", 4th edition, Prentice Hall, 1995
Laboratory	• Validation of a pendulum dynamics and estimation of gravitational acceleration. • Verification of mass-spring system and estimation of spring stiffness. • Estimation of the moment of inertia for a wheel and the damping condition. • Vibration measurement methods, Double cantilever test. • Computer-aided simulation and case studies, course project

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hrs.				Assessment			
EMM 203	Heat Transfer	EMM 109	3	Lec.	Lab	Tut	Sum	MT 1	MT 2	Std. Act.	Final
				2	0	2	4	30	20	10	40
Course Content	Thermal Conduction: Steady 1D Conduction, Plane Wall, Composite Plane Wall, Convection, Overall Heat Transfer Coefficient, Cylindrical Shell, Spherical Shell, Extended Surfaces (Fins), Conduction with Variable Thermal Conductivity, Steady 2D Conduction, Transient Conduction, Periodic Conduction. Convection: Types of Convection, Dimensionless Groups, Dimensional Analyses and similitude, Natural Convection, Forced Convection. Heat Exchanger. Thermal Radiation: Setfan-Boltzmann Law, Planck's Law, Radiation Properties of Real Surfaces, Emissivity and Absorptivity, Kirchoff's Law, Emissivity of Real Surfaces, Gray Surfaces, Selective Surfaces, Heat Exchange by Radiation, Heat Exchange between Two Planes, Heat Exchange between Two Cylinders or Spheres.										
References	• Incropera and De Witt, Fundamentals of heat and mass transfer, 7th Edition, 2012. • Yunus A. Cengel, "Heat Transfer: A Practical Approach", 2nd ed., McGraw-Hill, 2015										
Laboratory	• Determination of the heat conductivity of solids • Steady heat conduction in bars • Steady convection in non-homogeneous bars • Steady convection in homogeneous bars • Steady conduction in homogeneous radial patterns • Heat exchangers: parallel and counter flow heat exchangers • Thermocouples calibration test rig • Combined forced convection and radiation										

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hrs.				Assessment			
				Lec	Lab	Tut	Sum	MT1	MT2	Std. Act.	Final
EMM 204	Plumbing Systems	EME 102	3	2	0	2	4	30	20	10	40
Course Contents	Types of water services in buildings and facilities. Codes and standards for water supply and drainage systems. Water demands estimation, Systems of domestic water circulation, sizing of domestic water storage and piping system, Domestic hot water system and heating capacity, Sanitary drainage system (single pipe system, two pipes system, plumbing fixtures and fixtures units, sizing of drainage water piping system, sump pits and sump pumps, Rainwater drainage system, Ventilation system.										
References	• Tim Wentz, "Plumbing Systems: Analysis, Design, and Construction" Prentice Hall; 1st edition, 1996.										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hrs.				Assessment			
EMM 205	Projects Management	---	2	Lec.	Lab	Tut	Sum	MT1	MT2	Std. Act.	Final
				2	0	1	3	30	20	10	40
Course Content	Introduction to Project planning and scheduling, Project charter, Scope statement, Work Breakdown Structure, Responsibility Chart. Network diagram, Schedule analysis and possibilities using the Critical Path Method (CPM) and the Program Evaluation and Review Technique (PERT). Resource leveling and allocation, Time-cost trade off (Crashing a schedule), Gantt Chart, Time overlaps, Time and cost control, Risk monitoring and control, Computer applications										
References	• Moder J., Phillips C., and Davis E., "Project Management with CPM, PERT and Precedence Diagramming", Last Edition. • Gail Freeman-Rue & James Balkwill, "Management in Engineering, Principles & Practice", Prentice Hall, Last Edition.										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hrs.				Assessment				
EME 206	Electronic Devices and Circuits	EME 201	3	Lec.	Lab	Tut	Sum	MT1	MT2	Std. Act.	PE/OE	Final
				2	1	2	5	30	--	10	20	40
Course Content	Semiconductor physics, Structure of diodes, Diode circuits and rectifiers, Structure of BJT, Biasing and operation modes of transistors, DC and small signal analysis of transistor circuits, Amplifiers circuits using BJT, Power amplifiers, Field effect transistors, Biasing of FET, Small signal model of FET. Amplifier circuits using FET, Design of amplifier circuits, Frequency response of amplifier circuits, Active filters, Feedback in electronic circuits, Different feedback configuration in electronic circuits, Oscillators circuits.											
References	Adel S. Sedra and Kenneth C. Smith, "Microelectronic Circuits", Oxford University press.											
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 Name	Pre-req.	Cr. Hrs.	Ct. Hrs.				Assessment			
				Lec	Lab	Tut	Sum	MT1	MT2	Std. Act.	Final
EME 207	Electrical Power Systems	EME 106	3	2	0	2	4	30	20	10	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 Title	Pre-req	Cr. Hrs.	Ct. Hrs.				Assessment			
				Lec.	Lab	Tut	Sum	MT 1	MT 2	Std. Act.	Final
EMM 208	Fluid Machinery	EMM 102	3	2	0	2	4	30	20	10	40
Course Content	Introduction to turbo machines (definition, basic equation, similarity analysis). Flow analysis (one-dimensional fluid flow in turbo machines, two dimensional cascades in turbo machinery, and three dimensional flow). Types of pumps, fans, turbines and compressors. Thermal and hydraulic design and analysis of pumps, fans, turbines and compressors. Component selection, system design and performance evaluations.										
References	• William W. Peng, “Fundamentals of Turbo machinery” , Wiley • A Sayers, “Hydraulic and compressible flow turbomachiners.” 1990. • Husain et al, “Basic Fluid Mechanics and Fluid Machines”, 2008										
Laboratory	• Measuring the performance of pelton wheel at different deflection angle and flow rate • Measuring the performance of the Frances turbine at different inlet angle and flow rate • Measuring the pump performance • Measuring the generated forces from moving fluid (impact of jet)										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hrs.				Assessment				
				Lec.	Lab	Tut	Sum	MT 1	MT 2	Std. Act.	PE/ OE	Final
EMM 209	Design of Machine Elements	FRM 009 EMM 110	3	2	1	2	5	30	--	10	20	40
Course Content	Introduction to design process. Review of load and stress analysis, Mohr's circle for plane stress. Failures resulting from static loading, variable loading, and fatigue failure. Material selection for strength and rigidity. Design of mechanical elements: Knuckle joint - screws, fasteners - shafts and shaft components - mechanical springs - welding joints, Bonding, and permanent joints.											
References	• Robert L. Mott, " Machine elements in Mechanical Design", Pearson/Prentice Hall, 2004. • J.E. Shigley and C. R. Mischke, "Mechanical Engineering Design", McGraw-Hill, Last Edition.											
Laboratory	Term design projects: • Working and assembly drawing of parts and machine elements • Computer aided drafting of assembly drawings and machine elements											

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hrs.				Assessment				
				Lec	Lab	Tut	Sum	MT1	MT2	Std. Act.	PE/OE	Final
EME 210	Electric Power Distribution Systems	EME 207	3	2	1	2	5	30	--	10	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, Differential 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.											

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hrs.				Assessment			
EMM 301	Refrigeration	EMM 112	2	Lec.	Lab	Tut	Sum	MT 1	MT 2	Std. Act.	Final
				2	0	1	3	30	20	10	40
Course Content	Introduction to refrigeration and Refrigeration machines - Ideal and actual Vapour - compression refrigeration cycle - Refrigerants - Vapour refrigeration cycles (Single and multi stage) - Vapour absorption systems - Gas refrigeration cycles - Thermoelectric refrigeration systems - Lubricants in refrigeration systems - Expansion devices.										
References	R.S. Khurmi and J. K. Gupta, 1992, "A text book of refrigeration and air conditioning ", Eurasia Publishing House. Wilbert F. Stoecker, 1998, "Industrial Refrigeration Handbook, 1st Edition", McGraw-Hill Companies, Inc.										
Laboratory	Refrigeration Components Instruments and Tools Basic cycle performance, suction accumulator. Liquid receiver, different types of expansion device, oil separator, multi evaporators. Simple Vapour Compression Refrigeration System Performance Test General Cycle Refrigeration Trainer Computer controlled refrigeration system										

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hrs.				Assessment				
				Lec	Lab	Tut	Sum	MT 1	MT 2	Std. Act.	PE/ OE	Final
EMM 302	Refrigeration and AC Systems/ Components	EMM 301 & EMM 303	3	2	1	1	4	30	--	10	20	40
Course Contents	Air conditioning systems and classifications, Air terminal units (air handling units, fan coil units), Sections of air handling units (filters, cooling and dehumidifying coils, heating coils, Humidifiers, Fans), Chillers (air cooled chillers, water cooled chillers, cooling towers), condensing units and its components, Desiccant dehumidifiers, Chilled water networks and pumps, energy recovery systems, expansion devices, unitary air conditioning units.											
References	• Ananth Narayanan, “Basic Refrigeration and Air Conditioning”, McGraw Hill, 2013 • Miller, Rex; Miller, Mark R, 2011, "Air Conditioning and Refrigeration", McGraw-Hill Education.											

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hrs.				Assessment			
EMM 303	Air Conditioning Systems	EMM 112	3	Lec.	Lab	Tut	Sum	MT 1	MT 2	Std. Act.	Final
				2	0	2	4	30	20	10	40
Course Content	Introduction to air conditioning-Psychrometry-Psychrometric processes-Psychrometry of Air Conditioning Systems- Heating and cooling Load calculations-Air distribution systems-Air duct design-Fundamentals of HVAC Control.										
References	Faye C. McQuiston,"HVAC Analysis and Design", 6th edition (2004) R.S. Khurmi and J. K. Gupta , "A text book of refrigeration and air conditioning"										
Laboratory	Heating, cooling, humidification, dehumidification processes. Controlling devices in air conditioning system.										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hrs.				Assessment			
EME 304	Automatic Control	EME 106	2	Lec.	Lab	Tut	Sum	MT1	MT2	Std. Act.	Final
				2	0	1	3	30	20	10	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. John Wiley & Sons., 2020 • Katsuhiko, Ogata. Modern control engineering. Pearson, 2010.										
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 Name	Pre-req.	Cr. Hrs.	Ct. Hrs.				Assessment			
				Lec	Lab	Tut	Sum	MT1	PE/OE	Std. Act.	Final
EME 305	Low Current Distribution Systems	EME 210	3	2	2	0	4	30	20	10	40
Course Contents	Fire Alarm Industry Codes and Standards, building, fire, and life safety codes, requirements for fire detection and alarm systems, NFPA 72 and design. introduction about Fire Alarm System, Type of Detectors, types of Call points, Manual Station, Break Glass, Alarms, Modules, Fire Alarm Control Panel F.A.C.P, cables and pipes network, Telephone System, Data Network, audio / video System, security system. Recognize general requirements for the inspection, testing, and maintenance of low current systems.										
References	• NFPA 72: National Fire Alarm and Signaling Code • Egyptian Code										

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hrs.				Assessment			
				Lec	Lab	Tut	Sum	MT1	MT2	Std. Act.	Final
EMM 307	Fire Fighting Systems	EMM 102	3	2	0	2	4	30	20	10	40
Course Contents	Combustion and extinguishing theory for fire and explosion. Agents for fire extinguishing and flammability limits. Applicable Standards, Codes and Life Safety for firefighting system limitation, Fire Detection and Alarm System, Fire Fighting Systems, Manual Fire Fighting Systems (Portable Fire Extinguishers, Standpipe System, Fire Hydrant and Fire Department Connection), Automatic Fire Fighting Systems (Automatic Wet Suppression Systems, Automatic Dry Suppression Systems), Case Study and firefighting system design										
References	• A. Maurice Jones Jr., “Fire Protection Systems”, Publisher: Jones & Bartlett Learning; 2nd edition, 2014										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hrs.				Assessment			
EMM 309	Combustion	EMM 112	3	Lec.	Lab	Tut	Sum	MT 1	MT 2	Std. Act.	Final
				2	0	2	4	30	20	10	40
Course Content	Thermal properties of combustible gases (Air/fuel ratio, product of combustion, heat of combustion, fuel heating values) constant volume combustion constant pressure combustion, Hillums and Gibbs functions, combustion equilibrium, kinetic theory of combustion, flammability limit, combustion efficiency, flame velocity, burning velocity, flame stability, flame structure- premixed flame- diffusion flame- furnaces- gas turbine combustion- fuel properties (gas fuel-Liquid fuel gaseous fuel) - fuel nozzles design(gaseous, liquid fuel) - combustion in boiler- design of combustion chamber, Fuel cells and electrochemical fundamentals										
References	• Stefan R. Turns, 2000, " An Introduction to combustion: Concepts and Applications", International Editions, by McGraw-Hill. • Irvin Glassman, and Richard A. Yetter, 2008, "Combustion" , Fourth Edition, by Elsevier Inc. • Shripad Revankar and Pradip Majumdar, 2014, "Fuel Cells Principles Design and Analysis", by Taylor & Francis Group, LLC • John Newman and Karen E. Thomas-Alyea, 2004, "Electrochemical Systems", Third Edition, by Wiley Interscience										
Laboratory	• Identification and recognition of different types of fuel sources • Identification and recognition of different properties of liquid fuels, such as viscosity, density, heating value, flash and fire point, cetane number, octane number, etc. • Investigate the Droplet Evaporation of liquid fuels • Investigate the spray development of liquid fuel • Investigate the laminar and diffusion flames										

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hrs.				Assessment				
				Lec	Lab	Tut	Sum	MT 1	MT 2	PE /O E	Std. Act.	Final
EMM 401	Computer Applications in El/Mec System	EMM 303 & EME 305	2	1	2	0	3	30	--	20	10	40
Course Contents	Computers software in air conditioning systems, Cooling load calculations software, Air duct design software, water networks and hydronics systems software, hydraulic calculations software for firefighting systems, lighting distributions software, electric power software, recent soft wears in electromechanical systems.											
References	Nonlinear Control and Filtering Using Differential Flatness Approaches: Applications to Electromechanical Systems by Gerasimos G. Rigatos , Springer; 2015.											
Laboratory	Student's programs of tasks and problems are carried out in the engineering Computer Labs.											

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hrs.				Assessment			
				Lec	Lab	Tut	Sum	MT1	MT2	Std. Act.	Final
EMM 403	Process Control and Building management System	EME 304	2	2	0	1	3	30	20	10	40
Course Contents	Design of PI, PD, PID controllers, Design of servo system, Computers automations including PLCs, SCADA to control process, Process control in air conditioning systems, Firefighting systems, lighting systems and powers systems. Security and observation, Access control, Fire alarm system, Lifts, elevators etc., Plumbing, Closed-circuit television (CCTV), Other engineering systems, Control Panel, PA system, Alarm Monitor, Security Automation										
References	• Damian Flynn, 2003, "Thermal Power Plant Simulation and Control", The Institution of Engineering and Technology. • Karl J. Astrom, Tore Hagglund, 2009, "PID Controllers", Tech-lib.										
Laboratory	• Steam temperature control • Liquid level control • Flow control • HVAC control										

Elective I Courses:

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hrs.				Assessment			
				Lec	Lab	Tut	Sum	MT1	MT2	Std. Act.	Final
EMM 312	Renewable Energy	EME 106 EMM 109	3	2	0	2	4	30	20	10	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, NarosaPublishers, 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.										
Laboratory	• Expriments on solar cell • measurements of short circuit current and open circuit voltage of solar cell										

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hrs.				Assessment			
				Lec	Lab	Tut	Sum	MT1	MT2	Std. Act.	Final
EMM 314	Elevators and Escalators	EMM 209	3	2	0	2	4	30	20	10	40
Course Contents	Overview of elevators and escalators aspects, Planning and traffic analysis aspects, User safety aspects, public service elevators and escalators, locations components, operation and method of installation, commercial elevators and escalators. Anatomy of an escalators: step; Drive, step chain, lubricant free step chain; carriage, tracking system, safety benchmarking study. Planning: suitability for location, arrangements, width of step, internal/external drive, pit dimensions, angle of incline. Electrical systems: Safety devices, design principles, motor sizing and selection, drives, methods of starting, stopping and slowing down. Elevator and escalators backing.										
References	• George R. Strakosch, “Vertical transportation: elevators and escalators”, Wiley, 2nd Edition, 1983.										

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hrs.				Assessment			
				Lec	Lab	Tut	Sum	MT1	MT2	Std. Act.	Final
EMM 316	Solar Thermal and PV Systems	EMM 203	3	2	0	2	4	30	20	10	40
Course Contents	Solar energy (solar radiation intensity, angles, estimations and measurements), Solar energy systems, solar thermal collectors, solar water heaters, solar thermal power generation, Photo Voltic cells operation and efficiency, PV solar power system, Solar energy storage systems. Design/selection of PV cell, inverter type, meters, measurement / monitoring devices, AC/DC protection device & AC/DC cables.										
References	• Olindo Isabella, Klaus Jäger , Arno Smets, René van Swaaij, Miro Zeman ,"Solar Energy: The Physics and Engineering of Photovoltaic Conversion, Technologies and Systems" UIT Cambridge Ltd, 2016										

Elective II Courses:

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hrs.				Assessment			
				Lec	Lab	Tut	Sum	MT1	MT2	Std. Act.	Final
EME 322	Advanced Industrial Electronics	EME 206	3	2	0	2	4	30	20	10	40
Course Contents	Semiconductor diodes and Diodes applications, Resonant converters. Feedback and oscillator circuit, Power supply applications. Two terminal devices, Residential and industrial applications. Electric utility applications. Practical converter design considerations, operational and power amplifiers,										
References	• Robert L. Boylestad, : Louis Nashelsky, "Electronic Devices and Circuit Theory", Pearson 11th edition, 2013.										

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hrs.				Assessment			
				Lec	Lab	Tut	Sum	MT1	MT2	Std. Act.	Final
EME 324	Electrical Protection	EME 305	3	2	0	2	4	30	20	10	40
Course Contents	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.										
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 Name	Pre-req.	Cr. Hrs.	Ct. Hrs.				Assessment			
				Lec	Lab	Tut	Sum	MT1	MT2	Std. Act.	Final
EME 326	Electrostatic and Electromagnetic Fields	EME 106	3	2	0	2	4	30	20	10	40
Course Contents	Applications of Electromagnetic Field Theory , Differences between Circuit Theory and Electromagnetic Field Theory, Mathematical Preliminaries and Vector analysis. Electrostatic Fields Static electric fields. Steady electric currents. Static magnetic field. Varying fields and Maxwell's equations Electromagnetic Fields and Waves, Guided Waves, Transmission Lines, Radiation and Antennas.										
References	• G. S. N. Raju,"Electromagnetic Field Theory and Transmission Lines" Pearson India, June 2006.										

Elective III Courses:

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hrs.				Assessment			
				Lec.	Lab	Tut	Sum	MT 1	MT 2	Std. Act.	Final
EMM 332	Internal Combustion Engines	EMM 309	3	2	0	2	4	30	20	10	40
Course Content	Fundamentals of Internal Combustion engines, engine types, configurations and history of engines. Review of thermodynamics and combustion chemistry. Spark Ignition Engines, operating principle, standard cycles. Combustion in SI engines, knocking, SI engine emissions and emission control, Control of SI engines, effect of throttling. Compression ignition (Diesel) Engines: operating principle, cycles, combustion in diesel engines, diesel engine emissions and emission control, Control of CI engines. Turbo/supercharging, Alternative engine cycles (Homogeneous charge compression ignition (HCCI), gasoline direct injection (GDI), downsizing), Alternative fuels, Hybrid vehicles/Electric vehicles										
References	• Chris Mi, M. Abul Masrur, "Hybrid Electric Vehicles: Principles and Applications with Practical Perspectives (Automotive Series)", 2nd Edition, Wiley. • H.N. Gupta, 2006,"Fundamentals of Internal Combustion Engines", 2nd edition,Prentice-Hall of India Pvt.Ltd.										
Laboratory	Identification and recognition of different parts of four-stroke diesel engine (CI) Identification and recognition of different parts gasoline engine (SI) Investigate the function of glow plug on a live diesel engine test-bed Investigate the cooling system of a diesel engine Investigate the lubrication system of diesel engines Investigate the engine exhaust emissions such as CO2, CO, and Nox										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hrs.				Assessment			
EMM 334	Essentials of Energy Management	EMM 205	3	Lec.	Lab	Tut	Sum	MT 1	MT 2	Std. Act.	Final
				2	0	2	4	30	20	10	40
Course Content	Energy Resources, energy efficiency technologies, integration of renewable Energy with energy efficiency measures. Supply and demand side management. Industrial energy efficiency. Energy efficiency in residential, commercial, tourist and transport sectors. Energy efficiency policies, standards, codes, and benchmarking. Energy auditing and accounting, life cycle Assessment, Economics, and financing of Energy Efficiency options. Environmental impact of energy efficiency.										
References	• Craig B. Smith, Kelly Parmenter, 1981, "Energy, Management, Principles - Applications, Benefits, Savings", Pergamon.										

—Code	Course Title	Pre-req	CH	Weekly Contact Hours				Assessment Criteria %			
EMM 336	Wind Energy System Design	EMM 208 EMM 309	3	Lec.	Lab	Tut	Sum	MT 1	MT 2	Std. Act.	Final
				2	0	2	4	30	20	10	40
Course Content	Geophysics of wind resources; aerodynamics of horizontal-axis wind turbines; wind turbine performance; design loads; conceptual design of horizontal-axis wind turbines; blade design and its optimization; materials properties and materials selection; mechanical design and safety factors; wind turbine control; installation; wind farms; electrical systems for wind turbines										
References	• Jan Wenske, 2023, “Wind Turbine System Design: Nacelles, drivetrains and verification”, Publisher : The Institution of Engineering and Technology. • Gary L. Johnson, 1985, "Wind Energy Systems", Prentice-Hall • Earnest J. and T. Wizelius, Wind Power Plants and Project Development, PHI Learning, 2011.										

Elective IV Courses:

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hrs.				Assessment			
				Lec	Lab	Tut	Sum	MT1	MT2	Std. Act.	Final
EMM 411	Cold Stores and Industrial Refrigeration	EMM 301	3	2	0	2	4	30	20	10	40
Course Contents	Food storage and equipment, cooling and freezing times of food, food microbiology and refrigeration, refrigeration load, refrigerated facilities design, methods of precooling fruits, vegetables and cut flowers, industrial food freezing system, meat, poultry and fishery products, industrial applications (ice manufacturing, refrigeration in the chemical industries, low temperature applications and Cryogenics).										
References	• Shan K. Wang,"Handbook of Air Conditioning and Refrigeration" McGraw Hills, 2 Edition, 2016										

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hrs.				Assessment			
				Lec	Lab	Tut	Sum	MT1	MT2	Std. Act.	Final
EMM 413	Automotive Engineering	EMM 309	3	2	0	2	4	30	20	10	40
Course Contents	Engine and associated systems (fuel, ignition, cooling, lubrication). Turbocharging. Transmission. Steering. Braking. Suspension. Emission-control systems. Recent advances. Thermodynamic analysis of fuel-air cycles. Combustion charts. Chemical equilibrium and dissociation. Control of exhaust emissions. Engine friction. Heat transfer. Engine energy balance. Testing and performance maps.										
References	• Jeffrey K. Ball, Richard Stone,"Automotive Engineering Fundamentals" SAE International, ISBN 978-0-7680-0987-3, 2004.										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hrs.				Assessment			
				Lec.	Lab	Tut	Sum	MT 1	MT 2	Std. Act.	Final
EMM 415	Power Stations	EMM 112	3	2	0	2	4	30	20	10	40
Course Content	Co-Generation Plants, Combined Cycles, Heat Recovery Boilers, Efficiency of Combined Cycles, Performance Characteristics of Power Stations, Heat Rate and Incremental Rate, Optimum Load Division Among Power Generation Units, Control of the Steam Generators, Convection and Radiant Type Superheaters, Governing of Steam Turbines, Steam Partial Admission and Full Admission, Load Frequency Characteristics, Speed Regulation, Parallel Operation, Lubrication Systems, Protection and Tripping Systems, Start-Up and Shut Down Procedures, Procedure of Meeting the Power Demands: Adding Peaking Load Units, Connection between Zones of Different Longitudes, Energy Storage										
References	El-Wakil M. M., "Power Plant Technology", McGraw Hill, 1984 Gill A. B., "Power Plant Performance", Butterworth, 1984										

Elective V Courses:

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hrs.				Assessment			
				Lec	Lab	Tut	Sum	MT1	MT2	Std. Act.	Final
EME 421	Electro-Hydraulic Circuits	EME 304	3	2	0	2	4	30	20	10	40
Course Contents	Basic and components of hydraulic power systems, Hydraulic pumps, Hydraulic fluids, hydraulic valves, lines, fittings and seal, hydraulic modelling and simulation, hydraulic circuit design, hydrostatic transmission, Dynamic modelling and simulation, electric components, electro-hydraulic switches and switching circuitry, proportional and servo hydraulics, PLCs and hydraulic power.										
References	• M Rabie, "Fluid Power Engineering" McGraw-Hill Education; 1st edition, 2009										

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hrs.				Assessment			
				Lec	Lab	Tut	Sum	MT1	MT2	Std. Act.	Final
EME 423	Codes and Specifications of El/Mec Systems	EMM 302 & EME 305	3	2	0	2	4	30	20	10	40
Course Contents	International standards, IEC standards regarding the main specifications, testing, inspection and commissioning of electrical equipment and drives. Firefighting system international codes and standards, NFPE, HVAC codes and standards, International building codes, Plumbing codes.										
References	• Egyptian local codes, NFPA codes, NEC codes, ASHAREA codes and standards. International building codes.										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hrs.				Assessment			
				Lec.	Lab	Tut	Sum	MT1	MT2	Std. Act.	Final
EME 425	Computer Networks	EME 105	3	2	0	2	4	30	20	10	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”, 4th edition, Pearson Education/ PHI, New Delhi, India. • James F. Kurose, Keith W. Ross, "Computer Networking a Top-Down Approach", Pearson, 8th edition, 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/ • WENDELL ODOM, "CCNA-200-301-Official-Cert-Guide - volume 1 and 2", 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										

Elective VI Courses:

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hrs.				Assessment			
				Lec.	Lab	Tut	Sum	MT1	MT2	Std. Act.	Final
EME 431	Modern Control Systems	EME 304	3	2	0	2	4	30	20	10	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”. Pearson, 2011. • Katsuhiko, Ogata. “Modern control engineering”. Pearson, 2010.										
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	CH	Weekly Contact Hours				Assessment Criteria %			
				Lec.	Lab	Tut	Sum	MT1	MT2	Std. Act.	Final
EME 433	Power System Analysis	EME 304	3	2	0	2	4	30	20	10	40
Course Content	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, Generator speed control.										
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. Hrs.				Assessment			
				Lec	Lab	Tut	Sum	MT1	MT2	Std. Act.	Final
EME 435	Electrical Drives	EME 106 EME 304	3	2	0	2	4	30	20	10	40
Course Contents	Criteria for selecting drive components, DC motor drives, regenerative braking and four quadrant operation, Induction motor drives, slip power recovery, Doubly Fed Induction Motor drive (DFIM), synchronous motor drives, Permanent Magnet Synchronous Machine drive (PMSM): motor and generator 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 Title	Pre-req	Cr. Hrs.	Ct. Hrs.				Assessment			
				Lec.	Lab	Tut	Sum	SA	MT	PE/OE	Final
EMM 390	Senior Design Project I	70% of total CH	3	1	4	0	5	50	--	--	50
Course Content	The Course exploits the design experience for undergraduate students. It provides the essential concepts, ideas, and principles of the engineering design process, with the use of other concepts as standards, constraints, and communication. Students work in teams (can be a multidisciplinary team if accepted from the college council) students develop the project proposal and are required to present their proposal in oral presentation and submit a written version of it.										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hrs.				Assessment			
				Lec.	Lab	Tut	Sum	SA	MT	PE/OE	Final
EMM 490	Senior Design Project II	EME 390	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										

Program# 11 Construction Engineering and Management Program

Program Description

Construction engineering is a broad discipline concerned with the design, engineering, and management process of construction and building projects. It include: proficiency in engineering design; understanding of legal and professional practice issues related to the construction industry; understanding of construction processes, communications, methods, materials, systems, equipment, planning, scheduling, safety, cost analysis, and cost control; understanding of management topics such as economics, business, accounting, law, statistics, ethics, leadership, decision and optimization methods, process analysis and design, engineering economics, engineering management, safety, and cost engineering. The small class sizes within the Program allows a student-centric and individualized learning environment.

Basic Information

Program Vision

Our vision is to lead the field of construction engineering and management globally, as determined by the caliber of our professors, the influence of our academic work, and our stellar reputation.

Program Mission

The Benha faculty of Engineering Construction Engineering and Management program aims to develop the skills and knowledge students need to successfully complete construction projects on time and on budget while adhering to construction standards and safety guidelines within human values and social responsibility. Graduates will have sufficient knowledge and skills to develop their postgraduate research skills and find employment in the commercial, design-build, and residential sectors of the construction industry.

Program Objectives

The objectives of the BSc in The Construction Engineering and Management program are to enable its graduates to:

PO1. Apply a wide spectrum of engineering knowledge, science, and specialized skills with analytic, critical, and systemic thinking to identify and solve engineering problems in real-life situations.

PO2. Behave professionally, adhere to engineering ethics and standards, and work to develop the profession and community and promote sustainability principles.

PO3. Work in and lead a heterogeneous team and display leadership qualities, business administration, and entrepreneurial skills.

PO4. Master self-learning and life-long learning strategies to communicate effectively in academic/professional fields.

PO5. Apply analytical, experimental, design, construction engineering techniques and project management skills with proficiency aided by modern tools.

PO6. Graduate a postgraduate student who has the necessary scientific knowledge and innovative thinking needed for the Construction engineering and management engineering field.

Graduates Attributes

By the completion of the Construction Engineering and Management program of study, and according to NARS 2018, the graduate will be capable 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.

In addition to all engineering graduate attributes defined by NARS 2018, Construction and Management engineering graduates should be able to:

11. Identify the essential construction processes technologies techniques, Properties, behavior & fabrication of construction materials.
12. Master Projects management, including planning, finance, bidding, contract procedures, cost estimators, and quality systems.
13. Use the different analytical and computational methods that can be applied to the various areas of construction and building engineering.

Program Learning Outcomes

In addition to the competencies for all Engineering Programs (A-Level), the Construction Engineering and Management Program graduate must be able to (D-Level):

Level	Program Learning Outcomes according to NARS 2018	
A	General Competencies of Engineering Graduate	**PLO1**: Identity, 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 team
		PLO8: 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.
		PLO10: Acquire and apply new knowledge; and practice self, lifelong and other learning strategies.
D	Competencies of Construction engineering and Management Program	**PLO11**: Select appropriate and sustainable technologies for construction of buildings, infrastructures and water structures; using either numerical techniques or physical measurements and/or testing by applying a full range of civil engineering concepts and techniques of: Structural Analysis and Mechanics, Properties and Strength of Materials, Surveying, Soil Mechanics, Hydrology and Fluid Mechanics.
		PLO12: Achieve an optimum design of Reinforced Concrete and Steel Structures, Foundations and Earth Retaining Structures; and at least three of the following civil engineering topics: Transportation and Traffic, Roadways and Airports, Railways, Sanitary Works, Irrigation, Water Resources and Harbors; or any other emerging field relevant to the discipline.
		PLO13: Plan and manage construction processes; address construction defects, instability and quality issues; maintain safety measures in construction and materials; and assess environmental impacts of projects.
		PLO14: Deal with biddings, contracts and financial issues including project insurance and guarantees.
		PLO15: Create architectural, urban, and planning designs that satisfy both aesthetic and technical requirements, using adequate knowledge of history and theory, related fine arts, local culture and heritage, technologies and human sciences
		PLO16: Generate ecologically responsible, environmental conservation and rehabilitation designs; through understanding of: structural design, construction, technology and engineering problems associated with building designs.

Faculty Mission vs. Program Mission Matrix

Faculty Mission		Program Mission		
		The Benha faculty of Engineering Construction Engineering and Management program aims to develop the skills and knowledge students need to successfully complete construction projects on time and on budget while adhering to construction standards and safety guidelines within human values and social responsibility. Graduates will have sufficient knowledge and skills to develop their postgraduate research skills and find employment in the commercial, design-build, and residential sectors of the construction industry.		
		The Benha faculty of Engineering Construction Engineering and Management program aims to develop the skills and knowledge students need to successfully complete construction projects on time and on budget	adhering to construction standards and safety guidelines within human values and social responsibility.	Graduates will have sufficient knowledge and skills to develop their postgraduate research skills and find employment in the commercial, design-build, and residential sectors of the construction industry.
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.	Benha Faculty of Engineering - Benha University is committed to graduate well prepared engineers equipped with knowledge and skills necessary to compete in labor market	√		
	Capable of using and developing modern technology		√	
	Providing research in engineering fields to serve society and community			√

Program Mission vs. Program Objectives Matrix

Program Mission		Program Objectives					
		PO1	PO2	PO3	PO4	PO5	PO6
The Benha faculty of Engineering Construction Engineering and Management program aims to develop the skills and knowledge students need to successfully complete construction projects on time and on budget while adhering to construction standards and safety guidelines within human values and social responsibility. Graduates will have sufficient knowledge and skills to develop their postgraduate research skills and find employment in the commercial, design-build, and residential sectors of the construction industry.	The Benha faculty of Engineering Construction Engineering and Management program aims to develop the skills and knowledge students need to successfully complete construction projects on time and on budget	√				√	
	Adhering to construction standards and safety guidelines within human values and social responsibility.		√	√	√		
	Graduates will have sufficient knowledge and skills to develop their postgraduate research skills and find employment in the commercial, design-build, and residential sectors of the construction industry.				√	√	√

Program Objectives vs. Program Competencies Matrix

Program Objectives	Program Competencies															
	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	D1	D2	D3	D4	D5	D6
PO1	√	√							√		√	√		√	√	√
PO2			√								√	√	√		√	√
PO3							√	√	√				√			
PO4					√	√		√		√			√			
PO5				√	√	√	√	√		√				√		
PO6	Will be covered through postgraduate courses															

Program Objectives vs. Graduate Attributes Matrix

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

Career Prospects

Graduates of the Construction Engineering and Management program design and manage construction processes that create living and working environments such as office buildings, industrial buildings, housing, roads, bridges, utilities and water Resources. They can work in projects for: construction management; construction engineering; structures of all types; geo-techniques & foundations; transportation systems; surveying works; environmental engineering works; water resources, water supply systems. Following are some of the job opportunities that can be pursued by the program graduates:

Field engineer: implements and coordinates engineered construction processes.
Design engineer: develop conceptual and detailed designs for many construction projects such as office buildings, industrial buildings, housing, roads, bridges, and utilities.
Survey engineer: perform surveying activities for all types of construction projects.
Cost estimator: develops itemized costs and budgets for design and construction based upon knowledge and pre-design of operations, materials, and resource requirements.
Planning /scheduling engineer: designs and monitors the plan for timing and sequence of construction operations.
Quality control / assurance engineer: ensures that the items of the construction project and the construction process conform to specifications and standards.
Projects controls engineer: reviews the cost and time performance of the project during construction. Contract administrator: reviews the project's contracts and prepares / reviews change orders and claims.
Health and safety engineer: reviews and implements the project's health and safety system to ensure health and safety standards are adopted throughout the project.
Project engineer: designs all or part of the project construction process, coordinates construction engineering to accomplish the overall objectives of the facility design team.

Project manager: oversees all aspects of a project, coordinates subcontractors, and provides primary contact to the client as well as to the company's leaders.

Requirements of Program Courses

In order to get a Bachelor of Science Degree in this program, and to satisfy the Program Competencies, the following set of courses needs to be completed.

Program Requirements

Requirement		Cr. Hrs.	Ct. Hr.			
			Lect.	Lab.	Tut.	Sum
Benha University Requirements		14	14	0	0	14
Benha Faculty of Engineering Requirements		32	19	14	17	50
Program Requirements	From Basic science	12	8	6	2	16
	Compulsory Courses	84	58	30	40	128
	Elective courses	18	12	2	10	24
Total		160	111	52	69	232

University Requirements of Construction Engineering and Management Program

Lists of Humanities Courses of Construction Engineering and Management Program

Code	Course	Pre-requisites	Cr. Hrs.	Ct. Hr.			
				Lect.	Lab.	Tut.	Sum
UHS 101	Foreign Language	-----	2	2	0	0	2
UHS 103	Societal issues	-----	2	2	0	0	2
UHS 102	Information and Communication Technology	-----	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**

Lists of Electives Humanities of Construction Engineering and Management Program

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

Faculty Requirements of Construction Engineering and Management Program

Code	Course	Pre-requisites	Cr. Hrs.	Ct. Hr.			
				Lec.	Lab.	Tut	Sum
FRB 001	Analytical geometry & Linear Algebra	-----	3	2	0	2	4
FRB 003	Statics	-----	3	2	0	2	4
FRB 005	Waves and Heat	-----	3	2	2	1	5
FRB 007	Chemistry for Engineers	-----	4	3	2	1	6
FRM 009	Engineering Graphics	-----	2	0	0	4	4
FRB 002	Integration & Multivariable functions	FRB 001	3	2	0	2	4
FRB 004	Dynamics	FRB 003	3	2	0	2	4
FRB 006	Electricity and Magnetism	-----	3	2	2	1	5
FRM 008	Production Systems Engineering	-----	2	1	3	0	4
FRM 010	Computer Aided Drafting	FRM 009	2	1	2	0	3
FRE 012	Computer Programming	-----	2	0	2	2	4
FRB 103	Pollution and Industrial Safety	FRB 007	2	2	1	0	3
FT1	Field Training I		0	0	0	0	0
FT2	Field Training II		0	0	0	0	0
Total			**32**	**19**	**34**	**47**	**50**

Basic Science Requirements of Construction Engineering and Management Program

CODE	Course Name	Pre-requisites	Cr. Hrs.	Ct. Hr.			
				Lect.	Lab.	Tut.	Sum
FRB 001	Analytical geometry & Linear Algebra	-----	3	2	0	2	4
FRB 002	Integration & Multivariable functions	FRB 001	3	2	0	2	4
FRB 101	Engineering Differential Equations	FRB 002	3	2	0	2	4
FRB 104	Engineering Numerical Analysis	FRB 101	3	2	2	0	4
FRB 201	Applied Engineering Probability and Mathematical Statistics	-----	3	2	2	0	4
FRB 007	Chemistry for Engineers	-----	4	3	2	1	6
FRB 102	Water Chemistry	FRB 007	3	2	2	0	4
FRB 103	Pollution and Industrial Safety	FRB 007	2	2	1	0	3
FRB 005	Waves and Heat	-----	3	2	2	1	5
FRB 006	Electricity and Magnetism	-----	3	2	2	1	5
Total			**30**	**21**	**13**	**9**	**43**

Program Requirements

Lists of Compulsory Courses (96 Credit Hours)

Code	Course Title	Pre-requisites	Cr. Hrs.	Contact Hours			
				Lec.	Lab	Tut	Sum
FRB 101	Engineering Differential Equations	FRB 002	3	2	0	2	4
FRB 104	Engineering Numerical Analysis	FRB 101	3	2	2	0	4
FRB 201	Applied Engineering Probability and Mathematical Statistics	-----	3	2	2	0	4
FRB 102	Water Chemistry	FRB 007	3	2	2	0	4
Total from Basic Science			**12**	**8**	**6**	**2**	**16**
CMC 101	Structural Analysis-1	FRB 003	3	2	0	2	4
CMC 103	Properties and Testing of Construction Materials	FRB 003	2	2	1	0	3
CMC 105	Surveying for Engineers-1	FRB 002	3	2	2	1	5
CMA 107	Basic Architectural Engineering	FRM 009	2	1	0	2	3
CMC 109	Fluid Mechanics	FRB 005	2	2	1	0	3
CMC 102	Structural Analysis- 2	CMC 101	3	2	0	2	4
CMC 104	Construction Materials and Concrete Technology	CMC 103	3	2	2	1	5
CMC 106	Construction Engineers Drawing	FRM 010	2	1	3	0	4
CMC 108	Surveying for engineers- 2	CMC 105	3	2	0	2	4
CMA 110	Building Construction	CMA 107	2	2	0	1	3
CMC 112	Hydraulics for Construction Engineers	CMC 109	2	2	1	0	3
CMC 201	Hydrology and Water Resources	CMC 112	3	2	0	2	4
CMC 203	Soil Mechanics	CMC 103	3	2	2	1	5
CMC 205	Design of Metallic Structures-1	CMC 102	3	2	0	2	4
CMC 207	Design of R.C. Structures-1	CMC 102 +CMC 104	3	2	0	2	4
CMC 202	Transportation and Traffic Engineering	FRB 201	3	2	1	2	5
CMC 204	Geotechnical Engineering & Foundations	CMC 203	3	2	2	1	5
CMC 206	Construction Project Management	-----	3	2	0	2	4
CMC 208	Design of R.C. Structures-2	CMC 207	3	2	0	2	4
CMA 210	Introduction to City Planning	----	2	2	0	1	3
CMM 301	Technical Installations in Buildings	------	2	1	3	0	4
CMC 303	Methods and Equipments for Construction	CMC 207	3	2	0	2	4
CMC 305	Design and Construction of Foundations & Earth Retaining Structures	CMC 204	3	2	0	2	4
CMC 307	Cost Engineering & Quantity Surveying	CMC 206	3	2	0	2	4
CMC 309	Quality Control & Inspection of Structures	CMC 207	2	2	0	1	3
CMC 302	Sanitary Engineering	CMC 112	3	2	2	1	5

CMC 304	Construction and Site Safety	CMC 303	2	2	0	1	3
CMC 306	Project Planning, Scheduling, and Control	CMC 206	3	2	1	2	5
CMC 308	Senior Design Project I	*	2	0	4	0	4
CMC 401	Project Finance & Management	CMC 307	3	2	1	2	5
CMC 403	Construction Project Specifications, Bids, and Contracts	CMC 307	2	2	0	1	3
CMC 405	Senior Design Project II	CMC 308	3	1	4	0	5
			84	**58**	**30**	**40**	**128**

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

Lists of Elective Courses (18 Credit Hours)

CODE	Course Name	Pre-requisites	Cr. Hrs.	Ct. Hr.			
				Lect.	Lab.	Tut.	Sum
Elective I							
CMA 311	Building Technology	----	3	2	0	2	4
CMC 313	Highway Facilities	CMC 202	3	2	0	2	4
CMC 315	Bridge Building Technology	CMC 208	3	2	0	2	4
Elective II							
CMC 310	Value Engineering in the Construction Industry	-----	3	2	0	2	4
CMC 312	Engineering Economy	-----	3	2	0	2	4
CMC 314	Construction Quality Management	-----	3	2	0	2	4
Elective III							
CMC 316	Dynamic of Structures	CMC 102	3	2	0	2	4
CMC 318	Design of Metallic Structures-2	CMC 205	3	2	0	2	4
CMC 320	Prefabricated Water and Prestressed Concrete Structures	CMC 208	3	2	0	2	4
Elective IV							
CMC 407	Engineering for a Sustainable Environment	--	3	2	0	2	4
CMC 409	Environmental Engineering	FRB 102	3	2	0	2	4
CMC 411	Special Topics in Structural Analysis	CMC 102	3	2	0	2	4
Elective V							
CMC 413	Advanced Engineering Materials	CMC 104	3	2	0	2	4
CMA 415	Finishing Materials Technology	---	3	2	0	2	4
CMA 417	Principles and Approaches of Smart Cities	CMA 210	3	2	0	2	4
Elective VI							
CMC 419	Modeling and Simulation of Construction Systems	CMC 306	3	2	2	0	4
CMC 421	Geographic Information System GIS	CMC 108	3	2	2	0	4
CMC 423	Modeling of structures	CMC 102	3	2	2	0	4
Total			**18**	**12**	**2**	**10**	**24**

Proposed Study Plan

CODE	Course Name	Pre-requisites	Cr. Hrs.	Ct. Hr.				Final Exam Time	Assessment					
				Lect.	Lab.	Tut.	Sum		Mid 1	Mid 2	PE/OE	St. Act.	Final	sum
Level 0-1														
FRB 001	Analytical geometry & Linear Algebra	-----	3	2	0	2	4	2 hr	30	20	--	10	40	100
FRB 003	Statics	-----	3	2	0	2	4	2 hr	30	20	--	10	40	100
FRB 005	Waves and Heat	-----	3	2	2	1	5	2 hr	30	--	20	10	40	100
FRB 007	Chemistry for Engineers	-----	4	3	2	1	6	2 hr	30	--	20	10	40	100
FRM 009	Engineering Graphics	-----	2	0	0	4	4	2 hr	30	20	--	10	40	100
UHS 101	Foreign Language	-----	2	2	0	0	2	2 hr	30	20	--	10	40	100
UHS 103	Societal issues	-----	2	2	0	0	2	2 hr	30	20	--	10	40	100
			19	13	4	10	27							700

CODE	Course Name	Pre-requisites	Cr. Hrs.	Ct. Hr.				Final Exam Time	Assessment					
				Lect.	Lab.	Tut.	Sum		Mid 1	Mid 2	PE/OE	St. Act.	Final	sum
Level 0-2														
FRB 002	Integration & Multivariable functions	FRB 001	3	2	0	2	4	2 hr	30	20	--	10	40	100
FRB 004	Dynamics	FRB 003	3	2	0	2	4	2 hr	30	20	--	10	40	100
FRB 006	Electricity and Magnetism	-----	3	2	2	1	5	2 hr	30	--	20	10	40	100
FRM 008	Production Systems Engineering	-----	2	1	3	0	4	2 hr	30	--	20	10	40	100
FRM 010	Computer Aided Drafting	FRM 009	2	1	2	0	3	2 hr	30	20	40	10	--	100
UHS 102	Information and Communication Technology	-----	2	2	0	0	2	2 hr	30	20	--	10	40	100
FRE 012	Computer Programming	-----	2	0	2	2	4	2 hr	30	20	40	10	--	100
			17	10	9	7	26							700

Level 1-1														
CODE	Course Name	Pre-requisites	Cr. Hrs.	Ct. Hr.				Final Exam Time	Assessment					
				Lect.	Lab.	Tut.	Sum		Mid 1	Mid 2	PE/OE	St. Act.	Final	sum
FRB 101	Engineering Differential Equations	FRB 002	3	2	0	2	4	2 hr	30	20	--	10	40	100
CMC 101	Structural Analysis-1	FRB 003	3	2	0	2	4	2 hr	30	20	--	10	40	100
CMC 103	Properties and Testing of Construction Materials	FRB 003	2	2	1	0	3	2 hr	30	--	20	10	40	100
FRB 103	Environmental Pollution and Industrial Safety	FRB 007	2	2	1	0	3	2 hr	30	--	20	10	40	100
CMC 105	Surveying for Engineers-1	FRB 002	3	2	2	1	5	2 hr	30	--	20	10	40	100
CMA 107	Basic Architectural Engineering	FRM 009	2	1	0	2	3	2 hr	30	20	--	10	40	100
CMC 109	Fluid Mechanics	FRB 005	2	2	1	0	3	2 hr	30	--	20	10	40	100
			17	13	5	7	25							700

Level 1-2														
CODE	Course Name	Pre-requisites	Cr. Hrs.	Ct. Hr.				Final Exam Time		Assessment				
				Lect.	Lab	Tut.	Sum		Mid 1	Mid 2	PE/OE	St. Act.	Final	sum
FRB 102	Water Chemistry	FRB 007	3	2	2	0	4	2 hr	30	--	20	10	40	100
CMC 102	Structural Analysis- 2	CMC 101	3	2	0	2	4	2 hr	30	20		10	40	100
CMC 104	Construction Materials and Concrete Technology	CMC 103	3	2	2	1	5	2 hr	30	--	20	10	40	100
CMC 106	Construction Engineers Drawing	FRM 010	2	1	3	0	4	2 hr	30	20	--	10	40	100
CMC 108	Surveying for engineers 2	CMC 105	3	2	0	2	4	2 hr	30	20		10	40	100
CMA 110	Building Construction	CMA 107	2	2	0	1	3	2 hr	30	20		10	40	100
CMC 112	Hydraulics for Construction	CMC 109	2	2	1	0	3	2 hr	30	--	20	10	40	100
			18	13	8	6	27							700

Field Training I													
CODE	Course Name	Pre-requisites	Cr. Hrs.	Ct. Hr.				Final Exam Time	Assessment				
				Lect.	Lab.	Tut.	Sum		Mid 1	Mid 2	St. Act.	Final	sum
FT 1	Field Training I	Completion of 65 Cr. Hrs.	0	0	0	0	0	Oral	-	-	-	Pass or Fail	

	Level 2-1												
CODE	Course Name	Pre-requisites	Cr. Hrs.	Ct. Hr.				Final Exam Time	Assessment				
				Lect.	Lab.	Tut.	Sum		Mid 1	Mid 2	PE/OE	St. Act.	Final	sum
FRB 201	Applied Engineering Probability and Mathematical Statistics	-----	3	2	2	0	4	2 hr	30	--	20	10	40	100
CMC 201	Hydrology and Water Resources	CMC 112	3	2	0	2	4	2 hr	30	20	--	10	40	100
CMC 203	Soil Mechanics	CMC 103	3	2	2	1	5	2 hr	30	--	20	10	40	100
CMC 205	Design of Metallic Structures-1	CMC 102	3	2	0	2	4	2 hr	30	20	--	10	40	100
CMC 207	Design of R.C. Structures-1	CMC 102 +CMC 104	3	2	0	2	4	2 hr	30	20	--	10	40	100
UHS XXX	Humanities Elective I	----	2	2	0	0	2	2 hr	30	20	--	10	40	100
			17	12	4	7	23							600

Level 2-2														
CODE	Course Name	Pre-requisites	Cr. Hrs.	Ct. Hr.				Final Exam Time	Assessment					
				Lect.	Lab.	Tut.	Sum		Mid 1	Mid 2	PE/OE	St. Act.	Final	sum
FRB 104	Engineering Numerical Analysis	FRB 101	3	2	2	0	4	2 hr	30	--	20	10	40	100
CMC 202	Transportation and Traffic Engineering	FRB 201	3	2	1	2	5	2 hr	30	--	20	10	40	100
CMC 204	Geotechnical Engineering & Foundations	CMC 203	3	2	2	1	5	2 hr	30	--	20	10	40	100
CMC 206	Construction Project Management	-----	3	2	0	2	4	2 hr	30	20	--	10	40	100
CMC 208	Design of R.C. Structures-2	CMC 207	3	2	0	2	4	2 hr	30	20	--	10	40	100
CMA 210	Introduction to City Planning	----	2	2	0	1	3	2 hr	30	20	--	10	40	100
			17	12	5	8	25							600

Field Training I													
CODE	**Course Name**	**Pre-requisites**	**Cr. Hrs.**	**Ct. Hr.**				**Final Exam Time**	**Assessment**				
				Lect.	**Lab.**	**Tut.**	**Sum**		**Mid 1**	**Mid 2**	**St. Act.**	**Final**	**sum**
FT 2	Field Training II	Completion of 96 Cr. Hrs.	0	0	0	0	0	Oral	-	-	-	Pass or Fail	

Level 3-1														
CODE	Course Name	Pre-requisites	Cr. Hrs.	Ct. Hr.				Final Exam Time	Assessment					
				Lect.	Lab.	Tut.	Sum		Mid 1	Mid 2	PE/OE	St. Act.	Final	sum
CMM 301	Technical Installations in Buildings	---	2	1	3	0	4	2 hr	30	--	20	10	40	100
CMC 303	Methods and Equipment for Construction	CMC 207	3	2	0	2	4	2 hr	30	20	--	10	40	100
CMC 305	Design and Construction of Foundations & Earth Retaining Structures	CMC 204	3	2	0	2	4	2 hr	30	20	--	10	40	100
CMC 307	Cost Engineering & Quantity Surveying	CMC 206	3	2	0	2	4	2 hr	30	20	--	10	40	100
CMC 3XX	Elective I	*	3	2	0	2	4	2 hr	30	20	--	10	40	100
CMC 309	Quality Control & Inspection of Structures	CMC 207	2	2	0	1	3	2 hr	30	20	--	10	40	100
UHS XXX	Humanities Elective II	-----	2	2	0	0	2	2 hr	30	20	--	10	40	100
			18	13	3	9	25							700

* According to the Course Name

Level 3-2														
CODE	Course Name	Pre-requisites	Cr. Hrs.	Ct. Hr.				Final Exam Time	Assessment					
				Lect.	Lab.	Tut.	Sum		Mid 1	Mid 2	PE/OE	St. Act.	Final	sum
CMC 302	Sanitary Engineering	CMC 112	3	2	2	1	5	2 hr	30	--	20	10	40	100
CMC 304	Construction and Site Safety	CMC 303	2	2	0	1	3	2 hr	30	20	--	10	40	100
CMC 3XX	Elective II	*	3	2	0	2	4	2 hr	30	20	--	10	40	100
CMC 306	Project Planning, Scheduling, and Control	CMC 206	3	2	1	2	5	2 hr	30	--	20	10	40	100
CMC 3XX	Elective III	*	3	2	0	2	4	2 hr	30	20	--	10	40	100
UHS 104	Professional Ethics	-----	2	2	0	0	2	2 hr	30	20	--	10	40	100
CMC 308	Senior Design Project I	**	2	0	4	0	4	2 hr	--	--	--	50	50	100
			18	12	7	8	27							700

* According to the Course Name

**The student can register for the Senior Design Project course after passing 70% of the program cr. hrs, i.e., 112 Cr. Hr., Pre-requisites according to the project area.

Level 4-1														
CODE	Course Name	Pre-requisites	Cr. Hrs.	Ct. Hr.				Final Exam Time	Assessment					
				Lect.	Lab.	Tut.	Sum		Mid 1	Mid 2	PE/OE	St. Act.	Final	sum
CMC 401	Project Finance &Management	CMC 307	3	2	1	2	5	2 hr	30	--	20	10	40	100
CMC 4XX	Elective IV	*	3	2	0	2	4	2 hr	30	20	--	10	40	100
CMC 4XX	Elective V	*	3	2	0	2	4	2 hr	30	20	--	10	40	100
CMC 403	Construction Project Specifications, Bids, and Contracts	CMC 307	2	2	0	1	3	2 hr	30	20	--	10	40	100
CMC 4XX	Elective VI	*	3	2	2	0	4	2 hr	30	20	--	10	40	100
CMC 405	Senior Design Project II	CMC 308	3	1	4	0	5	2 hr	--	--	--	50	50	100
UHS XXX	Humanities Elective III	-----	2	2	0	0	2	2 hr	30	20	--	10	40	100
			19	13	7	7	27							700

* According to the Course Name

Matching Construction Engineering and Management Program Courses with ABET Requirements

ABET criteria for construction engineering management and similarly named engineering programs

Lead Society: Institute of Industrial and Systems Engineers , American Society of Civil Engineers

Construction Engineering and Management Program Courses Required to Cover ABET Criteria				
ABET Criteria		**CODE**	**Course Name**	**Credit Hours**
A minimum of 30 semester credit hours (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.	FRB 001	Analytical geometry & Linear Algebra	3
		FRB 002	Integration & Multivariable functions	3
		FRB 101	Engineering Differential Equations	3
	At least one additional area of basic science; apply probability and statistics to address uncertainty	FRB 104	Engineering Numerical Analysis	3
		FRB 201	Applied Engineering Probability and Mathematical Statistics	3
	Chemistry	FRB 007	Chemistry for Engineers	4
		FRB 102	Water Chemistry	3
		FRB 103	Environmental Pollution and Industrial Safety	2
	Calculus-based physics	FRB 005	Waves and Heat	3
		FRB 006	Electricity and Magnetism	3
Total				**30**
ABET Criteria		**CODE**	**Course Name**	**Credit Hours**
A minimum of 45 semester credit hours (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 construction processes and systems in a construction engineering specialty field.	CMC 104	Construction Materials and Concrete Technology	3
		CMA 110	Building Construction	2
		CMM 301	Technical Installations in Buildings	2
		CMC 303	Methods and Equipments for Construction	3
		CMC 3XX	Elective I	3
		CMC 3XX	Elective V	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 construction industry	CMC 306	Project Planning, Scheduling, and Control	3
		CMC 403	Construction Project Specifications, Bids, and Contracts	2
		CMC 304	Construction and Site Safety	2
		CMC 307	Cost Engineering & Quantity Surveying	3
		CMC 309	Quality Control &Inspection of Structures	2
	Explain basic concepts of economics, business, accounting, communications, leadership, decision and optimization methods, engineering economics	CMC 3XX	Elective II	3
		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	CMC 206	Construction Project Management	3
		CMC 401	Project Finance & Management	3
	Integrating management systems into a series of different technological environments	CMC 4XX	Elective IV	3
Total				**46**

Courses Plan and Matrix

Construction Engineering and Management Program Map

Compulsory Courses

Construction Engineering and Management Program Map

								CR	CT
Level 0-1	FRB 001 Analytical geometry & Linear Algebra 3 4	FRB 003 Statics 3 4	FRB 005 Waves and Heat 3 5	FRB 007 Chemistry for Engineers 4 6	FRM 009 Engineering Graphics 2 4	UHS 101 Foreign Language 2 2	UHS 102 Information and Communication Technology 2 2	19	27
PRE. Level 0-2	FRB 001 FRB 002 Integration & Multivariable functions 3 4	FRB 003 FRB 004 Dynamics 3 4	FRB 006 Electricity and Magnetism 3 5	FRM 008 Production Systems Engineering 2 4	FRM 009 FRM 010 Computer Aided Drafting 2 3	UHS 103 Social Issues 2 2	FRE 012 Computer Programming Fundamentals 2 4	17	26
PRE. Level 1-1	FRB 002 FRB 101 Engineering Differential Equations 3 4	FRB 003 CMC 101 Structural Analysis-1 3 4	FRB 003 CMC 103 Properties and Testing of Construction Materials 2 3	FRB 007 FRB 103 Environmental Pollution and Industrial Safety 2 3	FRB 002 CMC 105 Surveying for Engineers-1 3 5	FRM 009 CMA 107 Basic Architectural Engineering 2 3	FRB 005 CMC 109 Fluid Mechanics 2 3	17	25
PRE. Level 1-2	FRB 007 FRB 102 Water Chemistry 3 4	CMC 101 CMC 102 Structural Analysis- 2 3 4	CMC 103 CMC 104 Construction Materials and Concrete Technology 3 5	FRM 010 CMC 106 Construction Engineers Drawing 2 4	CMC 105 CMC 108 Surveying for Engineers-2 3 4	CMA 107 CMA 110 Building Construction 2 3	CMC 109 CMC 112 Hydraulics for Construction Engineers 2 3	18	27
	FT 103 Field Training I 0 25								
PRE. Level 2-1	FRB 201 Applied Engineering Probability and Mathematical Statistics 3 4	CMC 112 CMC 201 Hydrology and Water Resources 3 4	CMC 103 CMC 203 Soil Mechanics 3 5	CMC 102 CMC 205 Design of Metallic Structures-1 3 4	CMC 102 + CMC 104 CMC 207 Design of R.C. Structures-1 3 4		UHS XXX Humanities Elective I 2 2	17	23
PRE. Level 2-2	FRB 101 FRB 204 Engineering Numerical Analysis 3 4	FRB 201 CMC 202 Transportation and Traffic Engineering 3 5	CMC 203 CMC 204 Geotechnical Engineering and Foundations 3 5	CMC 206 Construction Project Management 3 4	CMC 207 CMC 208 Design of R.C. Structures-2 3 4	CMA 210 Introduction to City Planning 2 3		17	25
	FT 203 Field Training II 0 25								
PRE. Level 3-1	CMM 301 Technical Installations in Buildings 2 4	CMC 207 CMC 303 Methods and Equipments for Construction 3 4	CMC 204 CMC 305 Design and Construction of Foundations & Earth Retaining Structures 3 4	CMC 206 CMC 307 Cost Engineering & Quantity Surveying 3 4	CMC 3XX Elective I 3 4	CMC 207 CMC 309 Quality Control & Inspection of Structures 2 3	UHS XXX Humanities Elective II 2 2	18	25
PRE. Level3-2	CMC 112 CMC 302 Sanitary Engineering 3 5	CMC 303 CMC 304 Construction and Site Safety 2 3	CMC 3XX Elective II 3 4	CMC 206 CMC 306 Project Planning, Scheduling, and Control 3 5	CMC 3XX Elective III 3 4	CMC 308 Senior Design Project I 2 4	UHS104 Professional Ethics 2 2	18	27
PRE. Level 4-1	CMC 307 CMC 401 Project Finance & Management 3 5	CMC 4XX Elective IV 3 4	CMC 4XX Elective V 3 4	CMC 307 CMC 403 Construction Project Specifications, Bids, and Contracts 2 3	CMC 4XX Elective VI 3 4	CMC 308 CMC 405 Senior Design Project II 3 5	UHS XXX Humanities Elective III 2 2	19	27
	University Req.	Faculty Req.	Basic Science Req.	Elective Req.	Program Req.	CR : Crediet Hour CT : Contact Hour		160 CR	232 CT

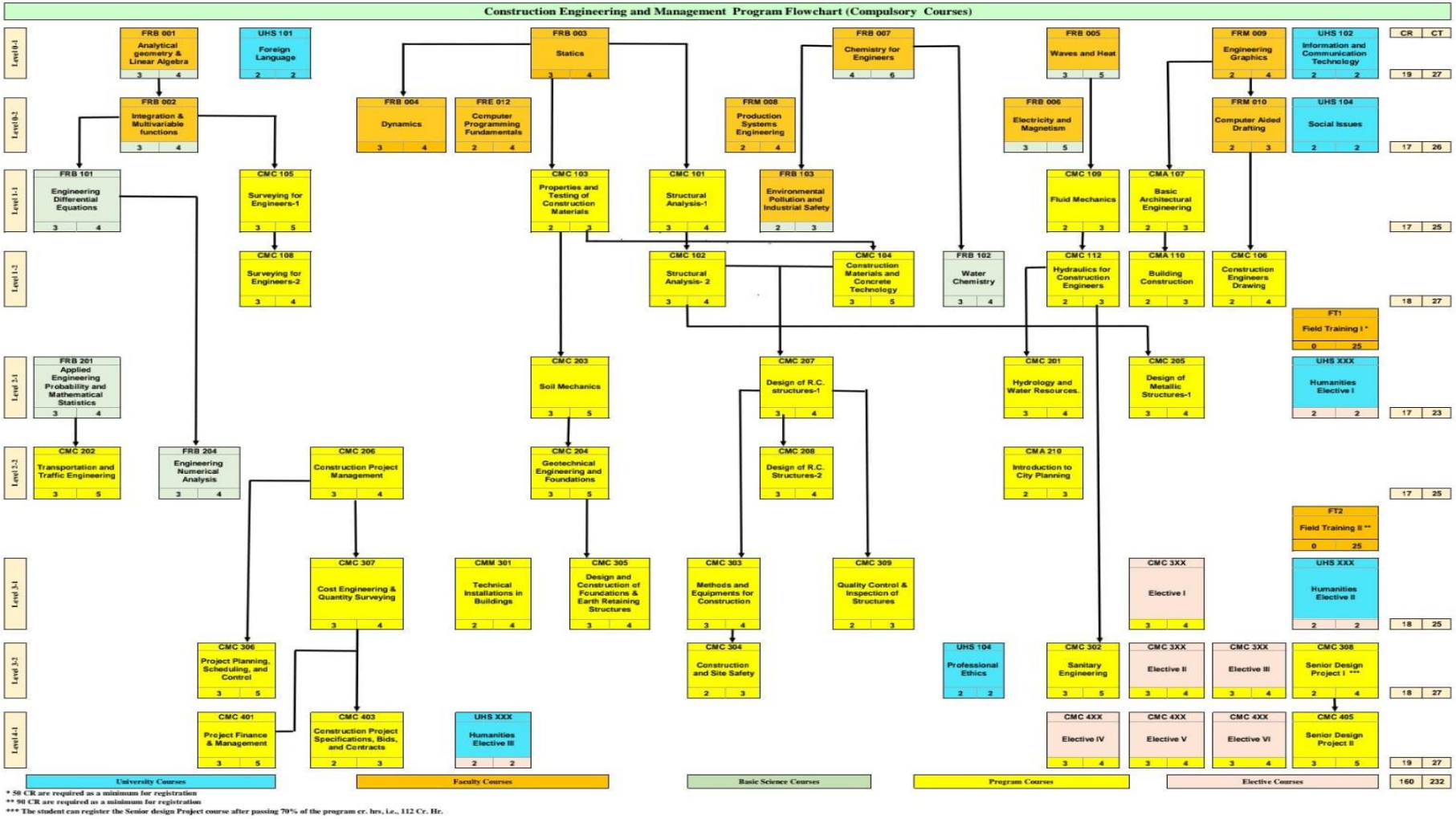
Construction Engineering and Management Program - Elective Courses Map

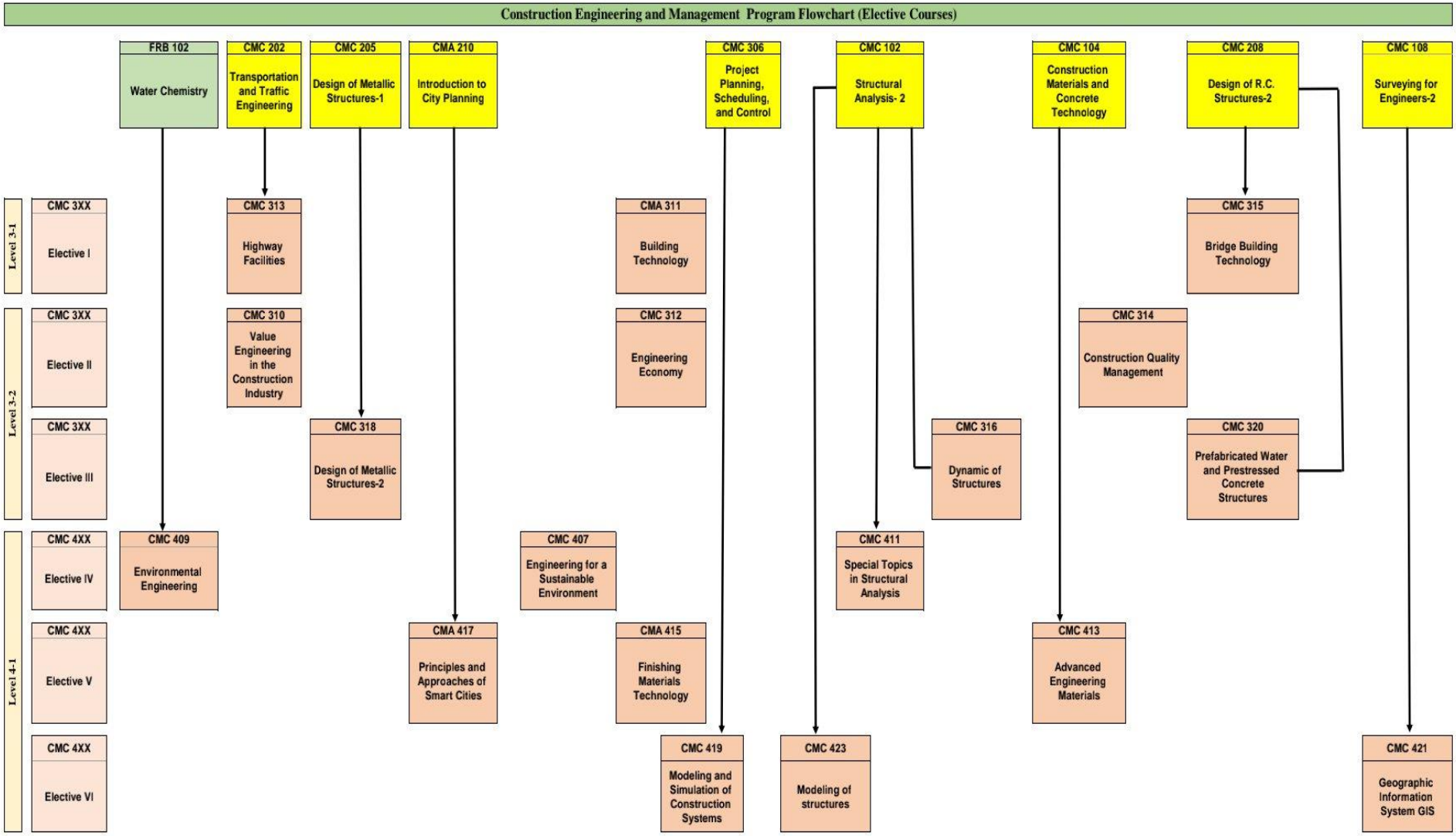
Level 3-1	PRE.	CMC 3XX Elective I 3 4	CMA 311 Building Technology 3 4	CMC 202 CMC 313 Highway Facilities 3 4	CMC 208 CMC 315 Bridge Building Technology 3 4
Level 3-2	PRE.	CMC 3XX Elective II 3 4	CMC 310 Value Engineering in the Construction Industry 3 4	CMC 312 Engineering Economy 3 4	CMC 314 Construction Quality Management 3 4
		CMC 3XX Elective III 3 4	CMC 102 CMC 316 Dynamic of Structures 3 4	CMC 205 CMC 318 Design of Metallic Structures-2 3 4	CMC 208 CMC 320 Prefabricated Water and Prestressed Concrete Structures 3 4
Level 4-1	PRE.	CMC 4XX Elective IV 3 4	CMC 407 Engineering for a Sustainable Environment 3 4	FRB 102 CMC 409 Environmental Engineering 3 4	CMC 102 CMC 411 Special Topics in Structural Analysis 3 4
		CMC 4XX Elective V 3 4	CMC 104 CMC 413 Advanced Engineering Materials 3 4	CMA 415 Finishing Materials Technology 3 4	CMA 210 CMA 417 Principles and Approaches of Smart Cities 3 4
		CMC 4XX Elective VI 3 4	CMC 306 CMC 419 Modeling and Simulation of Construction Systems 3 4	CMC 108 CMC 421 Geographic Information System GIS 3 4	CMC 102 CMC 423 Modeling of structures 3 4

Construction Engineering and Management Program - Humanities Elective Map

Level 2-1	UHS XXX Humanities Elective I	2	2	UHS 201 Principles of Entrepreneurship and Project Management	2	2	UHS 203 Human Resources Management	2	2
level 3-1	UHS XXX Humanities Elective II	2	2	UHS 301 Communication and Presentation Skills	2	2	UHS 302 Leadership Skills	2	2
level 4-1	UHS XXX Humanities Elective III	2	2	UHS 801 Research Methodologies	2	2	UHS 803 Thinking Skills	2	2

Construction Engineering and Management Flowchart




Construction Engineering and Management Program Flowchart (Elective Courses)
FRB 102
Water Chemistry
CMC 202
Transportation and Traffic Engineering
CMC 205
Design of Metallic Structures-1
CMA 210
Introduction to City Planning
CMC 306
Project Planning, Scheduling, and Control
CMC 102
Structural Analysis- 2
CMC 104
Construction Materials and Concrete Technology
CMC 208
Design of R.C. Structures-2
CMC 108
Surveying for Engineers-2
Level 3-1
CMC 3XX
Elective I
CMC 313
Highway Facilities
CMA 311
Building Technology
CMC 315
Bridge Building Technology
Level 3-2
CMC 3XX
Elective II
CMC 310
Value Engineering in the Construction Industry
CMC 312
Engineering Economy
CMC 314
Construction Quality Management
CMC 3XX
Elective III
CMC 318
Design of Metallic Structures-2
CMC 316
Dynamic of Structures
CMC 320
Prefabricated Water and Prestressed Concrete Structures
Level 4-1
CMC 4XX
Elective IV
CMC 409
Environmental Engineering
CMC 407
Engineering for a Sustainable Environment
CMC 411
Special Topics in Structural Analysis
CMC 4XX
Elective V
CMA 417
Principles and Approaches of Smart Cities
CMA 415
Finishing Materials Technology
CMC 413
Advanced Engineering Materials
CMC 4XX
Elective VI
CMC 419
Modeling and Simulation of Construction Systems
CMC 423
Modeling of structures
CMC 421
Geographic Information System GIS

Program Learning Outcomes to Course Matrix

Code	Title	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12	PLO13	PLO14	PLO15	PLO16
Main Humanities Courses																	
UHS 101	Foreign Language								*		*						
UHS 102	Information and Communication Technology				*						*						
UHS 103	Societal issues							*			*						
UHS 104	Professional Ethics				*	*											
Elective Humanities Courses																	
UHS XXX	Humanities Elective I			*	*												
UHS XXX	Humanities Elective II								*	*							
UHS XXX	Humanities Elective III					*					*						
Basic Science Requirements Courses																	
FRB 001	Analytical geometry & Linear Algebra	*		*													
FRB 002	Integration & Multivariable functions	*		*													
FRB 101	Engineering Differential Equations	*	*														
FRB 104	Engineering Numerical Analysis	*	*														
FRB 201	Applied Engineering Probability and Mathematical Statistics	*	*														
FRB 007	Chemistry for Engineers	*	*														
FRB 102	Water Chemistry	*	*		*												
FRB 103	Environmental Pollution and Industrial Safety	*		*	*												
FRB 005	Waves and Heat	*	*														
FRB 006	Electricity and Magnetism	*	*														
Courses Used as Faculty Requirements																	
FRM 009	Engineering Graphics						*		*								
FRM 008	Production Systems Engineering				*		*										
FRM 010	Computer Aided Drafting				*				*								

Code	Title	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12	PLO13	PLO14	PLO15	PLO16
FRE 012	Computer Programming	*		*													
FRB 003	Statics	*	*														
FRB 004	Dynamics	*	*														
Compulsory Courses																	
CMC 106	Construction Engineers Drawing								*				*				
CMC 101	Structural Analysis-1	*										*					
CMC 102	Structural Analysis-2	*										*					
CMC 201	Hydrology and Water Resources	*										*	*				
CMC 103	Properties and Testing of Construction Materials		*									*					
CMC 104	Construction Materials and Concrete Technology		*									*					
CMC 105	Surveying for Engineers-1		*					*				*					
CMC 108	Surveying for Engineers-2					*						*					
CMM 301	Technical Installations in Buildings		*	*		*						*					*
CMA 107	Basic Architectural Engineering								*							*	
CMA 110	Building Construction					*			*								*
CMA 210	Introduction to City Planning						*									*	*
CMC 109	Fluid Mechanics	*	*									*					
CMC 112	Hydraulics for Construction Engineers		*	*								*					
CMC 401	Project Finance & Management		*				*							*	*		
CMC 203	Soil Mechanics		*			*						*					
CMC 204	Geotechnical Engineering and Foundations		*	*								*	*				
CMC 305	Design and Construction of Foundations & Earth Retaining Structures			*									*				*
CMC 205	Design of Metallic Structures-1			*	*								*				*
CMC 207	Design of R.C. Structures-1			*	*								*				*
CMC 208	Design of R.C. Structures-2			*	*								*				*

Code	Title	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12	PLO13	PLO14	PLO15	PLO16
CMC 309	Quality Control & Inspection of Structures						*			*				*		*	
CMC 206	Construction Project Management						*	*		*				*	*		
CMC 307	Cost Engineering & Quantity Surveying						*							*	*		
CMC 306	Project Planning, Scheduling, and Control		*				*							*	*		
CMC 403	Construction Project Specifications, Bids, and Contracts						*							*	*		
CMC 302	Sanitary Engineering		*										*				
CMC 202	Transportation and Traffic Engineering	*	*			*							*	*			
CMC 303	Methods and Equipment for Construction					*	*					*					
CMC 304	Construction and Site Safety				*		*							*		*	
CMC 308	Senior Design Project I			*	*		*	*	*	*	*	*	*	*	*	*	*
CMC 405	Senior Design Project II			*	*		*	*	*	*	*	*	*	*	*	*	*
Program Elective Courses																	
CMC 3XX	Program Elective Courses I				*	*						*		*			*
CMC 3XX	Program Elective Courses II						*							*	*		
CMC 3XX	Program Elective Courses III			*									*				*
CMC 4XX	Program Elective Courses IV			*	*									*			
CMC 4XX	Program Elective Courses V										*					*	*
CMC 4XX	Program Elective Courses VI							*		*	*	*					*
Field Training																	
FT1	Field Training I							*			*						
FT2	Field Training II							*			*						

Construction Engineering and Management Program Courses

The course coding system is composed of three letters 3 denotes the department that offers the course, followed by 3 digits, where:

- the first digit from the left represents the course level (from 1 to 5),
- the middle and right digits represent the course sequence.

The coding system is demonstrated in the following table:

UHS XXX	University Requirement Compulsory and Elective Courses
FRB XXX	Courses offered by Basic Engineering Science Department
CMM XXX	Course offered by Mechanical Engineering Department
FRM XXX	Faculty requirement course offered by Mechanical Engineering Department
FRE XXX	Course offered by Electrical Engineering Department
CMA XXX	Course offered by Architecture Engineering Department
CMC XXX	Course offered by Civil Engineering Department

Program Requirements

Compulsory Courses

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hr.				Assessment			
				Lect.	Lab.	Tut.	Sum	Mid 1	Mid 2	St. Act.	Final
FRB 101	Engineering Differential Equations	FRB 002	3	2	0	2	4	30	20	10	40
Course Contents	**Basic Concepts of Ordinary and Partial differential equations (ODEs & PDEs):** Oder, Degree, Linearity, Formation, Geometric and physical applications (Newtons law of cooling, electric circuits), Types of solutions, Existence and uniqueness of solutions. **ODEs:** Solution of first order ODEs (Separable, Homogeneous, Exact, Integrating factor, Linear and Bernoulli equations). Orthogonal trajectories. Solution of nth order ODEs (homogeneous and non-homogeneous). System of first order linear differential equations. Laplace transforms and inverse Laplace transforms with applications. Fourier series with applications. Gamma and Beta functions **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 Name	Pre-req.	Cr. Hrs.	Ct. Hr.				Assessment			
				Lect.	Lab.	Tut.	Sum	Mid 1	PE/OE	St. Act.	Final
FRB 201	Applied Engineering Probability and Mathematical Statistics	----	3	2	2	0	4	30	20	10	40
Course Contents	**Probability:** Basic Theorems of Probability. Conditional Probability. Independent Events. Discrete and Continuous Random Variables. Mean and Variance of Distributions. Discrete Distributions (Binomial, Poisson and Hypergeometric Distribution). Continuous Distributions (Normal and Exponential Distribution). Distributions of Several Random Variables (Discrete and Continuous Two-Dimensional Distributions). **Mathematical Statistics:** Random Sampling. Sample mean and variance. Point Estimation of Parameters. Confidence Intervals. Simple and multiple Linear Regression and Correlation. Testing of Hypotheses. Markov chains. Quality Control. Engineering Applications. 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 Name	Pre-req.	Cr. Hrs.	Ct. Hr.				Assessment			
				Lect.	Lab.	Tut.	Sum	Mid 1	PE/OE	St. Act.	Final
FRB 104	Engineering Numerical Analysis	FRB 101	3	2	2	0	4	30	20	10	40

Course Contents	**Numeric in General:** Solution of linear systems by iterative methods (Jacobi Iteration, Gauss–Seidel Iteration Method, Convergence and Matrix Norms). Solution of nonlinear equations (Fixed-Point Iteration, Newton–Raphson's method, Sufficient Convergence Condition). Curve fitting (Least square method). Interpolations (Lagrange Interpolation, Newton's Forward and Backward Interpolations). Numerical differentiation. Numerical integration (Rectangular Rule, Trapezoidal Rule, Simpson's Rule). **Numeric for ODEs and PDEs:** Solution of first-order ODEs (Euler's method, Runge–Kutta Methods). Solution of higher order ODEs. Boundary and initial-boundary value problems for ODEs, Elliptic and parabolic PDEs (Finite difference methods, Explicit method, Crank–Nicolson Method). 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 Name	Pre-req.	Cr. Hrs.	Ct. Hr.				Assessment			
				Lect.	Lab.	Tut.	Sum	Mid 1	PE/OE	St. Act.	Final
FRB 102	Water Chemistry	FRB 007	3	2	2	-	4	30	20	10	40
Course Contents	This course aims to provide an introduction of equilibrium chemistry principles in aquatic systems. This course is designed for engineering students who are often required to understand the composition of solutions and direction of changes during treatment or in environmental systems. By completion of the course, the student will be able to interpret and communicate results related to water quality. Therefore, the course syllabus includes the following topics: equilibrium principles of acids-bases, dissolution-precipitation, titration, gas-liquid equilibrium, oxidation-reduction, complexation and water quality analysis and quality control.										
References	• Sawyer, McCarty & Parkin, Chemistry for Environmental Engineering, McGraw Hill, 2003 • Stumm & Morgan, aquatic Chemistry. Third edition, John Wiley&Sons. 1995										
Laboratory	• Acid – base titration • Total hardness, • Total alkali, • Conductivity, • Total dissolved solids										

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hr.				Assessment			
				Lect.	Lab.	Tut.	Sum	Mid 1	Mid 2	St. Act.	Final
CMC 101	Structure Analysis 1	FRB 003	3	2	0	2	4	30	20	10	40
Course Contents	Loads and reactions – Stability of structures (external and internal) – Straining actions in Statically determinate structures- Normal stresses – Shear stresses (pure shear, torsional) – Combined stresses. Elastic deflection of determinate structures (double Integration method and virtual work method).										
References	• Structural Analysis by Russell C. Hibbeler, Pearson, 9th Edition, 2014, ISBN-13:978-0-13-394284-2. • "Solved Examples in Determinate Structures", Dar-Elmaarefa, Egypt, Dr. Ahmed Youssef Kamal El-Deen, ISBN 21638/2016 • George, N. Frantziskonis. “Essentials of the Mechanics of Materials, Second Edition”. USA: Destech Publications, Inc. 2013. ISBN 13: 9781605950983 • Pytel, A. and Kiusalaas, J. “Mechanics of Materials Second Edition”. Cengage Learning2012. ISBN-13: 978-0-495-66775-9										

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hr.				Assessment			
				Lect.	Lab.	Tut.	Sum	Mid 1	Mid 2	St. Act.	Final
CMC 102	Structure Analysis 2	CMC 101	3	2	0	2	4	30	20	10	40
Course Contents	Analysis of statically indeterminate structures (Three moment equations). Analysis of statically indeterminate structures: Force approach (Consistent deformation method). Displacement approach (Slope deflection Method, Moment distribution method). Introduction to Matrix Structural Analysis for 1-D element using Stiffness method (Truss, Beam, and frame elements).										
References	• Aslam Kassimali , "Structural Analysis" Stamford USA: Cengage Learning, 4th Si Edition, 2011, ISBN-13: 978-0-495-29567-9 • Aslam Kassimali, "Structural Analysis", Stamford USA: Cengage Learning, 6th Si Edition, 2019, ISBN-13: 978-1337630948 • Jack C. McCormac, "Structural Analysis Using Classical and Matrix Methods", John Wiley & Sons, Inc, 4th Edition, 2007, ISBN-13: 978-0470036082.										

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hr.				Assessment			
				Lect.	Lab.	Tut.	Sum	Mid 1	PE/OE	St. Act.	Final
CMC 103	Properties and Testing of Construction Materials	FRB 003	2	2	1	0	3	30	20	10	40
Course Contents	Stress and strain - Types of tests - Testing machines - Strain gauge devices - Static tension test - Static compression test - Bending test - Shear test - Torsion test - Hardness test - Fatigue test - Impact test - Metals creep test.										
References	• Mechanics of Materials, James M. Kere & Barry J. Goodno, CENGAGE Learning, ISBN-13: 978-1111577735 / ISBN-10: 1111577730. • Strength of Materials, S. S. Bhavikatti,Vikas, Vicas, ISBN-13: 978-9325971578, ISBN-10: 9325971577. • A Textbook of Strength of Materials, Dr R.K. Bansal, LAXMI PUBLICATIONS (P) LTD, ISBN-10: 9788131808146 / ISBN-13: 978-8131808146. • المواد الهندسية مقاومتها واختبارها (الجزء الأول والجزء الثاني)، ا.د. احمد العريان - ا.د. عبد الكريم عطا • مقاومة واختبار المواد، د. عبد الوهاب محمد عوض - د. إبراهيم على درويش. • المواصفات القياسية المصرية.										
Laboratory	• Static tension test. • Static compression test. • Bending test. • Hardness test. • Impact test.										

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hr.				Assessment			
				Lect.	Lab.	Tut.	Sum	Mid 1	PE/OE	St. Act.	Final
CMC 104	Construction Materials and Concrete Technology	CMC 103	3	2	2	1	5	30	20	10	40
Course Contents	Types and properties of construction materials. Aggregate types, sources and quality, cements. Introduction to fiber reinforced polymers. Steel in construction, insulation materials and coatings. Concrete mix design, admixtures. Asphalt cement, asphalt concrete mix design. Concrete manufacture. Properties of fresh concrete. Properties of hardened concrete. Durability of concrete. Non-destructive testing. Special concretes.										
References	• للكود المصري لتصميم وتنفيذ المنشآت الخرسانية – 203. • الملحق الثالث للكود المصري لتصميم وتنفيذ المنشآت الخرسانية (دليل الاختبارات المعملية لمواد الخرسانة). • Building Materials, S. K. Duggal, Routledge, ISBN-10: 8122433790 / ISBN-13: 978-8122433791. • Concrete Technology, AM Neville, JJ Brooks, Longman, ISBN-10: 0273732196, ISBN-13: 978-0273732198. • Properties of Concrete and Structures, P.K. Mehta, Prentice Hall, ISBN-10: 0131671154, ISBN-13: 978-0131671157 • Materials of construction, R.C. Smith, McGraw-Hill, ISBN-10: 0070584761, ISBN-13: 978-0070584761. •										
Laboratory	• Specific surface area of cement, Setting time of cement, compressive strength of cement. • Sieve analysis of coarse and fine aggregate, bulk density of aggregate – specific weight of aggregate. • Coarse aggregate crushing value, Los Angles abrasion value of coarse aggregate. • Compression test. • Compacting factor test, Slump test. • Compressive strength test - Splitting tensile strength test – Modulus of rupture test. • Rebound hammer test - Ultrasonic Pulse velocity test.										

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hr.				Assessment			
				Lect.	Lab.	Tut.	Sum	Mid 1	PE/OE	St. Act.	Final
CMC 105	Surveying for Engineers-1	FR B 002	3	2	2	1	5	30	20	10	40
Course Contents	Principles of plane surveying; distances measurements (Optical, Electronic), angle and direction measurements; traverse computations; Coordinate systems for engineering works, setting out horizontal and vertical curves; earthwork computation; setting out engineering structures and construction projects, Levelling (theory, methods, and equipment)										
References	• Elementary Surveying - An Introduction to Geomatics -Thirteenth Edition-2012- CHARLES D. GHILANI-ISBN-13: 978-0-13-255434-3- ISBN-10: 0-13-255434-8 • Surveying for Civil and Mine Engineers Theory, Workshops, and Practicals-John Walker Joseph L. Awange- 2018-ISBN 978-3-319-53128-1- ISBN 978-3-319-53129-8 (eBook) • Surveying Engineering & Instruments- Valeria Shank- First Edition-2012- ISBN 978-81-323-4403-2										
Laboratory	• Distance measurements • Theodolite parts and calibration • Survey levelling instruments and height determination • Total station parts & software • Coordinates by Total Station • Lay out and setting out by Total Station										

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hr.				Assessment			
				Lect.	Lab.	Tut.	Sum	Mid 1	Mid 2	St. Act.	Final
CMC 106	Construction Engineers Drawing	FRM 010	2	1	3	0	4	30	20	10	40
Course Contents	Introduction to BIM in Autodesk Revit. Model creation, view creation, in Revit. Geometrical Constructions; two- dimensional drawing, sketching for creating solid models. Introduction to solid Modeling in Autodesk Inventor, creating solid model of structures in Autodesk Inventor environment. Creating orthographic views from a solid model in AutoCAD.										
References	• A Textbook of Engineering Drawing: Along with an Introduction to AutoCAD, International Publishing House, 2015. ISBN 9789384588687. • BIM and Construction Management: Proven Tools, Methods, and Workflows. Hardin and McCool, 2nd edition, Wiley 2015.										
Laboratory	• BIM and Construction Management. • BIM and Facility Management • Draw plan and elevation views of a building in AutoCAD environment. • Create solid models of objects; objects in basic shapes, custom built components, building models etc. using the tools of AutoCAD.										

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hr.				Assessment			
				Lect.	Lab.	Tut.	Sum	Mid 1	Mid 2	St. Act.	Final
CMA 107	Basic Architectural Engineering	FRM 009	2	1	0	2	3	30	20	10	40
Course Contents	Architectural engineering drawings is the language that is used to describe the size and shape of buildings. The course will enable the student to understand and use the architectural drawings language. It is designed to introduce the students the concepts, practices, standards, and drafting techniques needed for architectural design.										
References	• Ching, Francis D. K. (2014). Form, Space, and Order, (4th Edition). New Jersey: John Wiley & Sons Inc, ISBN: 978-1-118-74508-3 • Zell, Mo (2018). Architectural Drawing Course: Tools and Techniques for 2-D and 3-D Representation, (2nd Edition), B.E.S., ISBN 13: 9781438011158										

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hr.				Assessment			
				Lect.	Lab.	Tut.	Sum	Mid 1	Mid 2	St. Act.	Final
CMC 108	Surveying for engineers 2	CMC 105	3	2	0	2	4	30	20	10	40
Course Contents	Introduction to geodesy; Coordinate systems, Map projections, GNSS system concepts and characteristics, signal structure, receivers and antennae; GNSS measurements, GNSS time, error sources and measurement accuracy; position determination techniques – Errors Reduction Techniques, single point and differential positioning, static and kinematic GNSS, post-processing and Real-time processing, DGNSS concepts.										
References	• PRECISION SURVEYING The Principles and Geomatics Practice-JOHN OLUSEGUN OGUNDARE-2015-ISBN 978-1-119-10251-9 • Geodesy- Introduction to Geodetic Datum and Geodetic Systems-Zhiping Lu - Yunying Qu - Shubo Qiao-2014-ISBN 978-3-642-41244-8- ISBN 978-3-642-41245-5 (eBook) • ENGINEERING SATELLITE-BASED NAVIGATION AND TIMING-Global Navigation Satellite Systems, Signals, and Receivers-John W. Betz-2016-ISBN: 978-1-118-61597-3										

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hr.				Assessment			
				Lect.	Lab.	Tut.	Sum	Mid	PE/OE	St. Act.	Final
CMC 109	Fluid Mechanics	FRB 005	2	2	1	0	3	30	20	10	40
Course Contents	Dimensions and Units - Fluid Properties - Fluid Statics (Pressure distribution - Pressure measurements - Forces on submerged surfaces) - Buoyancy and Floatation - Fluids in Relative Equilibrium - Fluid Kinematics (Description of Fluids motion - Continuity Equation - Velocity and Acceleration) - Fluid Dynamics (Energy Equation - Applications of Bernoulli's Equation) - Impulse-Momentum Equation - Application of the Momentum Equation - Flow in Pipes – Pipes Systems.										
References	• A Brief Introduction to Fluid Mechanics, sixth Edition by Donald F. Young, Bruce R. Munson, Theodore H. Okiishi, Wade W. Huebsch, Wiley 2010, ISBN: 0470596791, 9780470596791 • E. Shashi Menon, "Liquid Pipeline Hydraulics", Marcel Dekker, 2004.										
Laboratory	• Determine Densities, Specific Gravities, Weights and Viscosity. • Bernoulli's Theorem Demonstration. • Flow through sharp edged Orifice. • Flow over Rectangular and Triangular Weirs. • Friction in a smooth bore pipe, Minor loss Experiment.										

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hr.				Assessment			
				Lect.	Lab.	Tut.	Sum	Mid 1	Mid 2	St. Act.	Final
CMA 110	Building Construction	CMA 107	2	2	0	1	3	30	20	10	40
Course Contents	The course aims to introduce students the relation between architectural designs and building components. It provides a fundamental understanding how to create the different basic elements of the building construction and provides the students with the basic knowledge of: Building Construction Stages, Wall bearing and Skeleton Structures, Stone construction, Masonry- raw bricks & brick masonry, Stairs detailing internal and external finishing materials.										
References	• McKay, W. B. (2005). Building Construction Metric Vol. I–IV. 4th Ed. Mumbai: Orient Longman. • Ching, Francis D. K. (2019). Architectural Graphics (6th Edition). New Jersey: John Wiley & Sons Inc.										

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hr.				Assessment			
				Lect.	Lab.	Tut.	Sum	Mid	PE/OE	St. Act.	Final
CMC 112	Hydraulics for Construction Engineers	CMC 109	2	2	1	0	3	30	20	10	40
Course Contents	Basic Principles (open channel flow) - Uniform Flow (Basic equations for steady uniform flow - Velocity and shear stress distributions in open channels) – Non-Uniform Flow (Specific energy - Hydraulics of channel bed transition) - Hydraulic Jumps - Gradually Varied Flow - Open Channel Design (Rigid boundary and erodible channel) - Dimensional analysis and Similarity (Methods of dimensional analysis - Model analysis and similarity) – Hydraulics Machinery (Pumps and Turbines)										
References	• Chadwick, A., Morfett, J. and Borthwick, M. (2021), Hydraulics in Civil and Environmental Engineering, 6th Edn., Published June 8, 2021, by CRC Press. ISBN 9780367460891. • Strum, W. T., (2001). Open Channels Hydraulics, McGraw-Hill Higher Education, USA. • Wynn P. (2014), Hydraulics for Civil Engineers by, ICE Publishing. First Edition. ISBN-13: 978-0727758453.										
Laboratory	• Open Channel Flow • Hydraulic Jump • Pump Characteristics										

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hr.				Assessment			
				Lect.	Lab.	Tut.	Sum	Mid 1	Mid 2	St. Act.	Final
CMC 201	Hydrology and Water Resources	CMC 112	3	2	0	2	4	30	20	10	40
Course Contents	Introduction to water balance and hydrological cycle, Precipitation, Evaporation, Transpiration, Infiltration, Runoff, Hydrograph. Steam flow measurements, Hydrograph analysis, flood routing, storage operations. Hydrology of the Nile basin, Nile water resources. Major projects constructed on the river Nile and suggested storage projects. Water problems in Egypt, water scarcity, water resources in Egypt, Renewable Water Resources conventional resources, and non-conventional water resources. Principles of water resources assessment. Economics and assessment principles of water projects.										
References	• Mays, L.W., Ground and surface water hydrology. John Wiley & Sons, Inc., 2012. ISBN: 978-0-470-16987-2 • Waller P, Yitayew M, Irrigation and Drainage Engineering, Springer 2016. ISBN: 978-3-319-34631-1 • Loki Radoslav, Water Resources Engineering, 2011, Publisher: Pon Press, ISBN 6137819787.by Loki Radoslav										

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hr.				Assessment			
				Lect.	Lab.	Tut.	Sum	Mid	PE/OE	St. Act.	Final
CMC 202	Transportation and Traffic Engineering	FRB 201	3	2	1	2	5	30	20	10	40
Course Contents	Transportation Planning: Introduction to transportation planning - Study area - Transportation planning surveys - Travel demand forecasting (Trip generation - Trip distribution - Modal split (Mode Choice) - Traffic assignment) - Transportation evaluation Traffic Engineering: Introduction (Road user characteristics - Vehicle characteristics) - Traffic volume - Traffic speed - Traffic density - Travel time and delay studies - Traffic Flow characteristics - Parking studies - Traffic control devices - Intersection control - Traffic signals design.										
References	• Traffic and Highway Engineering, Nicholas Garber and Lester Hoel, Fifth Enhanced SI Edition, CENGAG Learning, 2020, ISBN-13: 978-1-337-63104-4. • الكود المصرى للطرق – 2016 .										
Laboratory	• Traffic surveys (traffic volume count) • Speed & delay study • Parking study • Roadside and household interviews.										

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hr.				Assessment			
				Lect.	Lab.	Tut.	Sum	Mid	PE/OE	St. Act.	Final
CMC 203	Soil Mechanics	CMC 103	3	2	2	1	5	30	20	10	40
Course Contents	Introduction to Geotechnical Engineering - Definitions and Relationships - Index Properties of Soil - Soil Classification Systems (Unified – British) - Permeability and Seepage of Soil (Darcy's Law - Capillarity in Soils - Flow Net Analysis) - Stress Distribution in Soil (Point load – Uniform Load (Newmark – Fadum - Approximation)) - Shear Strength of Soil (Direct Shear Box - Triaxial– Unconfined Compression) - Lateral Earth Pressure (Active and Passive) - Soil Compaction (Standard Proctor - Modified Proctor).										
References	• **El-Kasaby, E. A., Soil Mechanics, Dar Al-Kutub Al-Almia, Cairo, 5th Ed., (21371/2013), ISBN 978 – 977 – 726 – 041 – 1, 2014.** • **Das, B. M, Soil Mechanics Laboratory Manual, Oxford University Press, 9th. Ed., ISBN 978 – 019 – 020 – 966 – 7, 2016 .**										
Laboratory	• Specific Gravity Determination. • Atterberg Limits (Liquid Limit – Plastic Limit – Shrinkage Limit). • Grain Size Distribution - Coarse Grained Soils. (Sieve Analysis). • Grain Size Distribution - Fine Grained Soils (Hydrometer Analysis). • Determination of Natural Unit Weight of Soil (Sand Bottle Test - Core Cutter Test). • Constant Head Permeability Test. • Falling Head Permeability Test. • Direct Shear Box Test. • Tri-axial Shear Test. • Unconfined Shear Test. • Standard Proctor Test. • Modified Proctor Test.										

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hr.				Assessment			
				Lect.	Lab.	Tut.	Sum	Mid	PE/OE	St. Act.	Final
CMC 204	Geotechnical Engineering & Foundations	CMC 203	3	2	2	1	5	30	20	10	40
Course Contents	Soil Consolidation and Settlement (Soil Consolidation Theory - Primary and Secondary Settlement - Oedometer Test) - Bearing Capacity of Soil (Terzaghi Eq. - Mayerhof Eq. – Egyptian Code Eq.) - Shallow Foundations (Construction Considerations - Design Considerations) - Design of Isolated Footings (Square and Rectangular Footings – Footing with Moment) - Design of Strip Footings - Design of Combined Footings - Design of Strap Beam Footings – Design of Rafts (Conventional Method – Ribbed Raft).										
References	• El-Kasaby, E. A., Soil Mechanics, Dar Al-Kutub Al-Almia, Cairo, 5th Ed., (21371/2013), ISBN 978 – 977 – 726 – 041 – 1, 2014. • El-Kasaby, E. A., Engineering of Surface Foundations, Dar Al-Kutub Al-Almia, Cairo, 5th Ed., (19440/2015), ISBN 978 – 977 – 726 – 139 – 5, 2015. • Das, B. M, Principles of Foundation Engineering, Brooks - Cole, 9th. Ed., ISBN 978 – 133 – 770 – 502 – 8, 2017.										
Laboratory	• One Dimensional Consolidation Test (Oedometer Test). • SPT: Standard Penetration Test. • CPT: Cone Penetration Test. • Plate Loading Test.										

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hr.				Assessment			
				Lect.	Lab.	Tut.	Sum	Mid 1	Mid 2	St. Act.	Final
CMC 205	Design of Metallic Structures-1	CMC 102	3	2	0	2	4	30	20	10	40
Course Contents	Steel as a construction material - Material properties and steel sections - Allowable Stress Design method - Design of tension members - Design of compression members - Columns in braced and unbraced frames - Design of flexural members - Types and classification of beam cross sections - Design of laterally supported and unsupported beams - Design of beam-columns (axial and flexural forces) - Design of bolted connections - Design of welded connections.										
References	• Egyptian code for design of steel structure. • Advanced Steel Design of Structures, by Prof. Srinivasan Chandrasekaran, Indian Institute of Technology, India. ISBN-13 9780367232900 • Steel Designers' Manual, by (Steel Construction Institute), Edited by Buick Davison and Graham W. Owens, ISBN-13 9781119249863 • Design of Metallic Structures, EHAB ELLOBODY, RAN FENG, BEN YOUNG, 2014, ISBN: 978-0-12-416561-8										

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hr.				Assessment			
				Lect.	Lab.	Tut.	Sum	Mid 1	Mid 2	St. Act.	Final
CMC 206	Construction Project Management	-----	3	2	0	2	4	30	20	10	40
Course Contents	Introduction to construction project management, need for project management, project definition, project life cycle, project success factors, key roles and tasks of construction project participants, construction project organizational structure, the project team, project site management, preparation of construction method, safety and health roles in construction projects.										
References	• Author: Paul Netscher "Construction Management: From Project Concept to Completion" CreateSpace Independent Publishing Platform (October 2017), ISBN-10: 1975934342, ISBN-13: 978-1975934347										

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hr.				Assessment			
				Lect.	Lab.	Tut.	Sum	Mid 1	Mid 2	St. Act.	Final
CMC 207	Design of R.C. Structures-1	CMC 102 +CMC 104	3	2	0	2	4	30	20	10	40
Course Contents	Properties of concrete materials - Ultimate limit states design method - Design of sections under pure bending moment (Rectangular, L & T - sections) - Load distribution – Design of section under shear – Design simple and continuous beams - Design of one-way and two-way solid slabs - Design of hollow block slabs - Design of panelled beams.										
References	• Egyptian Code for Design & Construction of Reinforced Concrete Structures – ECOP 203-2018 • Design of Concrete Structures, Arthur H Nilson, D.Darwin, Charles W. Fifteenth Edition,2016. • Design of reinforced concrete structures, Mashhour Ghoneim, Mahmoud Elmihilmy, Volume I, second edition, 2012. • Design of reinforced concrete structures, Mashhour Ghoneim, Mahmoud Elmihilmy, Volume 2, Third edition, 2012. • Fundamentals of Reinforcement Concrete and Prestressed concrete, M.Hilal, 1987.										

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hr.				Assessment			
				Lect.	Lab.	Tut.	Sum	Mid 1	Mid 2	St. Act.	Final
CMC 208	Design of R.C. Structures-2	CMC 207	3	2	0	2	4	30	20	10	40
Course Contents	Design of flat slabs - Design of sections subjected to bending moment and axial force - Analysis and design of columns – Design of RC frames -Design of Sections under Torsion- Serviceability limit states (deflection - crack width).										
References	• Egyptian Code for Design & Construction of Reinforced Concrete Structures – ECOP 203-2018 • Design of Concrete Structures, Arthur H Nilson, D.Darwin, Charles W. Fifteenth Edition,2016. • Fundamentals of Reinforcement Concrete and Prestressed concrete, M.Hilal, 1987. • Design of reinforced concrete structures, Mashhour Ghoneim, Mahmoud Elmihilmy, Volume 2, Third edition, 2012. • Design of reinforced concrete structures, Mashhour Ghoneim, Mahmoud Elmihilmy, Volume 3, First edition, 2011.										

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hr.				Assessment			
				Lect.	Lab.	Tut.	Sum	Mid 1	Mid 2	St. Act.	Final
CMA 210	Introduction to City Planning	----	2	2	0	1	3	30	20	10	40
Course Contents	The course aims to provide an introduction to understand the theoretical and practical skills of planning, its components, and problems by providing a historical and critical look. The course aims also to raise students' awareness on urban issues and problems. Throughout the course students will also become familiar with land use and spatial/physical components of the built environment.										
References	• Cervero, R., Guerra, E., Al, S., (2017), Beyond Mobility, Planning Cities for People and Places, Island Press, Washington, DCISBN-13: 978-1610918343										

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hr.				Assessment			
				Lect.	Lab.	Tut.	Sum	Mid	PE/OE	St. Act.	Final
CMM 301	Technical Installations in Buildings	-----	2	1	3	0	4	30	20	10	40
Course Contents	Thermal Comfort Heating. Ventilation & Air Conditioning. (HVAC), Central heating & Cooling Systems, Distribution Media, Delivery Devices. Heat and Moisture Transfer in Buildings, Lighting On-site power generation, Normal electrical systems. Special systems. Water supply & Drainage systems, types of fixtures, private sewerage systems, Fire protection systems, Architectural acoustics.										
References	• Building Technology: Mechanical and Electrical Systems- Architecture by Benjamin Stein, John Wiley & Sons, 2010.										
Laboratory	• A suitable Software for power distribution.										

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hr.				Assessment			
				Lect.	Lab.	Tut.	Sum	Mid	PE/OE	St. Act.	Final
CMC 302	Sanitary Engineering	CMC 112	3	2	2	1	5	30	20	10	40
Course Contents	Sources of pollution, Water resources and characteristics, Water quality, Water collection works, Water purification works, Water distribution works, Sewer systems, Wastewater characteristics, Wastewater treatment works, Wastewater disposal works, Treated wastewater reuse, Industrial wastes.										
References	• Introduction to Environmental Engineering by Mackenzie Davis, David Cornwell, McGrawHill, Fifth Edition, 2012.										
Laboratory	• Determine PH, Temperature, Total Solids (TS), Chloride, Nitrogen, Phosphorus, Heavy Metals, Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Dissolved Oxygen (DO), total bacteria account and Total coliform.										

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hr.				Assessment			
				Lect.	Lab.	Tut.	Sum	Mid 1	Mid 2	St. Act.	Final
CMC 303	Methods and Equipment for Construction	CMC 207	3	2	0	2	4	30	20	10	40
Course Contents	Techniques of building construction. Methods, materials, tools and equipment of construction. Traditional, mechanized and prefabrication construction systems. Selection of construction equipment. Applications on influence of construction methods on design and details. Evaluation and selection of appropriate construction technology. Sizing, operation and maintenance of construction equipment, design of temporary construction elements such as: concrete formwork, scaffolding systems, cofferdams. Type of cranes.										
References	• Construction Technology Paperback English by Mr Roy Chudley, Roger Greeno, ISBN-13 9780131286429										

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hr.				Assessment			
				Lect.	Lab.	Tut.	Sum	Mid 1	Mid 2	St. Act.	Final
CMC 304	Construction and Site Safety	CMC 303	2	2	0	1	3	30	20	10	40
Course Contents	Students acquire working knowledge of the construction hazards, safety precautions, and effective integration of safety regulations into the design and construction phases. Different types of construction related hazards including crane, equipment, and machinery, universal, access, construction, operation, and maintenance hazards together with methods to prevent them from happening are discussed										
References	• Construction Safety Engineering Principles (McGraw-Hill Construction Series): Designing and Managing Safer Job Sites, ISBN13: 9780071482448.										

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hr.				Assessment			
				Lect.	Lab.	Tut.	Sum	Mid 1	Mid 2	St. Act.	Final
CMC 305	Design and Construction of Foundations & Earth Retaining Structures	CMC 204	3	2	0	2	4	30	20	10	40
Course Contents	Pile Foundations (Types of Piles - Load Transfer Mechanisms - Static Capacity for Piles - Field Load Tests – Pile Group – Elastic Centre Method - Design of Pile Caps) - Introduction to Earth Retaining Structures - Pile wall (Secant piles - Tangent Piles - Bored Pile Wall) - Construction Techniques and Design of Retaining Walls (Cantilever RW – Counterfort RW) – Introduction to Reinforced Soil RW - SPW.										
References	• El-Kasaby, E. A., Design and Construction of Deep and Special Foundations, Dar Al-Kutub Al-Almia, Cairo, 4th Ed., (10651/2016), ISBN 978 – 977 – 726 – 168 – 5, 2016. • Das, B. M, Principles of Foundation Engineering, Brooks - Cole, 9th. Ed., ISBN 978 – 133 – 770 – 502 – 8, 2017. • Bowles, J., Foundation Analysis and Design, McGraw - Hill, 5th. Ed., ISBN 978 – 007 - 912 – 247 – 7, 2009.										

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hr.				Assessment			
				Lect.	Lab.	Tut.	Sum	Mid	PE/OE	St. Act.	Final
CMC 306	Project Planning, Scheduling, and Control	CMC 206	3	2	1	2	5	30	20	10	40
Course Contents	Concept of project planning, definition of planning techniques [Bar chart, arrow network, program evaluation and review technique (PERT), critical path method (CPM), line of balance technique (LOB)], Work Breakdown Structure (WBS), logic, networking by using CPM technique, scheduling and control models. Resource allocation and levelling, optimal schedules, documentation and reporting, time and cost control, progress monitoring and evaluation. Computer applications by primavera software package.										
References	• Textbook: Authors: Jimmie-Hinze " Construction Planning and Scheduling" Publisher: Prentice Hall; (International Ed.) 4th edition (January 2013), ISBN-13: 978-9332505735 • Reference: Daniel W. Halpin, Bolivar A. Senior, Gunnar Lucko “Construction Management” John Wiley & Sons, Inc., 5th Edition (August 2017), ISBN: 978-1-119-25680-9										
Laboratory	• Computer applications by primavera software package.										

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hr.				Assessment			
				Lect.	Lab.	Tut.	Sum	Mid 1	Mid 2	St. Act.	Final
CMC 307	Cost Engineering & Quantity Surveying	CMC 206	3	2	0	2	4	30	20	10	40
Course Contents	Introduction to project cost estimate, Conceptual estimating, cost indices, Quantity take-off methods, estimating costs for construction material, labour, equipment, project overhead, mark-up and profit, unit costs, production rates, and pricing methods, balanced bid and budget form preparation for projects., and bid unbalancing.										
References	• David Bratt, Fundamentals of Construction Estimating, 4th edition, Cengage Learning; 4th edition (January 1, 2018), ISBN-13: 978-1337399395 • Martin Brook "Estimating and Tendering for Construction Work", Taylor & Francis Ltd, 5th edition, (26 Jul 2016), ISBN13: 9781138838062										

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hr.				Assessment			
				Lect.	Lab.	Tut.	Sum	Mid 1	Mid 2	St. Act.	Final
CMC 308	Senior Design Project I	*	2	0	4	0	4	---	---	50	50
Course Contents	Topics are selected by groups of students according to their area of interest upon advisor approval. Projects address solution to open ended applications using an integrated engineering approach. Actual construction projects are selected by groups of students upon advisor approval for analysis. The management and technology aspects of construction are simulated and investigated.										
References	• According to the selected project.										
Laboratory	• According to the selected project.										

*According to the selected project.

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hr.				Assessment			
				Lect.	Lab.	Tut.	Sum	Mid 1	Mid 2	St. Act.	Final
CMC 309	Quality Control & Inspection of Structures	CMC 207	2	2	0	1	3	30	20	10	40
Course Contents	Introduction to quality improvement techniques. Control charts for variables and attributes. Quality systems; 1SO 9000, 1SO 14000. Total quality management. Maintenance of structures. Inspection and its related subjects. Deterioration of structures, causes and investigation. Structural behavior and different repair techniques for different structural materials.										
References	• Concrete and Steel Construction: Quality Control and Assurance by Mohamed A. El-Reedy, CRC press, 2013										

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hr.				Assessment			
				Lect.	Lab.	Tut.	Sum	Mid	PE/OE	St. Act.	Final
CMC 401	Project Finance & Management	CMC 307	3	2	1	2	5	30	20	10	40
Course Contents	Preparation of budgets. Type of budget. Classification of costs. Project cost accounting, time cost envelope (S-Curve), income and expenses cash flow forecasting, and cost of capital lock-up. The factors that affect capital lock-up. Economic assessments. Profitability measures. Inflation. Accuracy of future estimates. Financial modeling. Cost-benefit analysis. The financing of plant. Systematic plant selection										
References	• Daniel W. Halpin "Construction Management" textbook, John Wiley & Sons; 5th edition (August 7, 2017), ISBN-13: 978-1119256809.										
Laboratory	• Application by suitable software.										

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hr.				Assessment			
				Lect.	Lab.	Tut.	Sum	Mid 1	Mid 2	St. Act.	Final
CMC 403	Construction Project Specifications, Bids, and Contracts	CMC 307	2	2	0	1	3	30	20	10	40
Course Contents	Participants in a construction contract. Contract definition. Types of contracts; formation principles of a contract, performance or breach of contractual obligations. Analysis and comparison of the different kinds of construction contracts. Bidding logistics. Legal organizational structures. Different types and uses of specifications. Different forms of contracts utilized in construction.										
References	• Daniel W. Halpin, Bolivar A. Senior, Gunnar Lucko "Construction Management" John Wiley & Sons, Inc., 5th Edition (August 2017), ISBN: 978-1-119-25680-9 • Will Hughes, Ronan Champion, John Murdoch "Construction Contracts Law and Management" Published by Routledge (Taylor & Francis), April, 2015 ISBN 9780415657044.										

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hr.				Assessment			
				Lect.	Lab.	Tut.	Sum	Mid 1	Mid 2	St. Act.	Final
CMC 405	Senior Design Project II	CMC 308	3	1	4	0	5	---	---	50	50
Course Contents	Topics are selected by groups of students according to their area of interest upon advisor approval. Projects address solution to open ended applications using an integrated engineering approach. Actual construction projects are selected by groups of students upon advisor approval for analysis. The management and technology aspects of construction are simulated and investigated.										
References	• According to the selected project.										

Elective Courses

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hr.				Assessment			
				Lect.	Lab.	Tut.	Sum	Mid 1	Mid 2	St. Act.	Final
CMC 310	Value Engineering in the Construction Industry	---	3	2	0	2	4	30	20	10	40
Course Contents	The value concept: history, definitions, application to the construction industry, incentive provisions in construction contracts, factors to be considered, application to design. Value engineering methodology: information phase, speculative phase, analytical phase, proposal phase, and final report phase. Value engineering study procedures: objective, selecting the input required, required documentation, life cycle cost methodology										
References	• Building Information Modeling- A Strategic Implementation Guide for Architects, Engineers, Constructors, and Real Estate Asset Managers - Dana K. Smith, FAIA - 2009- ISBN 978-0-470-25003-7 • Value Engineering by Alphonse Dell'Isola, RSMeans, 1997										

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hr.				Assessment			
				Lect.	Lab.	Tut.	Sum	Mid 1	Mid 2	St. Act.	Final
CMC 312	Engineering Economy	--	3	2	0	2	4	30	20	10	40
Course Contents	Foundations of Engineering Economy, Interest Factors, Nominal and Effective Interest Rates, Present Worth Analysis, Annual Worth Analysis, Rate of Return Analysis, Benefit/Cost Analysis, Breakeven and Payback Analysis, Replacement and Retention Decisions, Effects of Inflation, Estimating Costs, Depreciation Methods, After-Tax Economic Analysis, Multiple Attributes and Risk.										
References	• Basics of Engineering Economy, Leland Blank & Anthony Tarquim, McGraw HILL, Third Edition, 2020, ISBN-13: 978-1260571141 • Engineering Economy, William G. Sullivan, Elin M. Wicks, & C. Patrick Koelling, Seventeenth Global Edition, Pearson, 2020, ISBN 13: 978-1-292-26490-5. • Engineering Economy, Leland Blank & Anthony Tarquim, McGraw HILL, Eighth Edition, 2018, ISBN: 978-0-07-352343-9										

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hr.				Assessment			
				Lect.	Lab.	Tut.	Sum	Mid 1	Mid 2	St. Act.	Final
CMA 311	Building Technology	----	3	2	0	2	4	30	20	10	40
Course Contents	Building technology of the main elements of building structural systems. Different structural systems will be addressed through describing and explaining their varied functions, types, materials, design considerations and execution techniques. (Reinforced Concrete structures, Pre-cast reinforced concrete construction, Steel structures)										
References	• Ching, Francis D.K., Building Construction Illustrated, 4th edition, John Wiley & Sons, Canada, 2001. • Fleming, E., Construction Technology - an illustrated introduction, 1st Edition, 2005, Blackwell publishing Ltd.										

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hr.				Assessment			
				Lect.	Lab.	Tut.	Sum	Mid 1	Mid 2	St. Act.	Final
CMC 313	Highway Facilities	CMC 202	3	2	0	2	4	30	20	10	40
Course Contents	Analysis of factors in developing highway transportation facilities, problems of highway geometric and design standards, planning and location principles, intersection design factors, structural design of pavement and highway maintenance.										
References	• Traffic and Highway Engineering, Nicholas Garber and Lester Hoel, Fifth Enhanced SI Edition, CENGAG Learning, 2020, ISBN-13: 978-1-337-63104-4. • 2016 – الكود المصرى للطرق .										

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hr.				Assessment			
				Lect.	Lab.	Tut.	Sum	Mid 1	Mid 2	St. Act.	Final
CMC 314	Construction Quality Management	----	3	2	0	2	4	30	20	10	40
Course Contents	Overview of quality, quality in construction projects, quality management system. Quality improvement techniques, control charts for variables and attributes. Lot-by-lot acceptance sampling by attributes, acceptance sampling systems, cost of quality, assessment of quality, total quality management. Computers and quality control.										
References	• Abdul Razzak Rumane, "Quality Management in Construction Projects" book, Published by CRC Press of Taylor & Francis Group, 2nd edition, December 10, 2019, ISBN 9780367890032										

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hr.				Assessment			
				Lect.	Lab.	Tut.	Sum	Mid 1	Mid 2	St. Act.	Final
CMC 315	Bridge Building Technology	CMC 208	3	2	0	2	4	30	20	10	40
Course Contents	A study of the unique design considerations, construction challenges, and load paths for a range of bridge types. Topics include fixed and moveable bridges, stringer/girder, steel truss, concrete slab, box girder, arch, suspension, and cable stayed bridges. Emphasis is placed on AASHTO loading and design requirements, load testing, and verification of unconventional materials. Covers case studies of bridges around the world.										
References	• Steel-concrete Composite Bridges by Nicholas J. Garber, Lester A. Hoel, ICE Publishing, 2013. • AISC Steel Design manual from CMCE 2315.										

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hr.				Assessment			
				Lect.	Lab.	Tut.	Sum	Mid 1	Mid 2	St. Act.	Final
CMC 316	Dynamic of Structures	CMC 102	3	2	0	2	4	30	20	10	40
Course Contents	Types of dynamic loads and the formulation of the equation of motion. Single degree of freedom systems, free and forced vibrations of multi degree of freedom systems. Response of structures to earthquakes. Design response spectra for structures, Design criteria for seismic resistant structures, Seismic response of tall buildings.										
References	• Dynamics of Structures by Anil K. Chopra, Pearson, 4 Edition, 2011.										

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hr.				Assessment			
				Lect.	Lab.	Tut.	Sum	Mid 1	Mid 2	St. Act.	Final
CMC 318	Design of Metallic Structures-2	CMC 205	3	2	0	2	4	30	20	10	40
Course Contents	Composite construction - composite floor beams (Strength requirement - shear connectors - formed metal deck) - Design of composite columns - Flexural design of slender sections - Connection classification and design (Flexible - Rigid – Semi rigid) - Design of base plates and anchor bolts – Introduction of Load and Resistance Factor Design (LRFD) - Identification of Limit states (Strength limit state and Serviceability limit state) - Design of tension, compression and flexure members using LRFD approach.										
References	• Egyptian Code of Practice for Steel Construction and Bridges (LRFD). • Steel Design for Engineers and Architects, by David A. Fanella, Rene Amon, Bruce Knobloch, Atanu Mazumder, United States of America ISBN-13: 978-1-4615-9731-5.										

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hr.				Assessment			
				Lect.	Lab.	Tut.	Sum	Mid 1	Mid 2	St. Act.	Final
CMC 320	Prefabricated Water and Prestressed Concrete Structures	CMC 208	3	2	0	2	4	30	20	10	40
Course Contents	Prefabricated concrete: design methods, floor and roof systems, wall panels and construction joints. Concrete water structures: design considerations, water tightness. Construction of circular and rectangular tanks. Prestressed concrete: basic principles, methods and systems of prestressing, partial loss of prestressing, analysis and design for flexural, shear and bearing.										
References	• Reinforced Concrete: Mechanics and Design by James K. Wight, James G. MacGregor, Prentice Hall, 5 Edition 2008.										

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hr.				Assessment			
				Lect.	Lab.	Tut.	Sum	Mid 1	Mid 2	St. Act.	Final
CMC 407	Engineering for a Sustainable Environment	----	3	2	0	2	4	30	20	10	40
Course Contents	Solid, industrial and hazardous waste generation and control, with an emphasis on sustainable engineering practices such as environmental impact assessment and performance, waste management, pollution prevention, waste minimization, cleaner production, energy recovery, recycling and reuse.										
References	• Energy, the Environment, and Sustainability- Efstathios E. Michaelides - International Standard Book Number-13: 978-1-138-03844-8										

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hr.				Assessment			
				Lect.	Lab.	Tut.	Sum	Mid 1	Mid 2	St. Act.	Final
CMC 409	Environmental Engineering	FRB 102	3	2	0	2	4	30	20	10	40
Course Contents	Introduction to environmental engineering, pollution problems, types of pollution, degrees of Pollution, sources of pollution, surface water pollution, groundwater Pollution, rainwater Pollution, sea & ocean water pollution, air pollution. Soil pollution, pollution control, pollution prevention. Samples conditions, chemical pollutions measuring in water, microbiological & biological pollution measuring in water, field pollution monitoring, environmental protection laboratory. Water supply, wastewater systems, solid waste management, air pollution. Solid waste management: collection, handling, separation and treatment, disposal, recycling, and reuse. Monitoring and control, noise, air pollution, environmental laws and its applications										
References	• An Integrated Approach to Environmental Management by Dibyendu Sarkar (Editor), Rupali Datta (Editor), Avinandan Mukherjee (Editor), Robyn Hannigan (Editor), Wiley, 2015.										

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hr.				Assessment			
				Lect.	Lab.	Tut.	Sum	Mid 1	Mid 2	St. Act.	Final
CMC 411	Special Topics in Structural Analysis	CMC 102	3	2	0	2	4	30	20	10	40
Course Contents	Elements of plate bending theory, circular plates, rectangular plates, large deflections of plates. Membrane stresses in shells, bending stresses in shells. Applications to pipes, tanks and pressure vessels.										
References	• Theory of plates and shells by S.S. Bhavikatti, 2016, ISBN-10 9386070812, ISBN-13 978-9386070814.										

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hr.				Assessment			
				Lect.	Lab.	Tut.	Sum	Mid 1	Mid 2	St. Act.	Final
CMC 413	Advanced Engineering Materials	CMC 104	3	2	0	2	4	30	20	10	40
Course Contents	Polymers and Epoxies, types, properties and applications of polymers concrete, Fibers, different types, of fibers reinforced concrete, properties, production and applications. Theory of failure of fiber reinforced concrete, Introduction of composite materials, Lightweight aggregate, natural and artificial aggregate, lightweight concrete, Insulating concrete, structural lightweight concrete, properties of lightweight concrete, design mixes of lightweight concrete, failure theories of lightweight concrete under different stresses, Massing and heavy concrete. Introduction of Egyptian and International Specifications.										
References	• Advanced Mechanics of Materials, by Arthur P. Boresi, Richard J. Schmidt, Omar M. Sidebottom, Wiley, 6 Edition, 2013.										

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hr.				Assessment			
				Lect.	Lab	Tut.	Sum	Mid 1	Mid 2	St. Act.	Final
CMA 415	Finishing Materials Technology	----	3	2	0	2	4	30	20	10	40
Course Contents	Focus will be placed on various building materials and construction techniques based on performing standards and codes, with each material's application explored in detail. To teach students about different types of floors and flooring materials, as well as partitions and panels, different surface finishes, and different routes of vertical transportation. To provide students with knowledge of the most recent advancements in building construction methods and their applications.										
References	• Dean, Y, (2016), Materials Technology, 2nd Edition, Routledge, ISBN: 9781315504278 • Fernandez, J., (2005), Material Architecture: emergent materials for innovative buildings and ecological construction, 1st Edition, Architectural Press, ISBN-13: 978-0750664974										

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hr.				Assessment			
				Lect.	Lab.	Tut.	Sum	Mid 1	Mid 2	St. Act.	Final
CMA 417	Principles and Approaches of Smart Cities	CMA 210	3	2	0	2	4	30	20	10	40
Course Contents	The course will introduce the concept, and technologies of smart cities in (e.g., transportation, buildings), and the concept of smart cities. Students will not only master the core technologies for building and implementing solutions for a smart and sustainable city during the course, but they will also gain an understanding of the problems that these solutions face. Students are urged to use critical thinking skills to accept technological solutions that will help cities become smarter and sustainable.										
References	• Komninos, N. (2014), The Age of Intelligent Cities: Smart Environments and Innovation-for-all Strategies (Regions and Cities) • Li, X. (2012), Smart City on Future Life - Scientific Planning and Construction, Posts and Telecom Press ISBN-13 : 978-7115270634										

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hr.				Assessment			
				Lect.	Lab.	Tut.	Sum	Mid	PE/OE	St. Act.	Final
CMC 419	Modeling and Simulation of Construction Systems	CMC 306	3	2	2	0	4	30	20	10	40
Course Contents	Building Information Modeling, Computer modeling of construction processes, 4-D Simulation of construction operations, Productivity modeling, measuring, and forecasting, Sequencing and coordination of construction systems, Post-Optimality Analysis of Integer and Linear Programming Models in construction, discrete event simulation of construction processes.										
References	• Suitable Software Manual.										
Laboratory	• Suitable Software.										

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hr.				Assessment			
				Lect.	Lab.	Tut.	Sum	Mid	PE/OE	St. Act.	Final
CMC 421	Geographic Information System GIS	CMC 108	3	2	2	0	4	30	20	10	40
Course Contents	Fundamentals of GIS -type, source, and format of data. GIS components, Data models, vector data models, Raster Data models, Data, and file structure. - Spatial Data Modeling- GIS Data Management- Data Input and Editing- Data Quality Issues- Data Analysis and Modeling- Creation of Information System: A Case Study										
References	- An Introduction to Geographical Information Systems, by Ian Heywood, Sarah Cornelius, Steve Carver, Prentice Hall 2006, ISBN: 0-13-129317-6, 978-0-13-129317-5, 9781405898447 • ELEMENTS OF GEOGRAPHIC INFORMATION SYSTEM-Brad Maguire-Andrew Miller-2008 • Principle of Geographical Information Systems-Otto Husiman-2009- ISBN:978-90-6164-5										
Laboratory	• ARC GIS Program ENVI Program										

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hr.				Assessment			
				Lect.	Lab.	Tut.	Sum	Mid	PE/OE	St. Act.	Final
CMC 423	Modeling of structures	CMC 102	3	2	2	0	4	30	20	10	40
Course Contents	General derivation of finite element equilibrium equations - General coordinate models for specific problem (one dimensional element - Plane stress/strain elements) - Lumping of structural properties and loads - Calculation of stresses and assessment of error - formulation of bar Element - Formulation of isoperimetric continuous elements: quadrilateral and triangular elements - Formulation of structural elements: beams -axisymmetric and plate bending elements - Numerical integration: Gauss formula (one dimension integration) - Integration in two dimensions- Computer Applications using ANSYS Engineering Simulation Software.										
References	• G. Ramamurty, " Applied Finite Element Analysis", New Delhi: 2nd Edition, I.K. Inc, 2010, ISBN-13: 978-9380578453 • George R. Buchanan," Schaum's Outline of Finite Element Analysis", 2nd Edition, United State of America, McGraw Hill Inc., 2015 • Saeed Moaveni, "Finite Element Analysis: Theory and Application with ANSYS", 4th Edition, Pearson Global Edition, 2015, ISBN 13: 978-0-273-77430-3.										
Laboratory	• ANSYS Software										

Program #12 Infrastructures and Utilities Engineering Program

Program Description

Civil engineering today is concerned with the deterioration of the nation's roads, bridges, water, and power distribution systems, storm and sanitary sewers, and other public infrastructure. The aim of the Infrastructures and Utilities Engineering Program is to graduate civil engineers responsible for the life cycle of the system he creates and must be capable of optimizing the total system performance of large-scale public works projects, including their social and environmental impacts, in a way that addresses critical issues of infrastructure behaviors, and deterioration science. On top of these fields comes surveying engineering, sanitary environment, transportation engineering, and water-related engineering projects who can enrich the water resources and public works field.

Basic Information

Program Vision

Our vision is to lead the world in infrastructure and utilities engineering, as determined by the caliber of our academics, the success of our research, and our stellar reputation.

Program Mission

The mission of the Infrastructures and Utilities Engineering program is to prepare well-educated and innovative graduates with knowledge and skills that meet the needs of the labor market and society, use modern technologies, and support lifelong learning.

Program Objectives

The objectives of the BSc in The Infrastructure and Utilities Engineering program are to enable its graduates to:

PO1. Apply a wide spectrum of engineering knowledge, science, and specialized skills with analytic, critical, and systemic thinking to identify and solve engineering problems in real-life situations.
PO2. Behave professionally, adhere to engineering ethics and standards, and work to develop the profession and community and promote sustainability principles.
PO3. Work in and lead a heterogeneous team and display leadership qualities, business administration, and entrepreneurial skills.
PO4. Master self-learning and life-long learning strategies to communicate effectively in academic/professional fields.
PO5. Preparing engineers with strong knowledge, and proficient skills in the design, operations, maintenance, analysis, evaluation systems, and rehabilitation of civil infrastructure projects.
PO6. Communicate with distinguished foreign universities in the field of Infrastructure and Utilities Engineering.

Graduates Attributes

By the completion of the Infrastructures and Utilities Engineering program of study, and according to NARS 2018, the graduate will be capable 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.

In addition to all engineering graduate attributes defined by NARS 2018, Infrastructures and Utilities Engineering graduates should be able to:

11. Design all types of roads, airport systems, transportation planning, railway engineering, and tunneling systems for different purposes.
12. Define and preserve properties (lands, real estate) of individuals, communities, and institutions, through different surveying and GIS tools.
13. Design all types of projects that are necessary for environmental engineering

Program Learning Outcomes

In addition to the competencies for all Engineering Programs (A-Level), the Infrastructures and Utilities Engineering Program graduate must be able to (B and C-Level):

Level	Program Learning Outcomes according to NARS 2018
A	**PLO1**: Identity, 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 team
	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.
B	**PLO11:** Select appropriate and sustainable technologies for construction of buildings, infrastructures, and water structures; using either numerical techniques or physical measurements and/or testing by applying a full range of civil engineering concepts and techniques of: Structural Analysis and Mechanics, Properties and Strength of Materials, Surveying, Soil Mechanics and Fluid Mechanics.

	PLO12: Achieve an optimum design of Reinforced Concrete and Steel Structures, Foundations and Earth Retaining Structures, Transportation and Traffic, Roadways and Airports, Railways, Sanitary Works, Irrigation, Water Resources and Harbours; or any other emerging field relevant to the discipline.
	PLO13: Plan and manage construction processes; address construction defects, instability and quality issues; and maintain safety measures in construction and materials.
	PLO14: Deal with biddings, contracts and financial issues including project insurance and guarantees; and assess environmental impacts of civil engineering projects.
C	**PLO15**: Identify principles in the fields of hydrographic and underground survey, geodesy, photogrammetry, remote sensing, roads, railways and airport systems, water and wastewater systems, and their codes of practice and standards. **PLO16:** Plan and design the highways, railways, airports, traffic and pavement management systems, water and wastewater networks, and treatment facilities and produce civil drawings. **PLO17:** Consider the environmental issues in transportation planning and traffic engineering, water and wastewater systems, and solid waste management, conduct field, and laboratory measurements, and assess the environmental impact of public works engineering projects. **PLO18:** Confirm the additional abilities to Use a wide range of analytical tools, techniques, equipment, and software packages in the field of, hydrographic and underground survey, photogrammetry, Geographic Information systems, and remote sensing.

Faculty Mission vs. Program Mission Matrix

Faculty Mission		Program Mission		
		The mission of the Infrastructures and Utilities Engineering program is to prepare well-educated and innovative graduates with knowledge and skills that meet the needs of the labor market and society, use modern technologies, and support lifelong learning.		
		the Infrastructures and Utilities Engineering program is to prepare well-educated and innovative graduates with knowledge and skills	To meet the needs of the labor market and society's needs	Capable of using modern technology and have a deep concern for lifelong learning.
Benha Faculty of Engineering - Benha University is committed to graduate well-prepared engineers equipped with the knowledge and skills necessary to compete for the in the labor market, capable of using and developing modern technology, and providing research in engineering fields to serve society and the community.	Benha Faculty of Engineering - Benha University is committed to graduate well-prepared engineers equipped with the knowledge and skills necessary to compete in the labor market	√		
	Providing research in engineering fields to serve society and the community		√	
	Capable of using and developing modern technology			√

Program Mission vs. Program Objectives Matrix

Program Mission		Program Objectives					
		PO1	PO2	PO3	PO4	PO5	PO6
The mission of the Infrastructures and Utilities Engineering program is to prepare well-educated and innovative graduates with knowledge and skills that meet the needs of the labor market and society, use modern technologies, and support lifelong learning	The Infrastructures and Utilities Engineering program is to prepare well-educated and innovative graduates with knowledge and skills	√				√	
	To meet the requirements of the labor market, society's needs		√	√	√		
	Capable of using modern technology, and deep concern in lifelong learning.				√	√	√

Program Objectives vs. Program Competencies Matrix

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

Program Objectives vs. Graduate Attributes Matrix

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

Career Prospects

Graduate engineers of this program can work on various infrastructure projects (Environmental Engineering, Road, Railway Tunnel work, Underground Survey, GNSS, and Hydrographic Survey).

Program graduates:

Design Engineer: Develop the basics and details of many infrastructures projects
Site Engineer: Applies and coordinates the various infrastructure processes on the site.
Survey Engineer: Infrastructure projects survey works.
Project manager: oversees all aspects of a project, coordinates subcontractors, and provides primary contact to the client as well as to the company's leaders.
Graduates of this program can work with:
Government authorities
Municipalities
Urban infrastructure organizations
Civil engineering contractors and project managers
Water and sanitation utility companies
Transport authorities and operating companies
Environmental engineering and Water regulatory authority organizations

Requirements of Program Courses

In order to get a Bachelor of Science Degree in this program, and to satisfy the Program competences, the following set of courses needs to be completed.

Program Requirements

Requirement		Cr. Hrs.	Ct. Hr.			
			Lect.	Lab.	Tut.	Sum
Benha University Requirements		14	14	0	0	14
Benha Faculty of Engineering Requirements		32	19	14	16	49
Program Requirements	From Basic science	12	8	6	3	17
	Compulsory Courses	84	57	30	39	126
	Elective courses	18	12	2	10	24
Total		160	110	52	68	230

University Requirements of Infrastructures and Utilities Engineering Program
Lists of Humanities Courses of Infrastructures and Utilities Engineering Program

Code	Course	Pre-requisites	Cr. Hrs.	Ct. Hr.			
				Lect.	Lab.	Tut.	Sum
UHS 101	Foreign Language	-----	2	2	0	0	2
UHS 103	Societal Issues	-----	2	2	0	0	2
UHS 102	Information and Communication Technology	-----	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**

Lists of Electives Humanities of Infrastructures and Utilities Engineering Program

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

Faculty Requirements of Infrastructures and Utilities Engineering Program

Code	Course	Pre-requisites	Cr. Hrs.	Ct. Hr.			
				Lec.	Lab.	Tut	Sum
FRB 001	Analytical geometry & Linear Algebra	-----	3	2	0	2	4
FRB 003	Statics	-----	3	2	0	2	4
FRB 005	Waves and Heat	-----	3	2	2	1	5
FRB 007	Chemistry for Engineers	-----	4	3	2	1	6
FRM 009	Engineering Graphics	-----	2	0	0	4	4
FRB 002	Integration & Multivariable functions	FRB 001	3	2	0	2	4
FRB 004	Dynamics	FRB 003	3	2	0	2	4
FRB 006	Electricity and Magnetism	-----	3	2	2	1	5
FRM 008	Production Systems Engineering	-----	2	1	3	0	4
FRM 010	Computer Aided Drafting	FRM 009	2	1	2	0	3
FRE 012	Computer Programming	-----	2	0	2	2	4
FRB 103	Environmental Pollution and Industrial Safety	FRB 007	2	2	1	0	3
FT 1	Field Training I		0	0	0	0	0
FT 2	Field Training II		0	0	0	0	0
Total			**32**	**19**	**14**	**17**	**50**

Basic Science Requirements of Infrastructures and Utilities Engineering Program

CODE	Course Name	Pre-requisites	Cr. Hrs.	Ct. Hr.			
				Lect.	Lab.	Tut.	Sum
FRB 001	Analytical geometry & Linear Algebra	-----	3	2	0	2	4
FRB 002	Integration & Multivariable functions	FRB 001	3	2	0	2	4
FRB 101	Engineering Differential Equations	FRB 002	3	2	0	2	4
FRB 201	Applied Engineering Probability and Mathematical Statistics	-----	3	2	2	0	4
FRB 104	Engineering Numerical Analysis	FRB 101	3	2	2	0	4
FRB 007	Chemistry for Engineers	-----	4	3	2	1	6
FRB 102	Water Chemistry	FRB 007	3	2	2	0	4
FRB 103	Environmental Pollution and Industrial Safety	FRB 007	2	2	1	0	3
FRB 005	Waves and Heat	-----	3	2	2	1	5
FRB 006	Electricity and Magnetism	-----	3	2	2	1	5
Total			**30**	**21**	**13**	**9**	**43**

Program Requirements
Lists of Compulsory Courses (96 Credit Hours)

Code	Course Title	Pre-requisites	Cr. Hrs.	Contact Hours			
				Lec	Lab	Tut	Sum
FRB 101	Engineering Differential Equations	FRB 002	3	2	0	2	4
FRB 102	Water Chemistry	FRB 007	3	2	2	0	4
FRB 201	Applied Engineering Probability and Mathematical Statistics	-----	3	2	2	0	4
FRB 104	Engineering Numerical Analysis	FRB 101	3	2	2	0	4
UIC 101	Structural Analysis I	FRB 003	3	2	0	2	4
UIC 103	Properties and Testing of Construction Materials	FRB 003	2	2	1	0	3
UIC 105	Surveying 1	FRB 002	3	2	2	1	5
UIC 107	CAD for Civil Engineers	FRM 010	2	1	3	0	4
UIC 109	Fluid Mechanics	FRB 005	2	2	1	0	3
UIC 102	Structural Analysis II	UIC 101	3	2	0	2	4
UIC 104	Construction Materials and Concrete Technology	FRB 007+UIC 103	3	2	2	1	5
UIC 106	Surveying 2	UIC 105	3	2	0	2	4
UIC 108	Engineering Geology	-----	2	2	0	1	3
UIC 110	Hydraulics	UIC 109	2	2	1	0	3
UIC 201	Transportation Planning	UIC 106	2	2	0	1	3
UIC 203	Design of R.C. Structures-1	UIC 102 +UIC 104	3	2	0	2	4
UIC 205	Environmental Engineering	FRB 102	2	2	0	1	3
UIC 207	Hydrographic Surveying	UIC 106	3	2	0	2	4
UIC 209	Soil Mechanics	UIC 103	3	2	2	1	5
UIC 202	Traffic Engineering	FRB 201	3	2	1	2	5
UIC 204	Design of R.C. Structures-2	UIC 203	3	2	0	2	4
UIC 206	Water Supply Engineering	UIC110+ UIC 205	3	2	2	1	5
UIC 208	Under-Ground Utility Surveying	UIC 106	3	2	0	2	4

UIC 210	Geotechnical Engineering & Foundations	UIC 209	3	2	2	1	5
UIC 301	Computer Applications	FRE 012	2	1	3	0	4
UIC 303	Highway Engineering I	UIC 201	3	2	2	1	5
UIC 305	Design of Metallic Structures-1	UIC 102	3	2	0	2	4
UIC 307	Wastewater Engineering	UIC 205	3	2	0	2	4
UIC 309	Design of Foundations and Earth Retaining Structures	UIC 210	3	2	0	2	4
UIC 302	Highway Engineering II	UIC 303	3	2	0	2	4
UIC 304	Water Distribution &Sewer System design	UIC 206+UIC 307	3	2	0	2	4
UIC 306	Ground Water Hydrology	UIC 110	3	2	0	2	4
UIC 308	Senior Design Project I	*	2	0	4	0	4
UIC 401	Infrastructure Management &Financing	-----	3	2	0	2	4
UIC 403	Senior Design Project II	UIC 308	3	1	4	0	5
			84	**57**	**30**	**39**	**126**

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

Lists of Elective Courses (18 Credit Hours)

CODE	Course Name	Pre-requisites	Cr. Hrs.	Ct. Hr.			
				Lect.	Lab.	Tut.	Sum
Elective I							
UIC 311	Dynamic of Structures	UIC102	3	2	0	2	4
UIC 313	Tunnels and Underground Structure	UIC 210	3	2	0	2	4
UIC 315	Special Topics in Structural Analysis	UIC 102	3	2	0	2	4
Elective II							
UIC 310	Photogrammetry by Drones	UIC 106	3	2	0	2	4
UIC 312	Remote Sensing	UIC 106	3	2	0	2	4
UIC 314	GIS Applications in Civil infrastructure Projects	UIC 106	3	2	0	2	4
Elective III							
UIC 316	Environmental Impact Assessment	UIC 205	3	2	0	2	4
UIC 318	Sustainable Transportation and Highways Engineering	UIC 202	3	2	0	2	4
UIC 320	Sustainable Environmental Engineering	UIC 205	3	2	0	2	4
Elective IV							
UIC 405	Pavement Evaluation and Management	UIC 303	3	2	0	2	4
UIC 407	Airports Engineering	UIC 303	3	2	0	2	4
UIC 409	Railways Engineering	UIC 201	3	2	0	2	4
Elective V							
UIC 411	Cost Engineering & Quantity Surveying	----------	3	2	0	2	4
UIC 413	Project Planning, Scheduling, and Control	----------	3	2	0	2	4

UIC 415	Construction Project Specifications, Bids, and Contracts	----------	3	2	0	2	4
Elective VI							
UIC 417	Computer Applications in Sanitary Engineering	UIC 304	3	2	2	0	4
UIC 419	Computer Applications in Transportation Systems	UIC 303	3	2	2	0	4
UIC 421	Programing Applications in Survey.	UIC 106	3	2	2	0	4
Total			**18**	**12**	**2**	**10**	**24**

Proposed Study Plan

Level 0-1														
CODE	Course Name	Pre-requisites	Cr. Hrs.	Ct. Hr.				Final Exam Time	Assessment					
				Lect.	Lab.	Tut.	Sum		Mid 1	Mid 2	PE/OE	St. Act.	Final	sum
FRB 001	Analytical geometry & Linear Algebra	-----	3	2	0	2	4	2 hr	30	20	--	10	40	100
FRB 003	Statics	-----	3	2	0	2	4	2 hr	30	20	--	10	40	100
FRB 005	Waves and Heat	-----	3	2	2	1	5	2 hr	30	--	20	10	40	100
FRB 007	Chemistry for Engineers	-----	4	3	2	1	6	2 hr	30	--	20	10	40	100
FRM 009	Engineering Graphics	-----	2	0	0	4	4	2 hr	30	20	--	10	40	100
UHS 101	Foreign Language	-----	2	2	0	0	2	2 hr	30	20	--	10	40	100
UHS 102	Information and Communication Technology	-----	2	2	0	0	2	2 hr	30	20	--	10	40	100
Sum			**19**	**13**	**4**	**10**	**27**							**700**

Level 0-2														
CODE	Course Name	Pre-requisites	Cr. Hrs.	Ct. Hr.				Final Exam Time	Assessment					
				Lect.	Lab.	Tut.	Sum		Mid 1	Mid 2	PE/OE	St. Act.	Final	sum
FRB 002	Integration & Multivariable functions	FRB 001	3	2	0	2	4	2 hr	30	20	--	10	40	100
FRB 004	Dynamics	FRB 003	3	2	0	2	4	2 hr	30	20	--	10	40	100
FRB 006	Electricity and Magnetism	-----	3	2	2	1	5	2 hr	30	--	20	10	40	100
FRM 008	Production Systems Engineering	-----	2	1	3	0	4	2 hr	30	--	20	10	40	100
FRM 010	Computer Aided Drafting	FRM 009	2	1	2	0	3	2 hr	30	20	40	10	--	100
UHS 103	Societal Issues	-----	2	2	0	0	2	2 hr	30	20	--	10	40	100
FRE 012	Computer Programming	-----	2	0	2	2	4	2 hr	30	20	40	10	--	100
Sum			**17**	**10**	**9**	**7**	**26**							**700**

Level 1-1														
CODE	Course Name	Pre-requisites	Cr. Hrs.	Ct. Hr.				Final Exam Time	Assessment					
				Lect.	Lab.	Tut.	Sum		Mid 1	Mid 2	PE/OE	St. Act.	Final	sum
FRB 101	Engineering Differential Equations	FRB 002	3	2	0	2	4	2 hr	30	20	--	10	40	100
UIC 101	Structural Analysis I	FRB 003	3	2	0	2	4	2 hr	30	20	--	10	40	100
UIC 103	Properties and Testing of Construction Materials	FRB 003	2	2	1	0	3	2 hr	30	--	20	10	40	100
FRB 103	Environmental Pollution and Industrial Safety	FRB 007	2	2	1	0	3	2 hr	30	--	20	10	40	100
UIC 105	Surveying 1	FRB 002	3	2	2	1	5	2 hr	30	--	20	10	40	100
UIC 107	CAD for Civil Engineers	FRM 010	2	1	3	0	4	2 hr	30	20	40	10	--	100
UIC 109	Fluid Mechanics	FRB 005	2	2	1	0	3	2 hr	30	--	20	10	40	100
Sum			**17**	**13**	**8**	**5**	**26**							**700**

Level 1-2														
CODE	Course Name	Pre-requisites	Cr. Hrs.	Ct. Hr.				Final Exam Time	Assessment					
				Lect.	Lab.	Tut.	Sum		Mid 1	Mid 2	PE/OE	St. Act.	Final	sum
FRB 102	Water Chemistry	FRB 007	3	2	2	0	4	2 hr	30	--	20	10	40	100
UIC 102	Structural Analysis II	UIC 101	3	2	0	2	4	2 hr	30	20	--	10	40	100
UIC 104	Construction Materials and Concrete Technology	FRB 007+UIC 103	3	2	2	1	5	2 hr	30	--	20	10	40	100
UIC 106	Surveying 2	UIC 105	3	2	0	2	4	2 hr	30	20	--	10	40	100
UIC 108	Engineering Geology	-----	2	2	0	1	3	2 hr	30	20	--	10	40	100
UIC 110	Hydraulics	UIC 109	2	2	1	0	3	2 hr	30	--	20	10	40	100
Sum			**16**	**12**	**5**	**6**	**23**							**600**

Field Training I													
CODE	Course Name	Pre-requisites	Cr. Hrs.	Ct. Hr.				Final Exam Time	Assessment				
				Lect.	Lab.	Tut.	Sum		Mid 1	Mid 2	St. Act.	Final	sum
FT 1	Field Training I	Completion of 65 Cr. Hrs.	0	0	0	0	0	Oral	-	-	-	Pass or Fail	

Level 2-1														
CODE	Course Name	Pre-requisites	Cr. Hrs.	Ct. Hr.				Final Exam Time	Assessment					
				Lect.	Lab.	Tut.	Sum		Mid 1	Mid 2	PE/OE	St. Act.	Final	sum
FRB 201	Applied Engineering Probability and Mathematical Statistics	-----	3	2	2	0	4	2 hr	30	--	20	10	40	100
UIC 201	Transportation Planning	UIC 106	2	2	0	1	3	2 hr	30	20	--	10	40	100
UIC 203	Design of R.C. Structures-1	UIC 102 +UIC 104	3	2	0	2	4	2 hr	30	20	--	10	40	100
UIC 205	Environmental Engineering	FRB 102	2	2	0	1	3	2 hr	30	20	--	10	40	100
UIC 207	Hydrographic Surveying	UIC 106	3	2	0	2	4	2 hr	30	20	--	10	40	100
UIC 209	Soil Mechanics	UIC 103	3	2	2	1	5	2 hr	30	--	20	10	40	100
UHS XXX	Humanities Elective I	-----	2	2	0	0	2	2 hr	30	20	--	10	40	100
Sum			**18**	**14**	**4**	**7**	**25**							**700**

Level 2-2														
CODE	Course Name	Pre-requisites	Cr. Hrs.	Ct. Hr.				Final Exam Time	Assessment					
				Lect.	Lab.	Tut.	Sum		Mid 1	Mid 2	PE/OE	St. Act.	Final	sum
FRB 104	Engineering Numerical Analysis	FRB 101	3	2	2	0	4	2 hr	30	--	20	10	40	100
UIC 202	Traffic Engineering	FRB 201	3	2	1	2	5	2 hr	30	--	20	10	40	100
UIC 204	Design of R.C. Structures-2	UIC 203	3	2	0	2	4	2 hr	30	20	--	10	40	100
UIC 206	Water Supply Engineering	UIC 110+UIC 205	3	2	2	1	5	2 hr	30	--	20	10	40	100
UIC 208	Under-Ground Utility Surveying	UIC 106	3	2	0	2	4	2 hr	30	20	--	10	40	100
UIC 210	Geotechnical Engineering & Foundations	UIC 209	3	2	2	1	5	2 hr	30	--	20	10	40	100
Sum			**18**	**12**	**7**	**8**	**27**							**600**

Field Training I													
CODE	Course Name	Pre-requisites	Cr. Hrs.	Ct. Hr.				Final Exam Time	Assessment				
				Lect.	Lab.	Tut.	Sum		Mid 1	Mid 2	St. Act.	Final	sum
FT 2	Field Training II	Completion of 96 Cr. Hrs.	0	0	0	0	0	Oral	-	-	-	Pass or Fail	

Level 3-1														
CODE	Course Name	Pre-requisites	Cr. Hrs.	Ct. Hr.				Final Exam Time	Assessment					
				Lect.	Lab.	Tut.	Sum		Mid 1	Mid 2	PE/OE	St. Act.	Final	sum
UIC 301	Computer Applications	FRE 012	2	1	3	0	4	2 hr	30	20	40	10	--	100
UIC 303	Highway Engineering I	UIC 201	3	2	2	1	5	2 hr	30	--	20	10	40	100
UIC 305	Design of Metallic Structures-1	UIC 102	3	2	0	2	4	2 hr	30	20	--	10	40	100
UIC 307	Wastewater Engineering	UIC 205	3	2	0	2	4	2 hr	30	20	--	10	40	100
UIC 3XX	Elective I	*	3	2	0	2	4	2 hr	30	20	--	10	40	100
UIC 309	Design of Foundations and Earth Retaining Structures	UIC 210	3	2	0	2	4	2 hr	30	20	--	10	40	100
UHS XXX	Humanities Elective II	-----	2	2	0	0	2	2 hr	30	20	--	10	40	100
Sum			**19**	**13**	**5**	**9**	**27**							**700**

*** According to the Course Name**

Level 3-2														
CODE	Course Name	Pre-requisites	Cr. Hrs.	Ct. Hr.				Final Exam Time	Assessment					
				Lect.	Lab.	Tut.	Sum		Mid 1	Mid 2	PE/OE	St. Act.	Final	sum
UIC 3XX	Elective II	*	3	2	0	2	4	2 hr	30	20	--	10	40	100
UIC 302	Highway Engineering II	UIC 303	3	2	0	2	4	2 hr	30	20	--	10	40	100
UIC 3XX	Elective III	*	3	2	0	2	4	2 hr	30	20	--	10	40	100
UIC 304	Water Distribution &Sewer System design	UIC 206+UIC 307	3	2	0	2	4	2 hr	30	20	--	10	40	100
UIC 306	Ground Water Hydrology	UIC 110	3	2	0	2	4	2 hr	30	20	--	10	40	100
UIC 308	Senior Design Project I	**	2	0	4	0	4	2 hr	30	20	--	10	40	100
UHS 104	Professional Ethics	-----	2	2	0	0	2	2 hr	30	20	--	10	40	100
Sum			**19**	**12**	**4**	**10**	**26**							**700**

*** According to the Course Name**

**** The student can register the senior design Project course after passing 70% of the program cr. hrs, i.e., 112 Cr. Hr. Pre-requisites according to the project area.**

Level 4-1													
CODE	Course Name	Pre-requisites	Cr. Hrs.	Ct. Hr.				Final Exam Time	Assessment					
				Lect.	Lab.	Tut.	Sum		Mid 1	Mid 2	PE/OE	St. Act.	Final	sum
UIC 401	Infrastructure Management &Financing	-----	3	2	0	2	4	2 hr	30	20	--	10	40	100
UIC 4XX	Elective IV	*	3	2	0	2	4	2 hr	30	20	--	10	40	100
UIC 4XX	Elective V	*	3	2	0	2	4	2 hr	30	20	--	10	40	100
UIC 4XX	Elective VI	*	3	2	2	0	4	2 hr	30	20	--	10	40	100
UIC 403	Senior Design Project II	UIC 308	3	1	4	0	5	2 hr	30	20	--	10	40	100
UHS XXX	Humanities Elective III	-----	2	2	0	0	2	2 hr	30	20	--	10	40	100
Sum			**17**	**11**	**6**	**6**	**23**							**600**

*** According to the Course Name**

Matching Infrastructures and Utilities Engineering Program Courses with ABET Requirements

ABET Program Criteria for Civil and Similarly Named Engineering Programs

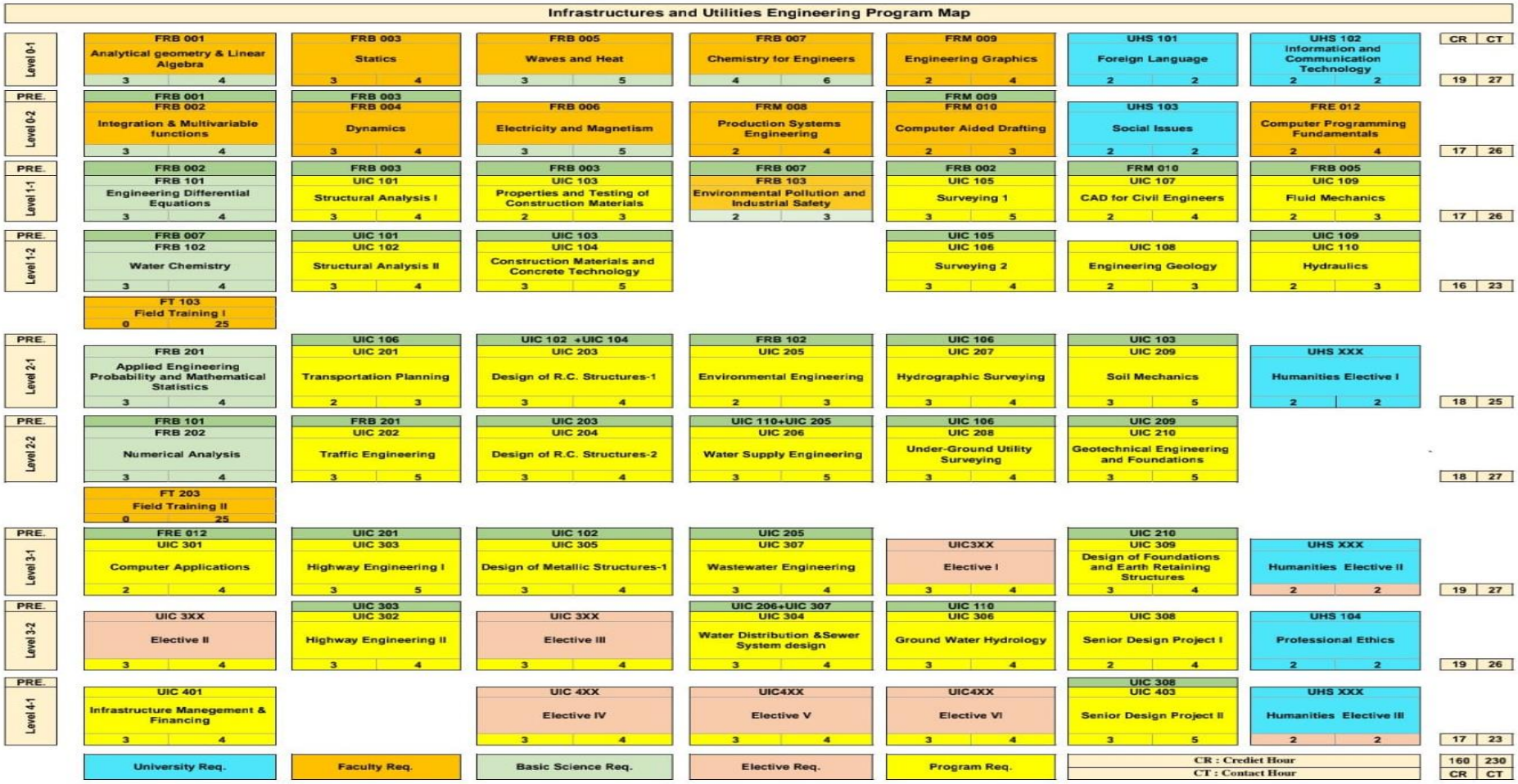
Lead Society: American Society of Civil Engineers

Construction Engineering and Management Program Courses Required to Cover ABET Criteria				
ABET Criteria		**CODE**	**Course Name**	**Credit Hours**
A minimum of 30 semester credit hours (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.	FRB 001	Analytical geometry & Linear Algebra	3
		FRB 002	Integration & Multivariable functions	3
		FRB 101	Engineering Differential Equations	3
	At least one additional area of basic science; apply probability and statistics to address uncertainty	FRB 104	Engineering Numerical Analysis	3
		FRB 201	Applied Engineering Probability and Mathematical Statistics	3
	Chemistry	FRB 007	Chemistry for Engineers	4
		FRB 102	Water Chemistry	3
		FRB 103	Environmental Pollution and Industrial Safety	2
	Calculus-based physics	FRB 005	Waves and Heat	3
		FRB 006	Electricity and Magnetism	3
Total				**30**
ABET Criteria		**CODE**	**Course Name**	**Credit Hours**
A minimum of 45 semester credit hours (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 solve problems in at least four technical areas appropriate to civil engineering.	UIC 102	Structural Analysis II	3
		UIC 201	Transportation Planning	2
		UIC 208	Under-Ground Utility Surveying	3
		UIC 301	Computer Applications	2
		UIC 3XX	Elective Courses II	3
	Conduct experiments in at least two technical areas of civil engineering and analyze and interpret the resulting data.	UIC 105	Surveying 1	3
		UIC 109	Fluid Mechanics	2
		UIC 202	Traffic Engineering	3
		UIC 206	Water Supply Engineering	3
	Design a system, component, or process in at least two civil engineering contexts;	UIC 3XX	Elective Courses I	3
		UIC 303	Highway Engineering I	3
		UIC 304	Water Distribution &Sewer System design	3

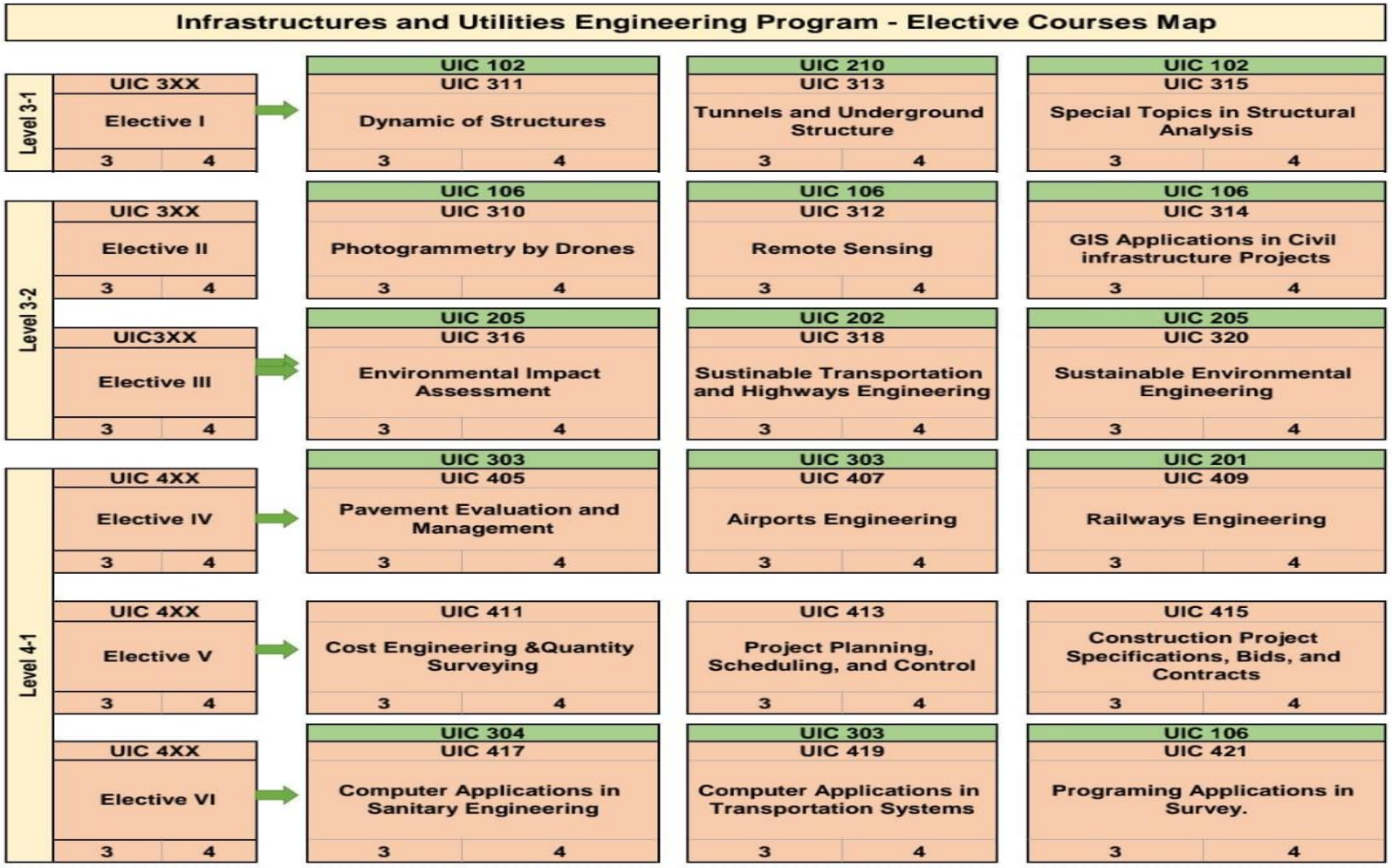
		UIC 309	Design of Foundations and Earth Retaining Structures	3
	Include principles of sustainability in design	UIC 3XX	Elective Courses III	3
	Explain basic concepts in project management, business, public policy, and leadership .	UHS 102	Information and Communication Technology	2
		UHS XXX	Humanities Elective I	2
		UHS XXX	Humanities Elective II	2
		UIC 401	Infrastructure Management &Financing	3
		UIC 4XX	Elective Courses V	3
	Analyze issues in professional ethics and explain the importance of professional licensure.	UHS 104	Professional Ethics	2
Total				**53**

Courses Plan and Matrix

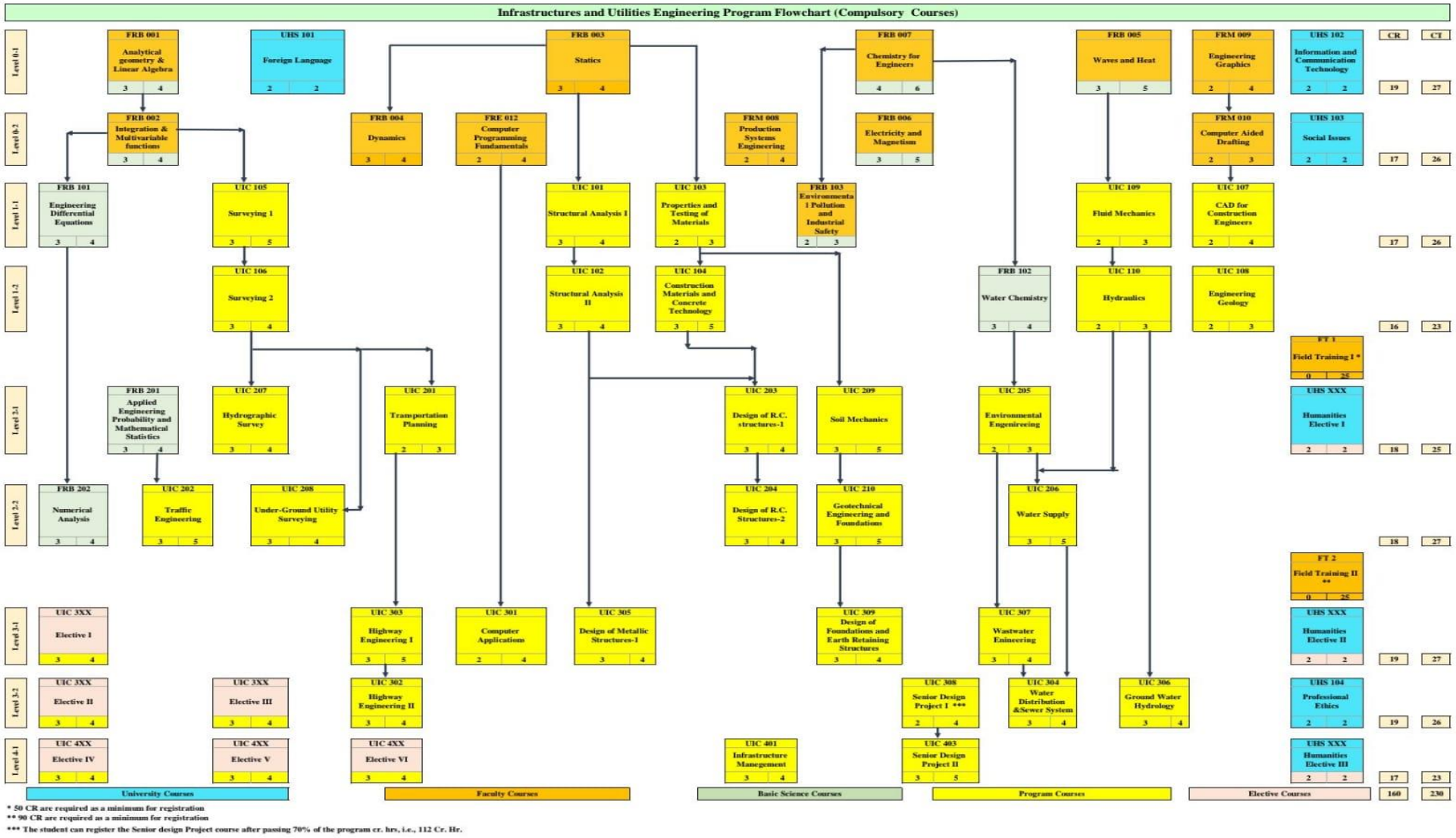
Infrastructures and Utilities Engineering Program Map



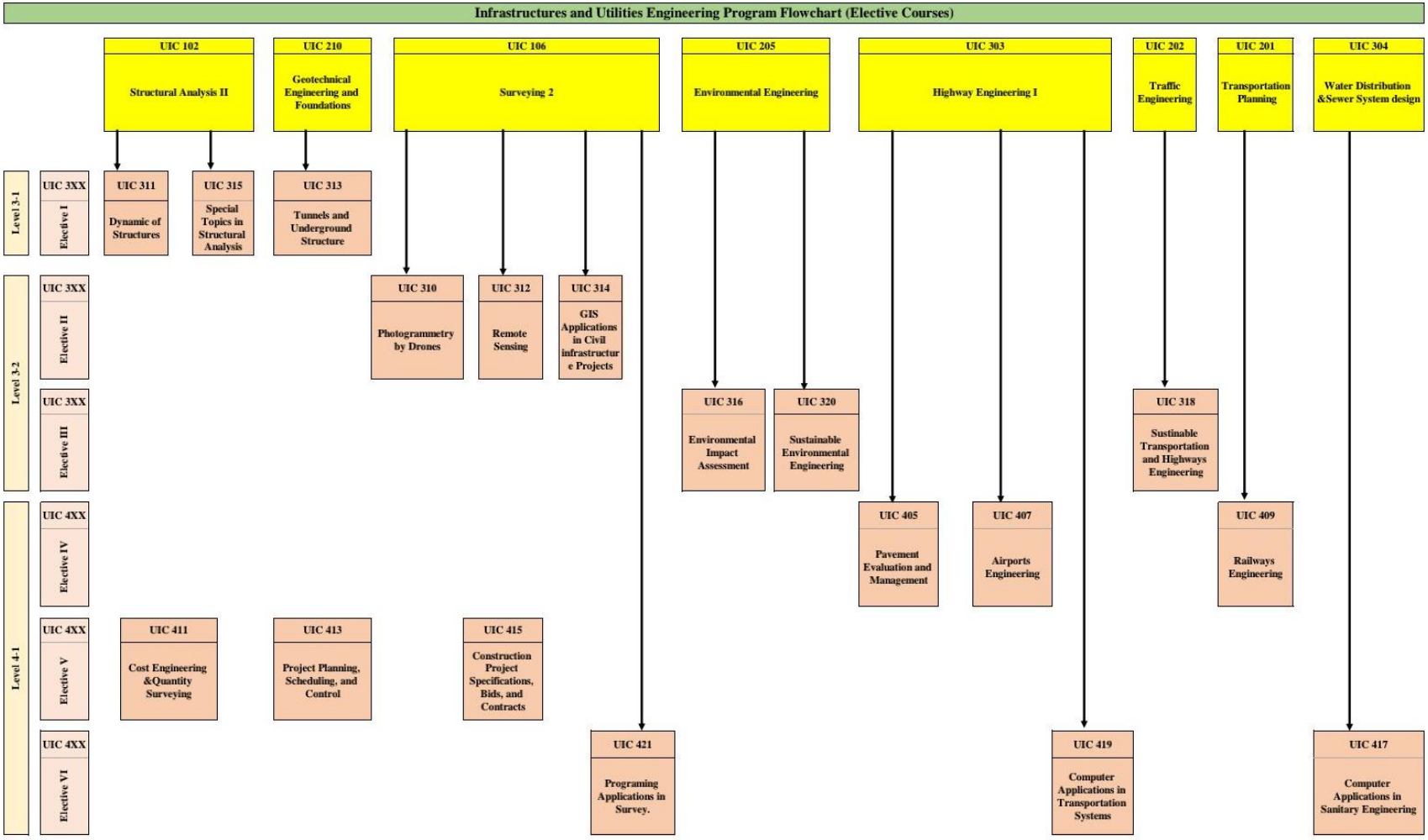
Elective Courses



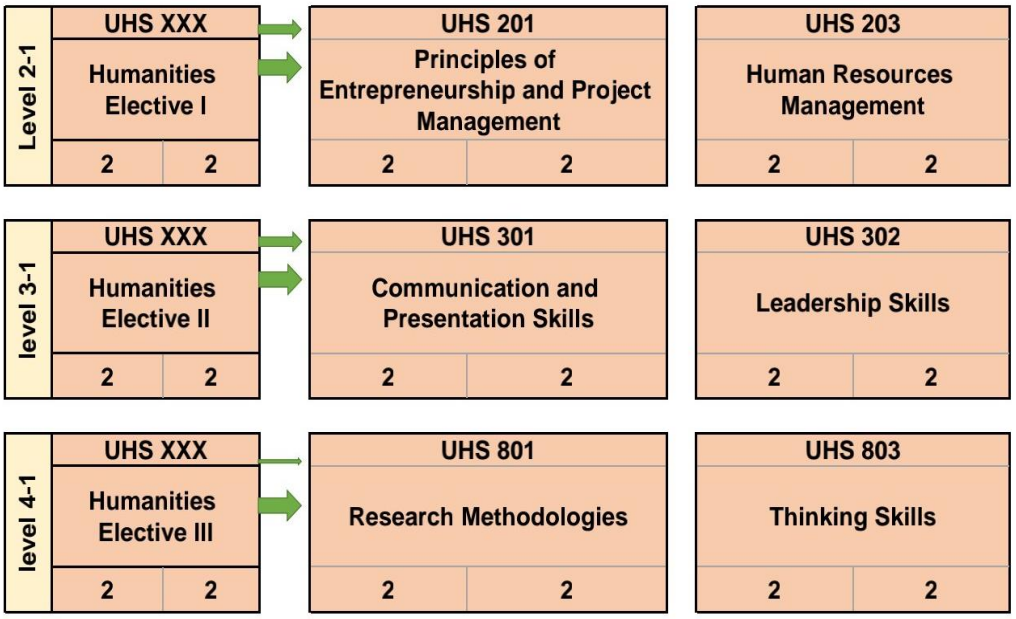
Infrastructures and Utilities Engineering Program Flowchart



Elective Courses



Infrastructures and Utilities Engineering Engineering Program - Humanities Elective Map



Program Learning Outcomes to Courses Matrix

Code	Title	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12	PLO13	PLO14	PLO15	PLO16	PLO17	PLO18
Main Humanities Courses																			
UHS101	Foreign Language								*		*								
UHS 102	Information and Communication Technology				*						*								
UHS 103	Societal issues							*			*								
UHS 104	Professional Ethics				*	*													
UHS XXX	Humanities Elective I			*	*														
UHS XXX	Humanities Elective II								*	*									
UHS XXX	Humanities Elective III					*					*								
FRB 001	Analytical geometry & Linear Algebra	*		*															
FRB 002	Integration & Multivariable functions	*		*															
FRB 101	Engineering Differential Equations	*	*																
FRB 104	Engineering Numerical Analysis	*	*																
FRB 201	Applied Engineering Probability and Mathematical Statistics	*	*																
FRB 007	Chemistry for Engineers	*	*																
FRB 102	Water Chemistry	*	*		*														
FRB 103	Environmental Pollution and Industrial Safety	*		*	*														
FRB 005	Waves and Heat	*	*																
FRB 006	Electricity and Magnetism	*	*																
FRM 009	Engineering Graphics						*		*										
FRM 008	Production Systems Engineering				*		*												
FRM 010	Computer Aided Drafting				*				*										
FRE 012	Computer Programming	*		*															
FRB 003	Statics	*	*																
FRB 004	Dynamics	*	*																
UIC 103	Properties and Testing of Construction Materials		*									*							
UIC 104	Construction Materials and Concrete Technology		*									*							
UIC 108	Engineering Geology					*						*							

UIC 209	Soil Mechanics		*			*						*						
UIC 210	Geotechnical Engineering and Foundations		*	*								*	*					
UIC 101	Structural Analysis I	*										*						
UIC 102	Structural Analysis II	*										*						
UIC 203	Design of R.C. Structures-1			*	*								*					
UIC 204	Design of R.C. Structures-2			*	*								*					
UIC 305	Design of Metallic Structures-1			*	*								*					
UIC 309	Design of Foundations and Earth Retaining Structures			*									*					
UIC 105	Surveying 1		*			*		*				*			*			
UIC 106	Surveying 2					*						*						
UIC 207	Hydrographic Surveying					*										*		*
UIC 208	Under-Ground Utility Surveying					*										*		*
UIC 201	Transportation Planning	*				*							*	*	*			
UIC 202	Traffic Engineering					*							*	*				
UIC 302	Highway Engineering II			*			*										*	
UIC 303	Highway Engineering I			*		*											*	*
UIC 109	Fluid Mechanics	*	*									*						
UIC 110	Hydraulics			*		*						*						
UIC 306	Ground Water Hydrology				*							*						
UIC 205	Environmental Engineering				*										*			
UIC 206	Water Supply Engineering		*										*					
UIC 304	Water Distribution &Sewer System design			*												*	*	
UIC 307	Wastewater Engineering				*											*		*
UIC 107	CAD for Construction Engineers				*								*					
UIC 301	Computer Applications		*														*		*
UIC 401	Infrastructure Management &Financing				*		*		*					*	*				
UIC 308	Senior Design Project I			*	*		*	*	*	*	*			*	*	*	*	*	*
UIC 403	Senior Design Project II			*	*		*	*	*	*	*			*	*	*	*	*	*
UIC 3XX	Program Elective Courses I			*						*			*						
UIC 3XX	Program Elective Courses II					*		*		*						*			*
UIC 3XX	Program Elective Courses III				*		*											*	
UIC 4XX	Program Elective Courses IV			*						*						*	*		
UIC 4XX	Program Elective Courses V						*							*	*				
UIC 4XX	Program Elective Courses VI					*	*	*		*	*						*	*	*
FT 1	Field Training I							*			*								
FT 2	Field Training II							*			*								

Infrastructures and Utilities Engineering Program Courses

Courses Coding System

The course coding system is composed of three letters 3 letters that denote the department that offers the course, followed by 3 digits, where:

- the first digit from the left represents the course level (from 1 to 5),
- the middle and right digits represent the course sequence.

The coding system is demonstrated in the following table:

UHS XXX	University Requirement Compulsory and Elective Courses
FRB XXX	Courses offered by Basic Engineering Science Department
FRM XXX	Faculty requirement course offered by Electrical Engineering Department
FRE XXX	Course offered by Electrical Engineering Department
UIC XXX	Course offered by Civil Engineering Department

Program Requirements
Compulsory Courses

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hr.				Assessment			
				Lect.	Lab.	Tut.	Sum	Mid 1	Mid 2	St. Act.	Final
FRB 101	Engineering Differential Equations	FRB 002	3	2	0	2	4	30	20	10	40
Course Contents	**Basic Concepts of Ordinary and Partial differential equations (ODEs & PDEs):** Oder, Degree, Linearity, Formation, Geometric and physical applications (Newtons law of cooling, electric circuits), Types of solutions, Existence and uniqueness of solutions. **ODEs:** Solution of first order ODEs (Separable, Homogeneous, Exact, Integrating factor, Linear and Bernoulli equations). Orthogonal trajectories. Solution of nth order ODEs (homogeneous and non-homogeneous). System of first order linear differential equations. Laplace transforms and inverse Laplace transforms with applications. Fourier series with applications. Gamma and Beta functions **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 Name	Pre-req.	Cr. Hrs.	Ct. Hr.				Assessment			
				Lect.	Lab.	Tut.	Sum	Mid	PE/OE	St. Act.	Final
FRB 102	Water Chemistry	FRB 007	3	2	2	0	4	30	20	10	40
Course Contents	This course aims to provide an introduction of equilibrium chemistry principles in aquatic systems. This course is designed for engineering students who are often required to understand the composition of solutions and direction of changes during treatment or in environmental systems. By completion of the course, the student will be able to interpret and communicate results related to water quality. Therefore, the course syllabus includes the following topics: equilibrium principles of acids-bases, dissolution-precipitation, titration, gas-liquid equilibrium, oxidation-reduction, complexation and water quality analysis and quality control.										
References	• Sawyer, McCarty & Parkin, Chemistry for Environmental Engineering, McGraw Hill, 2003 • Stumm & Morgan, aquatic Chemistry. Third edition, John Wiley&Sons. 1995										
Laboratory	• Acid – base titration • Total hardness, • Total alkali, • Conductivity, • Total dissolved solids										

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hr.				Assessment			
				Lect.	Lab.	Tut.	Sum	Mid	PE/OE	St. Act.	Final
FRB 201	Applied Engineering Probability and Mathematical Statistics	----	3	2	2	0	4	30	20	10	40
Course Contents	**Probability:** Basic Theorems of Probability. Conditional Probability. Independent Events. Discrete and Continuous Random Variables. Mean and Variance of Distributions. Discrete Distributions (Binomial, Poisson and Hypergeometric Distribution). Continuous Distributions (Normal and Exponential Distribution). Distributions of Several Random Variables (Discrete and Continuous Two-Dimensional Distributions). **Mathematical Statistics:** Random Sampling. Sample mean and variance. Point Estimation of Parameters. Confidence Intervals. Simple and multiple Linear Regression and Correlation. Testing of Hypotheses. Markov chains. Quality Control. Engineering Applications. 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 Name	Pre-req.	Cr. Hrs.	Ct. Hr.				Assessment			
				Lect.	Lab.	Tut.	Sum	Mid	PE/OE	St. Act.	Final
FRB 104	Engineering Numerical Analysis	FRB 101	3	2	2	0	4	30	20	10	40
Course Contents	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 Name	Pre-req.	Cr. Hrs.	Ct. Hr.				Assessment			
				Lect.	Lab.	Tut.	Sum	Mid 1	Mid 2	St. Act.	Final
UIC 101	Structure Analysis I	FRB 003	3	2	0	2	4	30	20	10	40
Course Contents	Loads and reactions – Stability of structures (external and internal) – Straining actions in Statically determinate structures- Normal stresses – Shear stresses (pure shear, torsional) – Combined stresses.										
References	• Structural Analysis by Russell C. Hibbeler, Pearson, 9th Edition, 2014, ISBN-13:978-0-13-394284-2. • "Solved Examples in Determinate Structures", Dar-Elmaarefa, Egypt, Dr. Ahmed Youssef Kamal El-Deen, ISBN 21638/2016 • George, N. Frantziskonis. "Essentials of the Mechanics of Materials, Second Edition". USA: Destech Publications, Inc. 2013. ISBN 13: 9781605950983 • Pytel, A. and Kiusalaas, J. "Mechanics of Materials Second Edition". Cengage Learning2012. ISBN-13: 978-0-495-66775-9										

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hr.				Assessment			
				Lect.	Lab.	Tut.	Sum	Mid 1	Mid 2	St. Act.	Final
UIC 102	Structure Analysis II	UIC 101	3	2	0	2	4	30	20	10	40
Course Contents	Buckling of Column, Elastic deflection of determinate structures (double Integration method and virtual work method). Influence line for determinate beam. Analysis of statically indeterminate structures: Force approach (Consistent deformation method,….). Displacement approach (Slope deflection Method, Moment distribution method,…)										
References	• Aslam Kassimali , "Structural Analysis" Stamford USA: Cengage Learning, 4th Si Edition, 2011, ISBN-13: 978-0-495-29567-9 • Aslam Kassimali, "Structural Analysis", Stamford USA: Cengage Learning, 6th Si Edition, 2019, ISBN-13 : 978-1337630948 • Jack C. McCormac, "Structural Analysis Using Classical and Matrix Methods", John Wiley & Sons, Inc, 4th Edition, 2007, ISBN-13: 978-0470036082.										

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hr.				Assessment			
				Lect.	Lab.	Tut.	Sum	Mid	PE/OE	St. Act.	Final
UIC 103	Properties and Testing of Construction Materials	FRB 003	2	2	1	0	3	30	20	10	40
Course Contents	Stress and strain - Types of tests - Testing machines - Strain gauge devices - Static tension test - Static compression test - Bending test - Shear test - Torsion test - Hardness test - Fatigue test - Impact test - Metals creep test.										
References	• Mechanics of Materials, James M. Kere & Barry J. Goodno, CENGAGE Learning, ISBN-13: 978-1111577735 / ISBN-10: 1111577730. • Strength of Materials, S. S. Bhavikatti,Vikas, Vicas, ISBN-13: 978-9325971578, ISBN-10: 9325971577. • A Textbook of Strength of Materials, Dr R.K. Bansal, LAXMI PUBLICATIONS (P) LTD, ISBN-10: 9788131808146 / ISBN-13: 978-8131808146. • المواد الهندسية مقاومتها واختبارها (الجزء الأول والجزء الثاني)، ا.د. احمد العريان - ا.د. عبد الكريم عطا • مقاومة واختبار المواد، د. عبد الوهاب محمد عوض - د. إبراهيم على درويش. • المواصفات القياسية المصرية.										
Laboratory	• Static tension test. • Static compression test. • Bending test. • Hardness test. • Impact test.										

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hr.				Assessment			
				Lect.	Lab.	Tut.	Sum	Mid	PE/OE	St. Act.	Final
UIC 104	Construction Materials and Concrete Technology	FRB 007+UIC 103	3	2	2	1	5	30	20	10	40

Course Contents

Types and properties of construction materials. Aggregate types, sources and quality, cements. Introduction to fiber reinforced polymers. Steel in construction, insulation materials and coatings. Concrete mix design, admixtures. Asphalt cement, asphalt concrete mix design. Concrete manufacture. Properties of fresh concrete. Properties of hardened concrete. Durability of concrete. Non-destructive testing. Special concretes.

References

- للكود المصري لتصميم وتنفيذ المنشآت الخرسانية – 203.
- الملحق الثالث للكود المصري لتصميم وتنفيذ المنشآت الخرسانية (دليل الاختبارات المعملية لمواد الخرسانة).
- Building Materials, S. K. Duggal, Routledge, ISBN-10: 8122433790 / ISBN-13: 978-8122433791.
- Concrete Technology, AM Neville, JJ Brooks, Longman, ISBN-10: 0273732196, ISBN-13: 978-0273732198.
- Properties of Concrete and Structures, P.K. Mehta, Prentice Hall, ISBN-10: 0131671154, ISBN-13: 978-0131671157
- Materials of construction, R.C. Smith, McGraw-Hill, ISBN-10: 0070584761, ISBN-13: 978-0070584761.

Laboratory

- Specific surface area of cement, Setting time of cement, compressive strength of cement.
- Sieve analysis of coarse and fine aggregate, bulk density of aggregate – specific weight of aggregate.
- Coarse aggregate crushing value, Los Angles abrasion value of coarse aggregate.
- Compression test.
- Compacting factor test, Slump test.
- Compressive strength test - Splitting tensile strength test – Modulus of rupture test.
- Rebound hammer test - Ultrasonic Pulse velocity test.

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hr.				Assessment			
				Lect.	Lab.	Tut.	Sum	Mid	PE/OE	St. Act.	Final
UIC 105	Surveying 1	FRB 002	3	2	2	1	5	30	20	10	40
Course Contents	Principles of plane surveying; distances measurements (Optical, Electronic), angle and direction measurements; traverse computations; Coordinate systems for engineering works, setting out horizontal and vertical curves; earthwork computation; setting out engineering structures and construction projects, Levelling (theory, methods, and equipment)										
References	• Elementary Surveying - An Introduction to Geomatics -Thirteenth Edition-2012- CHARLES D. GHILANI-ISBN-13: 978-0-13-255434-3- ISBN-10: 0-13-255434-8 • Surveying for Civil and Mine Engineers Theory, Workshops, and Practicals-John Walker Joseph L. Awange- 2018-ISBN 978-3-319-53128-1- ISBN 978-3-319-53129-8 (eBook) • Surveying Engineering & Instruments- Valeria Shank- First Edition-2012- ISBN 978-81-323-4403-2										
Laboratory	• Distance measurements • Theodolite parts and calibration • Survey levelling instruments and height determination • Total station parts & software • Coordinates by Total Station • Lay out and setting out by Total Station										

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hr.				Assessment			
				Lect.	Lab.	Tut.	Sum	Mid 1	Mid 2	St. Act.	Final
UIC 106	Surveying 2	UIC 105	3	2	0	2	4	30	20	10	40
Course Contents	Introduction to geodesy; Coordinate systems, Map projections, GNSS system concepts and characteristics, signal structure, receivers and antennae; GNSS measurements, GNSS time, error sources and measurement accuracy; position determination techniques – Errors Reduction Techniques, single point and differential positioning, static and kinematic GNSS, post-processing and Real-time processing, DGNSS concepts.										
References	• PRECISION SURVEYING The Principles and Geomatics Practice-JOHN OLUSEGUN OGUNDARE-2015-ISBN 978-1-119-10251-9 • Geodesy- Introduction to Geodetic Datum and Geodetic Systems-Zhiping Lu - Yunying Qu - Shubo Qiao-2014-ISBN 978-3-642-41244-8- ISBN 978-3-642-41245-5 (eBook) • ENGINEERING SATELLITE-BASED NAVIGATION AND TIMING-Global Navigation Satellite Systems, Signals, and Receivers-John W. Betz-2016-ISBN: 978-1-118-61597-3										

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hr.				Assessment			
				Lect.	Lab.	Tut.	Sum	Mid 1	Mid 2	St. Act.	Final
UIC 108	Engineering Geology	---	2	2	0	1	3	30	20	10	40
Course Contents	Earth composition. Major types of rocks and deposits. Soil and rock cycle. Minerals identification and classification. Clay minerals. Principles of structural geology: joints, faults, folds and landforms. Subsurface exploration: techniques and tests. Influence of geological origin on composition and structure of soils. Substance and mass properties of rock: compressibility, shear strength and permeability. Weathering and engineering aspects of transported soils: alluvial, colluvial, glacial, coastal, aeolian, lacustrine and residual soils. Soil description and engineering classification.										
References	• Basic Environmental and Engineering Geology by Bell, F.G., SPON, ISBN: 978-0-8155-1761-0, 978-0-8155-1340-7, 1-904445-02-0, 978-1-904445-02-9, 978-1-4200-4470-6										

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hr.				Assessment			
				Lect.	Lab.	Tut.	Sum	Mid 1	Mid 2	St. Act.	PE/OE
UIC 107	CAD for Civil Engineers	FRM 010	2	1	3	0	4	30	20	10	40
Course Contents	Application of AutoCAD Program in drawing different types of civil structures (Irrigation structures – Reinforced concrete structures – Steel structures- urban transportation systems).										
References	• A Textbook of Engineering Drawing: Along with an Introduction to AutoCAD, International Publishing House, 2015. ISBN 9789384588687										
Laboratory	• Irrigation structures drawing. • Reinforced concrete structures drawing. • Steel structures drawing. • Transportation systems drawing.										

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hr.				Assessment			
				Lect.	Lab.	Tut.	Sum	Mid	PE/OE	St. Act.	Final
UIC 109	Fluid Mechanics	FRB 005	2	2	1	0	3	30	20	10	40
Course Contents	Dimensions and Units - Fluid Properties - Fluid Statics (Pressure distribution - Pressure measurements - Forces on submerged surfaces) - Buoyancy and Floatation - Fluids in Relative Equilibrium - Fluid Kinematics (Description of Fluids motion - Continuity Equation - Velocity and Acceleration) - Fluid Dynamics (Energy Equation - Applications of Bernoulli's Equation) - Impulse-Momentum Equation - Application of the Momentum Equation - Flow in Pipes – Pipes Systems.										
References	• A Brief Introduction to Fluid Mechanics, sixth Edition by Donald F. Young, Bruce R. Munson, Theodore H. Okiishi, Wade W. Huebsch, Wiley 2010, ISBN: 0470596791, 9780470596791 • E. Shashi Menon, "Liquid Pipeline Hydraulics", Marcel Dekker, 2004.										
Laboratory	• Determine Densities, Specific Gravities, Weights and Viscosity. • Bernoulli's Theorem Demonstration. • Flow through sharp edged Orifice. • Flow over Rectangular and Triangular Weirs. • Friction in a smooth bore pipe, Minor loss Experiment.										

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hr.				Assessment			
				Lect.	Lab.	Tut.	Sum	Mid	PE/OE	St. Act.	Final
UIC 110	Hydraulics	UIC 109	2	2	1	0	3	30	20	10	40
Course Contents	Basic Principles (open channel flow) - Uniform Flow (Basic equations for steady uniform flow - Velocity and shear stress distributions in open channels) – Non-Uniform Flow (Specific energy - Hydraulics of channel bed transition) - Hydraulic Jumps - Gradually Varied Flow - Open Channel Design (Rigid boundary and erodible channel) - Dimensional analysis and Similarity (Methods of dimensional analysis - Model analysis and similarity) – Hydraulics Machinery (Pumps and Turbines)										
References	• Chadwick, A., Morfett, J. and Borthwick, M. (2021), Hydraulics in Civil and Environmental Engineering, 6th Edn., Published June 8, 2021, by CRC Press. ISBN 9780367460891. • Strum, W. T., (2001). Open Channels Hydraulics, McGraw-Hill Higher Education, USA. • Wynn P. (2014), Hydraulics for Civil Engineers by, ICE Publishing. First Edition. ISBN-13: 978-0727758453.										
Laboratory	• Open Channel Flow • Hydraulic Jump • Pump Characteristics										

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hr.				Assessment			
				Lect.	Lab.	Tut.	Sum	Mid 1	Mid 2	St. Act.	Final
UIC 201	Transportation Planning	UIC 106	2	2	0	1	3	30	20	10	40
Course Contents	Introduction to transportation planning - Study area - Transportation planning surveys - Travel demand forecasting (Trip generation - Trip distribution - Modal split (Mode Choice) - Traffic assignment) - Transportation evaluation										
References	• Traffic and Highway Engineering, Nicholas Garber and Lester Hoel, Fifth Enhanced SI Edition, CENGAG Learning, 2020, ISBN-13: 978-1-337-63104-4. • الكود المصرى للطرق – 2016 .										

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hr.				Assessment			
				Lect.	Lab.	Tut.	Sum	Mid	PE/OE	St. Act.	Final
UIC 202	Traffic Engineering	FRB 201	3	2	1	2	5	30	20	10	40
Course Contents	Introduction (Road user characteristics - Vehicle characteristics) - Traffic volume - Traffic speed - Traffic density - Travel time and delay studies - Traffic Flow characteristics - Parking studies - Traffic control devices - Intersection control - Traffic signals design.										
References	• Traffic and Highway Engineering, Nicholas Garber and Lester Hoel, Fifth Enhanced SI Edition, CENGAG Learning, 2020, ISBN-13: 978-1-337-63104-4. • الكود المصرى للطرق – 2016 .										
Laboratory	• Traffic surveys (traffic volume count) • Speed & delay study • Parking study • Roadside and household interviews.										

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hr.				Assessment			
				Lect.	Lab.	Tut.	Sum	Mid 1	Mid 2	St. Act.	Final
UIC 203	Design of R.C. Structures-1	UIC 102 +UIC 104	3	2	0	2	4	30	20	10	40
Course Contents	Properties of concrete materials - Ultimate limit states design method - Design of sections under pure bending moment (Rectangular, L & T - sections) - Load distribution – Design of section under shear – Design simple and continuous beams - Design of one-way and two-ways solid slabs - Design of hollow block slabs - Design of panelled beams.										
References	• Egyptian Code for Design & Construction of Reinforced Concrete Structures – ECOP 203-2018 • Design of Concrete Structures, Arthur H Nilson, D.Darwin, Charles W. Fifteenth Edition,2016. • Design of reinforced concrete structures, Mashhour Ghoneim, Mahmoud Elmihilmy, Volume I, second edition, 2012. • Design of reinforced concrete structures, Mashhour Ghoneim, Mahmoud Elmihilmy, Volume 2, Third edition, 2012. • Fundamentals of Reinforcement Concrete and Prestressed concrete, M.Hilal, 1987.										

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hr.				Assessment			
				Lect.	Lab.	Tut.	Sum	Mid 1	Mid 2	St. Act.	Final
UIC 204	Design of R.C. Structures-2	UIC 203	3	2	0	2	4	30	20	10	40
Course Contents	Design of flat slabs - Design of sections subjected to bending moment and axial force - Analysis and design of columns – Design of RC frames -Design of Sections under Torsion- Serviceability limit states (deflection - crack width). Design of water structures (Circular tank - rectangular tanks - Underground tanks - Elevated tanks - Wide tanks)										
References	• Egyptian Code for Design & Construction of Reinforced Concrete Structures – ECOP 203-2018 • Design of Concrete Structures, Arthur H Nilson, D.Darwin, Charles W. Fifteenth Edition,2016. • Fundamentals of Reinforcement Concrete and Prestressed concrete, M.Hilal, 1987. • Design of reinforced concrete structures, Mashhour Ghoneim, Mahmoud Elmihilmy, Volume 2, Third edition, 2012. • Design of reinforced concrete structures, Mashhour Ghoneim, Mahmoud Elmihilmy, Volume 3, First edition, 2011.										

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hr.				Assessment			
				Lect.	Lab.	Tut.	Sum	Mid 1	Mid 2	St. Act.	Final
UIC 205	Environmental Engineering	FRB 102	2	2	0	1	3	30	20	10	40
Course Contents	Introduction to environmental engineering, pollution problems, types of pollution, degrees of Pollution, sources of pollution, surface water pollution, groundwater Pollution, rainwater Pollution, sea & ocean water pollution, air pollution. Soil pollution, pollution control, pollution prevention. Samples conditions, chemical pollutions measuring in water, microbiological & biological pollution measuring in water, field pollution monitoring . Water supply, wastewater systems, air pollution.										
References	• An Integrated Approach to Environmental Management by Dibyendu Sarkar (Editor), Rupali Datta (Editor), Avinandan Mukherjee (Editor), Robyn Hannigan (Editor), Wiley, 2015.										

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hr.				Assessment			
				Lect.	Lab.	Tut.	Sum	Mid	PE/OE	St. Act.	Final
UIC 206	Water Supply Engineering	UIC 110+UIC 205	3	2	2	1	5	30	20	10	40
Course Contents	Introduction, Preliminary studies for water supply projects, sources of water, water quality and standards, design flow rates, water collection, Design of water treatment plants using conventional processes (Sedimentation - Coagulation and Flocculation - Filtration - Disinfection), water pumping and transportation works, water storage.										
References	• Water and Wastewater Technology: Pearson New International Edition, ISBN-13: 9781292021041 Lectures presentations • Water Engineering-Hydraulics, Distribution and Treatment,2015, ISBN 978-0-470-39098-6 • شبكات المياه - الكود المصرى • محطات تنقية مياه الشرب - الكود المصرى										
Laboratory	• Determine Turbidity, PH, Temperature, Total Dissolved Solids (TDS), Total Suspended Solids (TSS), Volatile Solids (VS), Chloride, Iron and Manganese, Arsenic, Fluorides and total bacteria account										

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hr.				Assessment			
				Lect.	Lab.	Tut.	Sum	Mid 1	Mid 2	St. Act.	Final
UIC 207	Hydrographic Surveying	UIC 106	3	2	0	2	4	30	20	10	40
Course Contents	introduction to natural phenomena and their effect on coasts and harbours - Planning factors which affect the design of harbours and their protection. Different kinds of hydrographic survey - Engineering projects that need the application of hydrographic surveying applications - Instruments used in hydrographic surveying, kinds and accuracies - Navigation tools used marine scanning - Topographic maps production of seabed - Different methods for volumes computations of sea bed for different hydrographic projects.										
References	• Manual of Offshore Surveying for Geoscientists and Engineers, by R. P. Loweth, Springer Netherlands (1997), ISBN: 978-94-010-6461-3, 978-94-011-5826-8 • Surveying for Civil and Mine Engineers, Theory, Workshops, and Practicals, John Walker • Joseph L. Awange, 2018, ISBN 978-3-319-53128-1										

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hr.				Assessment			
				Lect.	Lab.	Tut.	Sum	Mid 1	Mid 2	St. Act.	Final
UIC 208	Under-Ground Utility Surveying	UIC 106	3	2	0	2	4	30	20	10	40
Course Contents	Basics of Surveying the Underground - Transferring Traversing and Levelling Measurements Transferring surface coordinates to underground workings Understanding limitations of transfer techniques - Traditional Methods to Map Utilities -Common Utility Types - Basic introduction to utility detection theory and methods –Electromagnetic pipe and cable locators Basic Ground Penetrating Radar (GPR) - Principles- Electro Magnetic VS GPR Comparison.										
References	• Walker J, Awange JL (2018) Surveying for Civil and Mine Engineers. Springer Nature. • Awange J, Paláncz B Geospatial Algebraic Computations. 3rd edition. Springer-Verlag GmbH- ISBN 978-3-030-45803-4 • Costello, Brad, UNDERGROUND CHECK SURVEY, ENG4111/4112 – Undergraduate dissertation, University of Southern Queensland, 2016. (https://eprints.usq.edu.au/31389/1/Costello_B_Gharineiat.pdf) • Erica Carrick utsi (2017) Ground Penetrating Radar Theory and practice – Elsevier - Paperback ISBN: 9780081022160										

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hr.				Assessment			
				Lect.	Lab.	Tut.	Sum	Mid	PE/OE	St. Act.	Final
UIC 209	Soil Mechanics	UIC 103	3	2	2	1	5	30	20	10	40
Course Contents	Introduction to Geotechnical Engineering - Definitions and Relationships - Index Properties of Soil - Soil Classification Systems (Unified – British) - Permeability and Seepage of Soil (Darcy's Law - Capillarity in Soils - Flow Net Analysis) - Stress Distribution in Soil (Point load – Uniform Load (Newmark – Fadum - Approximation)) - Shear Strength of Soil (Direct Shear Box - Triaxial– Unconfined Compression) - Lateral Earth Pressure (Active and Passive) - Soil Compaction (Standard Proctor - Modified Proctor).										
References	• El-Kasaby, E. A., Soil Mechanics, Dar Al-Kutub Al-Almia, Cairo, 5th Ed., (21371/2013), ISBN 978 – 977 – 726 – 041 – 1, 2014. • Das, B. M, Soil Mechanics Laboratory Manual, Oxford University Press, 9th. Ed., ISBN 978 – 019 – 020 – 966 – 7, 2016 .										
Laboratory	• Specific Gravity Determination. • Atterberg Limits (Liquid Limit – Plastic Limit – Shrinkage Limit). • Grain Size Distribution - Coarse Grained Soils. (Sieve Analysis). • Grain Size Distribution - Fine Grained Soils (Hydrometer Analysis). • Determination of Natural Unit Weight of Soil (Sand Bottle Test - Core Cutter Test). • Constant Head Permeability Test. • Falling Head Permeability Test. • Direct Shear Box Test. • Tri-axial Shear Test. • Unconfined Shear Test. • Standard Proctor Test. • Modified Proctor Test.										

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hr.				Assessment			
				Lect.	Lab.	Tut.	Sum	Mid	PE/OE	St. Act.	Final
UIC 210	Geotechnical Engineering & Foundations	UIC 209	3	2	2	1	5	30	20	10	40
Course Contents	Soil Consolidation and Settlement (Soil Consolidation Theory - Primary and Secondary Settlement - Oedometer Test) - Bearing Capacity of Soil (Terzaghi Eq. - Mayerhof Eq. – Egyptian Code Eq.) - Shallow Foundations (Construction Considerations - Design Considerations) - Design of Isolated Footings (Square and Rectangular Footings – Footing with Moment) - Design of Strip Footings - Design of Combined Footings - Design of Strap Beam Footings - Design of Rafts (Conventional Method – Ribbed Raft).										
References	• El-Kasaby, E. A., Soil Mechanics, Dar Al-Kutub Al-Almia, Cairo, 5th Ed., (21371/2013), ISBN 978 – 977 – 726 – 041 – 1, 2014. • El-Kasaby, E. A., Engineering of Surface Foundations, Dar Al-Kutub Al-Almia, Cairo, 5th Ed., (19440/2015), ISBN 978 – 977 – 726 – 139 – 5, 2015. • Das, B. M, Principles of Foundation Engineering, Brooks - Cole, 9th. Ed., ISBN 978 – 133 – 770 – 502 – 8, 2017. • Das, B. M, Soil Mechanics Laboratory Manual, Oxford University Press, 9th. Ed., ISBN 978 – 019 – 020 – 966 – 7, 2016.										
Laboratory	• One Dimensional Consolidation Test (Oedometer Test). • SPT: Standard Penetration Test. • CPT: Cone Penetration Test. • Plate Loading Test.										

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hr.				Assessment			
				Lect.	Lab.	Tut.	Sum	Mid	PE/OE	St. Act.	Final
UIC 301	Computer Applications	FRE 012	2	1	3	0	4	30	20	10	40
Course Contents	Suitable computer programming language. Computer applications in Infrastructures engineering (numerical applications, and engineering applications).										
References	• Computer Applications in Civil Engineering by Paul D. Spindel, Van Nostrand Reinhold Company.										
Laboratory	• A suitable computer programming language. • Computer applications by Infrastructures software package.										

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hr.				Assessment			
				Lect.	Lab.	Tut.	Sum	Mid 1	Mid 2	St. Act.	Final
UIC 302	Highway Engineering II	UIC 303	3	2	0	2	4	30	20	10	40

Course Contents

Geometric design:
At-grade intersection design - Interchange design - Capacity and level of service analysis on basic freeway and multilane highway segments - Capacity and level of service analysis of weaving, merge and diverge segments on freeways and multilane highways - Highway traffic safety.
Structural design:
Stresses in rigid pavement - Rigid pavement design - Asphalt concrete mix planet - Pavement layers construction - Pavement maintenance - Drainage.

References

- Traffic and Highway Engineering, Nicholas Garber and Lester Hoel, Fifth Enhanced SI Edition, CENGAG Learning, 2020, ISBN-13: 978-1-337-63104-4.
- Traffic Engineering, Roger P. Roess - Elena S. Prassas and William R. McShane, Fifth Edition, Pearson, 2019, ISBN-13: 978-9353434854.
- AASHTO, A Policy on Geometric Design of Highways and Streets “Green Book”, 7th Edition, ISBN-13: 978-1560516767.
- Pavement Analysis and Design, Yang Huang, Second International Edition, Pearson, 2012, ISBN-13: 978-0-13-272610-8.

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hr.				Assessment			
				Lect.	Lab.	Tut.	Sum	Mid	PE/OE	St. Act.	Final
UIC 303	Highway Engineering I	UIC 201	3	2	2	1	5	30	20	10	40

Course Contents

Geometric design:
Functional Classification of Roads & Cross Section Elements, sight distance, Vertical Alignment, Horizontal Alignment.
Structural design:
Pavement types and components - Subgrade soil classification - Subgrade soil strength- Soil compaction - Soil stabilization - Stresses in flexible pavement - Flexible pavement design - Testing and specifications of road aggregates - Testing and specifications of bituminous materials - Hot mix asphalt concrete characteristics and design.

References

- Traffic and Highway Engineering, Nicholas Garber and Lester Hoel, Fifth Enhanced SI Edition, CENGAG Learning, 2020, ISBN-13: 978-1-337-63104-4.
- AASHTO, A Policy on Geometric Design of Highways and Streets “Green Book”, 7th Edition, 2018, ISBN-13: 978-1560516767.
- Pavement Analysis and Design, Yang Huang, Second International Edition, Pearson, 2012, ISBN-13: 978-0-13-272610-8.
- Hot Mix Asphalt Materials, Mixture Design and Construction, E. Ray and Prithvi S. Kandhal and Freddy L. Roberts and Y. Richard Kim and Dah-Yinn Lee and Thomas W. Kennedy Brown , Third Edition, National Asphalt Pavement Association Research and Education Foundation, 2009, ISBN-13 : 978-0914313021

Laboratory

- Tests of sub grade soil,
- Tests of road aggregates
- Tests of bituminous materials
- Hot mix asphalt concrete design (Marshall Method)

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hr.				Assessment			
				Lect.	Lab.	Tut.	Sum	Mid 1	Mid 2	St. Act.	Final
UIC 304	Water Distribution &Sewer System design	UIC 206+ UIC 307	3	2	0	2	4	30	20	10	40
Course Contents	Water distribution systems: Introduction of water network, Classification of Water Distribution System, Requirements of a Good Water Distribution System, Basic Principles of Hydraulics Applicable to Water Distribution Systems, Design of Water Distribution System, Water Quality in Water Distribution Systems. Sewer systems: Introduction, types of sewer system (planning of sewer system, sewer pipes, sewer appurtenances, design of sewer system										
References	• Water and Wastewater Calculations Manual by Shun Lin, C. Lee, McGraw-Hill Professional, 2 Edition, 2007 • Water Engineering-Hydraulics, Distribution and Treatment,2015, ISBN 978-0-470-39098-6										

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hr.				Assessment			
				Lect.	Lab.	Tut.	Sum	Mid 1	Mid 2	St. Act.	Final
UIC 305	Design of Metallic Structures-1	UIC 102	3	2	0	2	4	30	20	10	40
Course Contents	Steel as a construction material - Material properties and steel sections - Allowable Stress Design method - Design of tension members - Design of compression members - Columns in braced and unbraced frames - Design of flexural members - Types and classification of beam cross sections - Design of laterally supported and unsupported beams - Design of beam-columns (axial and flexural forces) - Design of bolted connections - Design of welded connections.										
References	• Egyptian code for design of steel structure. • Advanced Steel Design of Structures, by Prof. Srinivasan Chandrasekaran, Indian Institute of Technology, India. ISBN-13 9780367232900 • Steel Designers' Manual, by (Steel Construction Institute), Edited by Buick Davison and Graham W. Owens, ISBN-13 9781119249863 • Design of Metallic Structures, EHAB ELLOBODY, RAN FENG, BEN YOUNG, 2014, ISBN: 978-0-12-416561-8										

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hr.				Assessment			
				Lect.	Lab.	Tut.	Sum	Mid 1	Mid 2	St. Act.	Final
UIC 306	Ground Water Hydrology	UIC 110	3	2	0	2	3	30	20	10	40
Course Contents	Introduction: Groundwater and hydrologic cycle, Importance of groundwater, the relation of groundwater to geologic structure, Types and physical properties of aquifers, Aquifer systems in Egypt. Groundwater exploration methods. Groundwater hydraulics: Infiltration, Seepage, Percolation, Darcy's law, Hydraulic conductivity measurements, Flow governing equations. Well hydraulics: Flow towards wells, Safe yield, Well construction, well development and pumping tests. Well evaluation. Introduction to Groundwater quality and pollution: Pollution sources. Pollution control and remedy measures.										
References	• Mays, L.W., Ground and surface water hydrology. John Wiley & Sons, Inc., 2012. ISBN: 978-0-470-16987-2 • Subramanya, K., Engineering Hydrology. 4th Edition 2017.										

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hr.				Assessment			
				Lect.	Lab.	Tut.	Sum	Mid 1	Mid 2	St. Act.	Final
UIC 307	Wastewater Engineering	UIC 205	3	2	0	2	4	30	20	10	40
Course Contents	Wastewater characteristics, Wastewater treatment works, Wastewater disposal works, Treated wastewater reuse, Industrial wastes. Preliminary studies for wastewater projects. Wastewater collection systems: flow rate. Physical, Chemical, and biological processes for wastewater treatment.										
References	• Wastewater Engineering - Treatment and Reuse (4th edition), by Metcalf & Eddy 2004, ISBN: 0070495394, 9780070495395 • Water Engineering-Hydraulics, Distribution and Treatment,2015, ISBN 978-0-470-39098-6										

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hr.				Assessment			
				Lect.	Lab.	Tut.	Sum	Mid 1	Mid 2	St. Act.	Final
UIC 308	Senior Design Project I	*	2	0	4	0	4	---	---	50	50
Course Contents	Topics are selected by groups of students according to their area of interest (Transportation Engineering OR Geomatics and Environmental Engineering OR Water Engineering) upon advisor approval. Projects address solution to open ended applications using an integrated engineering approach.										
References	• According to the selected project.										
Laboratory	• According to the selected project.										

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

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hr.				Assessment			
				Lect.	Lab.	Tut.	Sum	Mid 1	Mid 2	St. Act.	Final
UIC 309	Design of Foundations and Earth Retaining Structures	UIC 210	3	2	0	2	4	30	20	10	40
Course Contents	Pile Foundations (Types of Piles - Load Transfer Mechanisms - Static Capacity for Piles - Field Load Tests – Pile Group – Elastic Centre Method - Design of Pile Caps) - Introduction to Earth Retaining Structures - Pile wall (Secant piles - Tangent Piles - Bored Pile Wall) - Construction Techniques and Design of Retaining Walls (Cantilever RW – Counterfort RW) – Introduction to Reinforced Soil RW - SPW.										
References	• El-Kasaby, E. A., Design and Construction of Deep and Special Foundations, Dar Al-Kutub Al-Almia, Cairo, 4th Ed., (10651/2016), ISBN 978 – 977 – 726 – 168 – 5, 2016. • Das, B. M, Principles of Foundation Engineering, Brooks - Cole, 9th. Ed., ISBN 978 – 133 – 770 – 502 – 8, 2017. • Bowles, J., Foundation Analysis and Design, McGraw - Hill, 5th. Ed., ISBN 978 – 007 - 912 – 247 – 7, 2009.										

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hr.				Assessment			
				Lect.	Lab.	Tut.	Sum	Mid 1	Mid 2	St. Act.	Final
UIC 401	Infrastructure Management &Financing	-----	3	2	0	2	4	30	20	10	40
Course Contents	An introduction to infrastructure management systems, including management process, data collection technologies, interdependence, benchmarking, and best practices for sustainability. Other related issues, such as, resilience security of infrastructure systems are addressed, infrastructure economics, infrastructure, management systems, preparation of safety and health roles in the project and infrastructure planning under risk and uncertainty										
References	• Information Systems for Engineering and Infrastructure Asset Management, by Abrar Haider, Gabler Verlag 2013, ISBN: 978-3-8349-4233-3, 978-3-8349-4234-0										

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hr.				Assessment			
				Lect.	Lab.	Tut.	Sum	Mid 1	Mid 2	St. Act.	Final
UIC 403	Senior Design Project II	UIC 308	3	1	4	0	5	---	---	50	50
Course Contents	Topics are selected by groups of students according to their area of interest (Transportation Engineering OR Geomatics and Environmental Engineering OR Water Engineering) upon advisor approval. Projects address solution to open ended applications using an integrated engineering approach.										
References	• According to the selected project.										
Laboratory	• According to the selected project.										

Elective Courses

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hr.				Assessment			
				Lect.	Lab.	Tut.	Sum	Mid 1	Mid 2	St. Act.	Final
UIC 311	Dynamic of Structures	UIC 102	3	2	0	2	4	30	20	10	40
Course Contents	Types of dynamic loads and the formulation of the equation of motion. Single degree of freedom systems, free and forced vibrations of multi degree of freedom systems. Response of structures to earthquakes. Design response spectra for structures, Design criteria for seismic resistant structures, Seismic response of tall buildings.										
References	• Dynamics of Structures by Anil K. Chopra, Pearson, 4 Edition, 2011.										

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hr.				Assessment			
				Lect.	Lab	Tut.	Sum	Mid 1	Mid 2	St. Act.	Final
UIC 313	Tunnels and Underground Structure	UIC 210	3	2	0	2	4	30	20	10	40
Course Contents	History of tunnels – Using of tunnels – Hydraulic tunnels classification - Tunneling methods in soft ground – Tunneling in rock – Rock mass evaluation systems – Technology of tunnels in soil and rock – Design of tunnel supporting systems – Planning and design of site investigation – Instrumentation, monitoring and evaluation of engineering behavior of underground structures – Numerical analysis of tunnels.										
References	Underground Structures: Design and Instrumentation, by R.S. Sinha, Academic Press, Elsevier 1989, ISBN: 978-0-444-87462-7 • Handbook of Tunnel Engineering, Volume I: Structures and Methods, by Bernhard Maidl, Markus Thewes, Ulrich Maidl, David S. Sturge, Ernst & Sohn 2013, ISBN: 9783433030486, 9783433603505, 9783433603512, 9783433603529, 978343360349.										

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hr.				Assessment			
				Lect.	Lab.	Tut.	Sum	Mid 1	Mid 2	St. Act.	Final
UIC 315	Special Topics in Structural Analysis	UIC 102	3	2	0	2	4	30	20	10	40
Course Contents	Elements of plate bending theory, circular plates, rectangular plates, large deflections of plates. Membrane stresses in shells, bending stresses in shells. Applications to pipes, tanks and pressure vessels.										
References	• Theory of plates and shells by S.S. Bhavikatti, 2016, ISBN-10 9386070812, ISBN-13 978-9386070814.										

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hr.				Assessment			
				Lect.	Lab.	Tut.	Sum	Mid 1	Mid 2	St. Act.	Final
UIC 310	Photogrammetry by Drones	UIC 106	3	2	0	2	4	30	20	10	40
Course Contents	Photogrammetry principles - Classifications of Photogrammetry according to the purpose - Classification of the Photogrammetry according to the sensor location - Aerial Photogrammetry - Terrestrial Photogrammetry - Close Range Photogrammetry (CRP) - UAV Photogrammetry - UAV Classification - UAV images processing techniques.										
References	• Handbook of Unmanned Aerial Vehicles- Kimon P. Valavanis • George J. Vachtsevanos-2015- ISBN 978-90-481-9706-4 -ISBN 978-90-481-9707-1 (eBook) • UAV-Based Remote Sensing -Volume 2- Felipe Gonzalez Toro - First Edition -2018- ISBN 978-3-03842-856-5										

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hr.				Assessment			
				Lect.	Lab.	Tut.	Sum	Mid 1	Mid 2	St. Act.	Final
UIC 312	Remote Sensing	UIC 106	3	2	0	2	4	30	20	10	40
Course Contents	Basics and principles of remote sensing, Definitions, Energy sources. Advantages of remote sensing technique. Photo and image interpretation. Control points and ground truth observations. Field work steps. Remote sensing application in civil and environmental engineering. Image processing and interpretations.										
References	• REMOTE SENSING AND IMAGE INTERPRETATION- Thomas M. Lillesand, Emeritus - Seventh Edition-2015- ISBN 978-1-118-34328-9. • Remote Sensing Digital Image Analysis: An Introduction, by John A. Richards, Xiuping Jia, Springer 2005, ISBN 9783540251286, 3-540-25128-6										

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hr.				Assessment			
				Lect.	Lab.	Tut.	Sum	Mid 1	Mid 2	St. Act.	Final
UIC 314	Geographic Information System GIS	UIC 106	3	2	0	2	4	30	20	10	40
Course Contents	Introduction to geographic information systems (GIS) -type, source and format of data. GIS components, Data models: coordinates, attribute data and types, vector data models, Raster Data models, Data and file structure. Map projection and coordinate systems. Building a GIS data base, digitizing, coordinate transformation. Digital Data. Attribute data and tables. Basic spatial analysis in infrastructure projects.										
References	• An Introduction to Geographical Information Systems, by Ian Heywood, Sarah Cornelius, Steve Carver, Prentice Hall 2006, ISBN: 0-13-129317-6, 978-0-13-129317-5, 9781405898447										

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hr.				Assessment			
				Lect.	Lab.	Tut.	Sum	Mid 1	Mid 2	St. Act.	Final
UIC 316	Environmental Impact Assessment	UIC 205	3	2	0	2	4	30	20	10	40
Course Contents	Main parameters of environment impact on the projects. Environmental Impact of the project on the human. Environmental Impact of the project on animals and plants. Environmental impact of the project on the rest of components of the environment. Environmental impact of the project during and after the construction. Environmental impact assessment in Egypt and different countries. Steps for performing environmental impact assessment. Case studies and applications.										
References	• Environmental impact assessment: a guide to procedures, by DETR & The National Assembly for Wales, Thomas Telford Publishing 2000, ISBN: 2016-05-22 07:20:00 • Environmental Impact Assessment and Strategic Environmental Assessment: Towards an Integrated Approach, by Hussein Abaza, Ronald Bisset, Barry Sadler, ISBN: 9280724290, 9789280724295 • AIR POLLUTION ,EALTH AND ENVIRONMENTAL IMPACTS, BHOLA R, GURJAR,2010, ISBN 13: 978-1-439-0963-1										

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hr.				Assessment			
				Lect.	Lab	Tut	Sum	Mid 1	Mid 2	St. Act.	Final
UIC 318	Sustainable Transportation and Highways Engineering	UIC 202	3	2	0	2	4	30	20	10	40
Course Contents	Overview & analysis of concepts & designs for sustainable transportation from global-to-local, interdisciplinary perspective, including pedestrians, bicyclists, and public transportation. Addresses economy, environment, and equity. Hands on design project.										
References	• Sustainable Transportation Systems Engineering- Francis M. Vanek, -Largus T. Angenent, -.James H. Banks, 2014- ISBN: 9780071800129										

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hr.				Assessment			
				Lect.	Lab	Tut	Sum	Mid 1	Mid 2	St. Act.	Final
UIC 320	Sustainable Environmental Engineering	UIC 205	3	2	0	2	4	30	20	10	40
Course Contents	Sustainability. Sustainable water supply. Sustainable sanitation. Sustainable solid waste management. Life cycle analysis. Sustainable cities. Sustainable communities. Sustainable living. Leadership in Energy and Environmental Design (LEED) accreditation for buildings. Greenhouse gas emissions. Biodiversity. Sustainable water supply. Case studies and applications.										
References	• Environmental Engineering: Designing a Sustainable Future (Green Technology), by Anne E. Maczulak, Facts on File 2009, ISBN: 9780816072002, 0816072000, 9781438127477										

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hr.				Assessment			
				Lect.	Lab.	Tut.	Sum	Mid 1	Mid 2	St. Act.	Final
UIC 405	Pavement Evaluation and Management	UIC 303	3	2	0	2	4	30	20	10	40
Course Contents	Structural and functional evaluation of pavements, flexible pavements by, Analysis of data, interpretation and applications. Use of modern equipment for pavement surface condition measurements. Evaluation of new pavement materials- Model studies, pavement testing Under controlled conditions, accelerated testing and evaluation methods. Instrumentation for pavement testing. Introduction to pavement management: components & principals of pavement management systems, pavement maintenance measures, planning investment, research management. Pavement Performance Prediction. Modelling in rehabilitation budget planning.										
References	• Pavement Evaluation and Management System, R SRINIVASA. KUMAR, 2014. ISBN 9788173719226. • Pavement Evaluation and Management, Faiq M. Sarhan Al-Zwainy, 2020, ISBN 0244561087.										

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hr.				Assessment			
				Lect.	Lab.	Tut.	Sum	Mid 1	Mid 2	St. Act.	Final
UIC 407	Airports Engineering	UIC 303	3	2	0	2	4	30	20	10	40
Course Contents	Types of airports – Airport planning and configuration – Geometric design of the landing area and runway direction – Safety areas – Instrument landing system – Marking and signing of airport – Airport lighting – Soil classification for airports - Structural design methods for flexible and rigid pavements of airports										
References	• Planning and Design of Airports, by Robert Horonjeff, Francis McKelvey, William Sproule, Seth Young, McGraw-Hill Professional 2010, ISBN: 0071446419, 9780071446419 • Airport Design and Operation, ANTONI´N KAZDA & ROBERT E. CAVES, Emerald Group Publishing Limited, Third Edition, 2015, ISBN: 978-1-78441-870-0.										

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hr.				Assessment			
				Lect.	Lab.	Tut.	Sum	Mid 1	Mid 2	St. Act.	Final
UIC 409	Railway Engineering	UIC 201	3	2	0	2	4	30	20	10	40
Course Contents	Introduction to Railways Engineering, Urban and Sub-urban design of railways, Vertical and horizontal curves- rails design- wood and concrete sleepers design- stresses in gravels section– railways intersections- signs and design of control stations; Economical and environmental effect of railways.										
References	• Practical railway engineering, by Clifford F. Bonnett, Imperial College Press; Distributed by World Scientific Pub 2005, ISBN: 1860945155, 9781860945151 • Railway Engineering, by Satish Chandra, M.M. Agarwal, 2nd edition 2013, ISBN-10: 019808353X.										

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hr.				Assessment			
				Lect.	Lab.	Tut.	Sum	Mid 1	Mid 2	St. Act.	Final
UIC 411	Cost Engineering & Quantity Surveying	------	3	2	0	2	4	30	20	10	40
Course Contents	Introduction to project cost estimate, Conceptual estimating, cost indices, Quantity take-off methods, estimating costs for construction material, labour, equipment, project overhead, mark-up and profit, unit costs, production rates, and pricing methods, balanced bid and budget form preparation for projects., and bid unbalancing.										
References	• David Bratt, Fundamentals of Construction Estimating, 4th edition, Cengage Learning; 4th edition (January 1, 2018), ISBN-13: 978-1337399395 • Martin Brook "Estimating and Tendering for Construction Work", Taylor & Francis Ltd, 5th edition, (26 Jul 2016), ISBN13: 9781138838062										

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hr.				Assessment			
				Lect.	Lab.	Tut.	Sum	Mid 1	Mid 2	St. Act.	Final
UIC 413	Project Planning, Scheduling, and Control	------	3	2	0	2	4	30	20	10	40
Course Contents	Concept of project planning, definition of planning techniques [Bar chart, arrow network, program evaluation and review technique (PERT), critical path method (CPM), line of balance technique (LOB)], Work Breakdown Structure (WBS), logic, networking by using CPM technique, scheduling and control models. Resource allocation and levelling, optimal schedules, documentation and reporting, time and cost control, progress monitoring and evaluation. Computer applications by primavera software package.										
References	• Textbook: Authors: Jimmie-Hinze " Construction Planning and Scheduling" Publisher: Prentice Hall; (International Ed.) 4th edition (January 2013), ISBN-13: 978-9332505735 • Reference: Daniel W. Halpin, Bolivar A. Senior, Gunnar Lucko "Construction Management" John Wiley & Sons, Inc., 5th Edition (August 2017), ISBN: 978-1-119-25680-9										
Laboratory	• Computer applications by primavera software package.										

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hr.				Assessment			
				Lect.	Lab.	Tut.	Sum	Mid 1	Mid 2	St. Act.	Final
UIC 415	Construction Project Specifications, Bids, and Contracts	-----	3	2	0	2	4	30	20	10	40
Course Contents	Participants in a construction contract. Contract definition. Types of contracts; formation principles of a contract, performance or breach of contractual obligations. Analysis and comparison of the different kinds of construction contracts. Bidding logistics. Legal organizational structures. Different types and uses of specifications. Different forms of contracts utilized in construction.										
References	• Daniel W. Halpin, Bolivar A. Senior, Gunnar Lucko "Construction Management" John Wiley & Sons, Inc., 5th Edition (August 2017), ISBN: 978-1-119-25680-9 • Will Hughes, Ronan Champion, John Murdoch "Construction Contracts Law and Management" Published by Routledge (Taylor & Francis), April, 2015 ISBN 9780415657044.										

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hr.				Assessment			
				Lect.	Lab.	Tut.	Sum	Mid	PE/OE	St. Act.	Final
UIC 417	Computer Applications in Sanitary Engineering	UIC 304	3	2	2	0	4	30	20	10	40
Course Contents	introduction to Water Cad software: Training to feed the software with the input data such as: water demand, flow pattern, peak flow factors, elevated tanks data, pumps data, and junction ground levels, and fire hydrants data. Introduction to Sewer CAD: Training to feed the software with the input data such as flow at each manhole, conduit catalogues design constrains in Sewer CAD (such as minimum and maximum slopes minimum and maximum covers, velocity of flow, partially full and manhole). Laboratory training on using Water Cad and Sewer CAD (data entry and output data).										
References	• WaterCad & SewerCad manual										
Laboratory	• Training on using WaterCad and SewerCad (data entry and output data).										

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hr.				Assessment			
				Lect.	Lab.	Tut.	Sum	Mid	PE/OE	St. Act.	Final
UIC 419	Computer Applications in Transportation Systems	UIC 303	3	2	2	0	4	30	20	10	40
Course Contents	This course focuses on the fundamentals behind some of the most popular computer software packages used in the planning, design, operations, and management of transportation systems. Topics includes highway planning and design, pavement design, signal optimization, forecasting of traffic flows and passenger volumes, simulation of traffic and transit systems, design, and evaluation of Intelligent Transportation Systems.										
References	• The manual of the used software.										
LAB.	• According to used software.										

Code	Course Name	Pre-req.	Cr. Hrs.	Ct. Hr.				Assessment			
				Lect.	Lab.	Tut.	Sum	Mid	PE/OE	St. Act.	Final
UIC 421	Programing Applications in Survey	UIC 106	3	2	2	0	4	30	20	10	40
Course Contents	This course focuses on the fundamentals of the most popular computer software packages used in surveying engineering. Topics includes General software for surveying: Civil Cad, SURFER, Agi soft meta shape Program, ENVI Program										
References	• Handbook of Unmanned Aerial Vehicles- Kimon P. Valavanis • George J. Vachtsevanos-2015- ISBN 978-90-481-9706-4 -ISBN 978-90-481-9707-1 (eBook) • REMOTE SENSING AND IMAGE INTERPRETATION- Thomas M. Lillesand, Emeritus - Seventh Edition-2015- ISBN 978-1-118-34328-9										
Laboratory	• ARC GIS Program										

Program # 13 Mechatronics and Automation Engineering Program

Program Description

Mechatronics and automation engineering program is the field concerned with the integration between mechanical systems, electrical systems and computer control systems to develop a new multidisciplinary system with better functionality and to convert conventional machines into automated and smart ones. Mechatronics and automation technologies are widely used in several applications and various aspects of industry including robotics, CNC machines, automotive industries, AI applications, etc.

Basic Information

Program Mission

Mechatronics and automation program aims to prepare an outstanding engineer with the skills required to handle fully automated industrial systems with high standards of safety and security. Additionally, it aims to help students develop the essential knowledge needed to keep up with the modern technologies to successfully compete in the current dynamic labor market. Mechatronics and automation graduates will possess sufficient expertise to serve the community in several multidisciplinary sectors.

Program Objectives

Upon completion of this program, mechatronics and automation engineering program graduates are expected to be able to:

PO1. Apply a wide spectrum of engineering knowledge, science, and specialized skills with analytic, critical, and systematic thinking to identify and solve engineering problems in real life situation.
PO2. Behave professionally and adhere to engineering ethics and standards and work to develop the profession and community and promote sustainability principles.
PO3. Work in and lead a heterogeneous team and display leadership qualities, business administration, and entrepreneurial skills.
PO4. Use techniques, skills, and modern engineering tools necessary for engineering practice.
PO5. Master self-learning and life-long learning strategies to communicate effectively in academic/professional fields.
PO6. Design and develop multidisciplinary systems to solve industrial problems.
PO7. Use modern engineering techniques, skills and methods to control Mechatronics applications.

Graduate Attributes (GA)

According to graduate attributes defined by NARS 2018, graduates should be able to:

GA1. Master a wide spectrum of engineering knowledge and specialized skills and can apply acquired knowledge using theories and abstract thinking in real life situations.
GA2. Apply analytic critical and systemic thinking to identify, diagnose and solve engineering problems with a wide range of complexity and variation.
GA3. Behave professionally and adhere to engineering ethics and standards.
GA4. Work in and lead a heterogeneous team of professionals from different engineering specialties and assume responsibility for own and team performance.
GA5. Recognize his/her role in promoting the engineering field and contribute to the development of the profession and the community.
GA6. Value the importance of the environment, both physical and natural, and work to promote sustainability principles.
GA7. Use techniques, skills, and modern engineering tools necessary for engineering practice.
GA8. 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.
GA9. Communicate effectively using different modes, tools, and languages with various audiences; to deal with academic/professional challenges in a critical and creative manner.

GA10. Demonstrate leadership qualities, business administration and entrepreneurial skills.

In addition to all engineering and mechanical engineering graduate attributes defined by NARS 2018, mechatronics engineering graduate should be able to:

GA11. Demonstrate the theoretical and practical knowledge of multi disciplines within mechatronics systems.

GA12. Use latest technologies and apply knowledge in various disciplines to identify and solve complex mechatronics problem.

GA13. Design, develop, and conduct experimental tests in the mechatronic engineering.

GA14. Work efficiently and integrally in a multidisciplinary team with leading skills.

Program Learning Outcomes (PLO)

- **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 D**

In addition to the Competencies for All Engineering Programs (Level A, NARS 2018), Mechatronics engineer must be able to:

PLO11. Model, analyze and design physical systems applicable to the specific discipline by applying the concepts of: Thermodynamics, Fluid Mechanics, Material Processing, Material Properties, Measurements, Instrumentation, Control Theory and Systems, Mechanical Design and Analysis, Dynamics, and Vibrations.

PLO12. Plan, manage and carry out designs of mechanical systems and machine elements using appropriate materials both traditional means and computer-aided tools and software contemporary to the mechanical engineering field.

PLO13: Design, model and analyze an electrical/electronic/digital system or component for a specific application; and identify the tools required to optimize this design.

PLO14: Design and implement elements, modules, sub-systems or systems in electrical/electronic/digital engineering using technological and professional tools.

PLO15: Understand the basic principles, theories, and engineering fundamentals within the field of mechatronics engineering including embedded systems, mechatronic systems design, controllers and data communication.

PLO16: Recognize mechatronics as the integration of multiple disciplines in industrial processes.

Benchmark: **University of Sydney**

URL: (https://www.sydney.edu.au/handbooks/engineering/engineering_combined/combined_mechatronic.shtml)

Comparison between Mechatronics and Automation competencies and the adopted learning outcomes of University of Sydney:

Benha University	University of Sydney
PLO15: Understand the basic principles, theories and engineering fundamentals within the field of mechatronics engineering including embedded systems, mechatronic systems design, controllers and data communication.	Demonstrate proficiency with the tools, methods, principles, technical knowledge, and conceptual frameworks of mechatronics, including embedded systems and mechatronic systems design, microcontrollers, and data communication
PLO16: Recognize mechatronics as the integration of multiple disciplines in industrial processes.	Recognise and respond to the interdisciplinary context of mechatronic engineering.

Faculty Mission vs. Program Mission Matrix

Faculty Mission		Program Mission		
		Mechatronics and automation program aims to prepare an outstanding engineer with the skills required to handle fully automated industrial systems with high standards of safety and security. Additionally, it aims to help students develop the essential knowledge needed to keep up with the modern technologies to successfully compete in the current dynamic labor market. Mechatronics and automation graduates will possess sufficient expertise to serve the community in several multidisciplinary sectors.		
		Mechatronics and automation program aims to prepare an outstanding engineer with the skills required to handle fully automated industrial systems with high standards of safety and security	Additionally, it aims to help students develop the essential knowledge needed to keep up with the modern technologies to successfully compete in the current dynamic labor market.	Mechatronics and automation graduates will possess sufficient expertise to serve the community in several multidisciplinary sectors.
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
Mechatronics and automation program aims to prepare an outstanding engineer with the skills required to handle fully automated industrial systems with high standards of safety and security. Additionally, it aims to help students develop the essential knowledge needed to keep up with the modern technologies to successfully compete in the current dynamic labor market. Mechatronics and automation graduates will possess sufficient expertise to serve the community in several multidisciplinary sectors.	Mechatronics and automation program aims to prepare an outstanding engineer with the skills required to handle fully automated industrial systems with high standards of safety and security	√	√		√		√	
	Additionally, it aims to help students develop the essential knowledge needed to keep up with the modern technologies to successfully compete in the current dynamic labor market.	√	√			√		√
	Mechatronics and automation graduates will possess sufficient expertise to serve the community in several multidisciplinary sectors.			√			√	√

Program Objectives vs. Program Competencies Matrix

Program Objectives	Program Competencies															
	Level A										Level D					
	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	D1	D2	D3	D4	D5	D6
PO1	√	√								√	√		√		√	√
PO2		√			√			√				√		√		
PO3			√			√	√		√						√	√
PO4		√	√	√							√		√			
PO5	√				√			√		√		√		√		
PO6															√	√
PO7															√	√

Program Objectives vs. Graduate Attributes Matrix

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

Career Prospects

Graduates of the mechatronics and automation engineering program will be qualified to work in a wide range of careers due to the huge experience they gain throughout their study. They can work in the automated production lines for maintenance, installation and operation purposes. They can also work in various mechatronics applications including robotics, embedded systems, automotive industry, AI-based systems and CNC machines, etc.

Program Concentrations

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

1. Mechatronics Engineering.
2. Automation Engineering.

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

List of Mechatronics and Automation Engineering Requirement Courses

Requirement		Cr. Hrs.	Ct. Hr.			
			Lec.	Lab	Tut	Sum
University Requirements		14	14	0	0	14
Faculty Requirements		32	19	14	17	50
Program Requirements	From Basic Science	12	8	0	8	16
	Compulsory Courses	**84**	**42**	**59**	**19**	**120**
	Elective Courses	18	12	0	12	24
Total		160	95	73	56	224

Basic Science Requirements of Mechatronics and Automation Engineering

Code	Course Title	Pre-Req	Cr. Hrs.	Ct. Hr.			
				Lec	Lab	Tut	Sum
FRB 001	Analytical geometry & Linear Algebra		3	2	0	2	4
FRB 002	Integration & Multivariable functions	FRB 001	3	2	0	2	4
FRB 005	Waves and Heat		3	2	2	1	5
FRB 006	Electricity and Magnetism		3	2	2	1	5
FRB 007	Chemistry for Engineers		4	3	2	1	6
FRB 101	Engineering Differential Equations	FRB 002	3	2	0	2	4
FRB 103	Environmental Pollution and Industrial Safety	FRB 007	2	2	1	0	3
FRB 104	Engineering Numerical Analysis	FRB 101	3	2	2	0	4
FRB 201	Applied Engineering Probability and Mathematical Statistics	FRB 002	3	2	2	0	4
FRB 206	Multiple Integrals & Complex Analysis	FRB 002	3	2	0	2	4
Total			**30**	**21**	**11**	**11**	**43**

Faculty requirement Courses

Code	Course	Pre-requisites	Cr. Hrs.	Ct. Hrs.			
				Lec.	Lab.	Tut	Sum
FRB 001	Analytical geometry & Linear Algebra	-----	3	2	0	2	4
FRB 003	Statics	-----	3	2	0	2	4
FRB 005	Waves and Heat	-----	3	2	2	1	5
FRB 007	Chemistry for Engineers	-----	4	3	2	1	6
FRM 009	Engineering Drawing	-----	2	0	0	4	4
FRB 002	Integration & Multivariable functions	FRB 001	3	2	0	2	4
FRB 004	Dynamics	FRB 003	3	2	0	2	4
FRB 006	Electricity and Magnetism	-----	3	2	2	1	5
FRM 008	Production Systems Engineering	-----	2	1	3	0	4
FRM 010	Engineering Drawing by Computer	FRM 009	2	1	2	0	3
FRE 012	Computer Programming	-----	2	0	2	2	4
FRB 103*	Environmental Pollution and Industrial Safety	FRB 007	2	2	1	0	3
FT 103	Field Training I	Completion of 65 CH	0	0	0	0	0
FT 203	Field Training II	Completion of 96 CH	0	0	0	0	0
Total			**32**	**19**	**14**	**17**	**50**

Mechanical & Electrical Engineering Disciplines Requirements

Code	Course	Pre-Req	Cr. Hrs.	Ct. Hr.			
				Lec.	Lab.	Tut.	Sum
FRB 101	Engineering Differential Equations	FRB 002	3	2	0	2	4
FRB 104	Engineering Numerical Analysis	FRB 101	3	2	2	0	4
FRB 201	Applied Engineering Probability and Mathematical Statistics	FRB 002	3	2	2	0	4
FRB 206	Multiple Integrals & Complex Analysis	FRB 002	3	2	0	2	4
Total from Basic science			12	8	4	4	16
MAM 101	Fluid Mechanics	FRB 005	3	2	2	1	5
MAM 103	Kinematics of Machines	FRB 004	3	2	1	2	5
MAM 105	Mechanics and Testing of Materials	FRM 008	3	2	2	1	5
MAM 107	Materials Science and Engineering	FRB 006	3	2	2	0	4
MAE 101	Electrical Circuits	FRB 006	2	1	0	2	3
MAM 109	Computer Applications	FRE 012	2	1	2	0	3
MAM 102	Thermodynamics	FRB 005	3	2	1	2	5
MAM 104	Measurement and Instrumentation	FRB 006	2	1	2	1	4
MAM 106	Design of Machine Elements	MAM 105	3	2	3	0	5
MAM 108	Manufacturing Technology	FRM 008	2	1	2	0	3
MAE 102	Electronic Devices and Circuits	MAE 101	2	1	0	2	3
MAM 201	Project Management	FRB 002	2	2	0	1	3
MAM 203	Dynamic Modeling and Simulation	FRB 101	3	2	1	2	5
MAM 205	Fluid Power Systems	MAM 101	2	1	3	0	4
MAM 207	Mechanical Design	MAM 105	3	2	3	0	5
MAM 209	Mechanical Vibrations	FRB 004	3	2	2	1	5
MAE 211	Electric Machinery	MAE 101	2	2	1	1	4
MAM 202	Automatic Control Systems	MAM 209	3	2	2	1	5
MAM 204	Introduction to Mechatronics	MAE 102	3	2	2	0	4
MAE 206	Logic Circuits Design & Applications	MAE 102	3	2	2	0	4
MAM 208	Industrial Robots	MAM 103	3	2	2	0	4
MAM 301	Design of Mechatronic Systems	MAM 204	3	2	2	0	4
MAE 303	Power Electronics	MAE 211	3	2	2	0	4
MAM 309	Technical Reports		1	**0**	2	0	2
MAM 302	CAD/CAM	MAM 207	3	2	2	0	4
MAE 304	Microprocessors & Microcontrollers	MAE 206	3	2	1	1	4
MAM 306	Engineering Economics		2	2	0	1	3
MAM 390	Senior Design Project I		2	2	0	0	2
MAE 401	Artificial Intelligence	MAE 304	2	1	2	1	4
MAE 403	Programmable Logic Controllers	MAE 206	3	2	2	0	4
MAE 405	Electric Drives	MAE 303	3	2	3	0	5
MAM 490	Senior Design Project II	MAM 390	3	0	6	0	6
Total			**84**	**42**	**59**	**19**	**120**

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

Major Requirements of Mechatronics and Automation Engineering

Code	Course	Pre-Req	Cr. Hrs.	Ct. Hr.			
				Lec	Lab	Tut	Sum
MAM 204	Introduction to Mechatronics	MAE 102	3	2	2	0	4
MAE 206	Logic Circuits Design & Applications	MAE 102	3	2	2	0	4
MAM 208	Industrial Robots	MAM 103	3	2	2	0	4
MAM 301	Design of Mechatronic Systems	MAM 204	3	2	2	0	4
MAE 303	Power Electronics	MAE 211	3	2	2	0	4
MAX xxx	Elective I		3	2	0	2	4
MAX xxx	Elective II		3	2	0	2	4
MAM 302	CAD/CAM	MAM 207	3	2	2	0	4
MAE 304	Microprocessors & Microcontrollers	MAE 206	3	2	1	1	4
MAX xxx	Elective III		3	2	0	2	4
MAX xxx	Elective IV		3	2	0	2	4
MAE 405	Electric Drives	MAE 303	3	2	3	0	5
MAE 403	Programmable Logic Controllers	MAE 206	3	2	2	0	4
MAE 401	Artificial Intelligence	MAE 304	2	1	2	1	4
MAX xxx	Elective V		3	2	0	2	4
MAX xxx	Elective VI		3	2	0	2	4
MAM 390	Senior Design Project I		2	2	0	0	2
MAM 490	Senior Design Project II	MAM 390	3	0	6	0	6
Total			**52**	**33**	**25**	**15**	**73**

* Elective courses are selected from two concentrations (x, y)

Concentration Requirements Mechatronics Engineering (concentration "x")

Code	Course	Pre-Req	Cr. Hrs.	Ct. Hr.			
				Lec	Lab	Tut	Sum
Pool Courses for Elective I, Elective II							
MAM 331	Mobile Robots	MAM 208	3	2	0	2	4
MAE 333	Digital Control	MAM 202	3	2	0	2	4
MAE 335	Computer Interfacing	MAE 206	3	2	0	2	4
Pool Courses for Elective III, Elective IV							
MAM 332	Autonomous systems	MAM 208	3	2	0	2	4
MAE 334	Micro Electromechanical Systems (MEMS)	MAM 301	3	2	0	2	4
MAM 336	Automotive Engineering	MAM 301	3	2	0	2	4
Pool Courses for Elective V, Elective VI							
MAE 431	Embedded System Design	MAE 304	3	2	0	2	4
MAM 433	Biomechatronic	**MAM 301**	3	2	0	2	4
MAM 435	Autotronics	**MAM 301**	3	2	0	2	4
Total			**18**	**12**	**0**	**12**	**24**

Concentration Requirements of Automation Engineering (MAX x4x)

Code	Course	Pre-Req	Cr. Hrs.	Ct. Hr.			
				Lec	Lab	Tut	Sum
Pool Courses for Elective I, Elective II							
MAE 341	Industrial Automation	MAM 208	3	2	0	2	4
MAE 343	Machine Vision Systems	MAM 204	3	2	0	2	4
MAM 345	Playware Technology	MAM 208	3	2	0	2	4
Pool Courses for Elective II, Elective IV							
MAE 342	Theory of Automata	**MAM 202**	3	2	0	2	4
MAM 344	Sensors and Actuators	MAM 208	3	2	0	2	4
MAM 346	Industrial Material Flow Management	MAM 301	3	2	0	2	4
Pool Courses for Elective V, Elective VI							
MAM 441	Hydraulic Servo Control	**MAM 205**	3	2	0	2	4
MAE 443	Internet of things	MAE 304	3	2	0	2	4
MAM 445	Computer Numerical Control (CNC)	MAM 302	3	2	0	2	4
Total			**18**	**12**	**0**	**12**	**24**

*The course content must be approved by Mechanical Engineering Department Council before registration.

Proposed Study Plan for Mechatronics and Automation Engineering

Level 0-1														
Code	Course Title	Pre-Req	Cr. Hrs.	Ct. Hr.				Final Exam Time	Assessment					
				Lec	Lab	Tut	Sum		MT1	MT2	PE/ OE	SA	Final	Sum
FRB 001	Analytical geometry & Linear Algebra		3	2	0	2	4	2 Hr	30	20	--	10	40	100
FRB 003	Statics		3	2	0	2	4	2 Hr	30	20	--	10	40	100
FRB 007	Chemistry for Engineers		4	3	2	1	6	2 Hr	30	--	20	10	40	100
FRB 005	Waves and Heat		3	2	2	1	5	2 Hr	30	--	20	10	40	100
FRM 009	Engineering Drawing		2	0	0	4	4	2 Hr	30	20	--	10	40	100
UHS 101	Foreign Language		2	2	0	0	2	2 Hr	30	20	--	10	40	100
UHS 102	Information and Communication Technology		2	2	0	0	2	2 Hr	30	20	--	10	40	100
Total			19											700

Level 0-2														
Code	Course Title	Pre-Req	Cr. Hrs.	Ct. Hr.				Final Exam Time	Assessment					
				Lec	Lab	Tut	Sum		MT1	MT2	PE/ OE	SA	Final	Sum
FRB 002	Integration & Multivariable functions	FRB 001	3	2	0	2	4	2 Hr	30	20	--	10	40	100
FRB 004	Dynamics	FRB 003	3	2	0	2	4	2 Hr	30	20	--	10	40	100
FRM 008	Production Systems Engineering		2	1	3	0	4	2 Hr	30	--	20	10	40	100
FRB 006	Electricity and Magnetism		3	2	2	1	5	2 Hr	30	--	20	10	40	100
FRM 010	Engineering Drawing by Computer	FRM 009	2	1	2	0	3	2 Hr	30	20	40	10	--	100
FRE 012	Computer Programming		2	0	2	2	4	2 Hr	30	20	40	10	--	100
UHS 103	Societal Issues		2	2	0	0	2	2 Hr	30	20	--	10	40	100
Total			17											700

Level 1-1														
Code	Course Title	Pre-Req	Cr. Hrs.	Ct. Hr.				Final Exam Time	Assessment					
				Lec	Lab	Tut	Sum		MT1	MT2	PE/ OE	SA	Final	Sum
FRB 101	Engineering Differential Equations	FRB 002	3	2	0	2	4	2 Hr	30	20	--	10	40	100
MAM 101	Fluid Mechanics	FRB 005	3	2	2	1	5	2 Hr	30	--	20	10	40	100
MAM 103	Kinematics of Machines	FRB 004	3	2	1	2	5	2 Hr	30	--	20	10	40	100
MAM 107	Materials Science and Engineering	FRB 006	3	2	2	0	4	2 Hr	30	--	20	10	40	100
MAM 105	Mechanics and Testing of Materials	FRM 008	3	2	2	1	5	2 Hr	30	--	20	10	40	100
MAE 101	Electrical Circuits	FRB 006	2	1	0	2	3	2 Hr	30	20	--	10	40	100
MAM 109	Computer Applications	FRE 012	2	1	2	0	3	2 Hr	30	--	20	10	40	100
Total			19											700

Field Training I														
Code	Course Title	Pre-Req	Cr. Hrs.	Ct. Hr.				Final Exam Time	Assessment					
				Lec	Lab	Tut	Sum		MT1	MT2	SA	Final	Sum	
FT 103	Field Training I	Completion of 65 Cr. Hrs.	0	0	0	0	0	Oral	-	-	-	Pass or Fail	-	

Level 1-2														
Code	Course Title	Pre-Req	Cr. Hrs.	Ct. Hr.				Final Exam Time	Assessment					
				Lec	Lab	Tut	Sum		MT1	MT2	PE/ OE	SA	Final	Sum
FRB 206	Multiple Integrals & Complex Analysis	FRB 002	3	2	0	2	4	2 Hr	30	20	--	10	40	100
MAM 102	Thermodynamics	FRB 005	3	2	1	2	5	2 Hr	30	--	20	10	40	100
MAM 106	Design of Machine Elements	MAM 105	3	2	3	0	5	2 Hr	30	--	20	10	40	100
MAM 104	Measurement and Instrumentation	FRB 006	2	1	2	1	4	2 Hr	30	--	20	10	40	100
MAM 108	Manufacturing Technology	FRM 008	2	1	2	0	3	2 Hr	30	--	20	10	40	100
MAE 102	Electronic Devices and Circuits	MAE 101	2	1	0	2	3	2 Hr	30	20	--	10	40	100
UHS 104	Professional Ethics		2	2	0	0	2	2 Hr	30	20	--	10	40	100
Total			17											700

Level 2-1														
Code	Course Title	Pre-Req	Cr. Hrs.	Ct. Hr.				Final Exam Time	Assessment					
				Lec	Lab	Tut	Sum		MT1	MT2	PE/ OE	SA	Final	Sum
MAM 201	Project Management	FRB 002	2	2	0	1	3	2 Hr	30	20	--	10	40	100
MAM 203	Dynamic Modeling and Simulation	FRB 101	3	2	1	2	5	2 Hr	30	--	20	10	40	100
MAM 205	Fluid Power Systems	MAM 101	2	1	3	0	4	2 Hr	30	--	20	10	40	100
MAM 207	Mechanical Design	MAM 106	3	2	3	0	5	2 Hr	30	--	20	10	40	100
MAM 209	Mechanical Vibrations	FRB 004	3	2	2	1	5	2 Hr	30	--	20	10	40	100
MAE 211	Electric Machinery	MAE 101	3	2	1	1	4	2 Hr	30	--	20	10	40	100
UHS XXX	Humanities - Elective I		2	2	0	0	2	2 Hr	30	20	--	10	40	100
Total			18											700

Level 2-2														
Code	Course Title	Pre-Req	Cr. Hrs.	Ct. Hr.				Final Exam Time	Assessment					
				Lec	Lab	Tut	Sum		MT1	MT2	PE/ OE	SA	Final	Sum
FRB 104	Engineering Numerical Analysis	FRB 101	3	2	2	0	4	2 Hr	30	--	20	10	40	100
MAM 204	Introduction to Mechatronics	MAE 102	3	2	2	0	4	2 Hr	30	--	20	10	40	100
MAE 206	Logic Circuits Design & Applications	MAE 102	3	2	2	0	4	2 Hr	30	--	20	10	40	100
MAM 208	Industrial Robots	MAM 103	3	2	2	0	4	2 Hr	30	--	20	10	40	100
MAM 202	Automatic Control Systems	MAM 209	3	2	2	1	5	2 Hr	30	--	20	10	40	100
FRB 103	Environmental Pollution and Industrial Safety	FRB 007	2	2	1	0	3	2 Hr	30	--	20	10	40	100
UHS 3XX	Humanities Elective II		2	2	0	0	2	2 Hr	30	20	--	10	40	100
Total			19											700

Field Training II													
Code	Course Title	Pre-Req	Cr. Hrs.	Ct. Hr.				Final Exam Time	Assessment				
				Lec	Lab	Tut	Sum		MT1	MT2	SA	Final	Sum
FT 203	Field Training II	Completion of 96 Cr. Hrs.	0	0	0	0	0	Oral	-	-	-	Pass or Fail	-

Level 3-1															
Code	Course Title	Pre-Req	Cr. Hrs.	Ct. Hr.				Final Exam Time	Assessment					
				Lec	Lab	Tut	Sum		MT1	MT2	PE/ OE	SA	Final	Sum
FRB 201	Applied Engineering Probability and Mathematical Statistics	FRB 002	3	2	2	0	4	2 Hr	30	--	20	10	40	100
MAX xxx	Elective I		3	2	0	2	4	2 Hr	30	20	--	10	40	100
MAM 301	Design of Mechatronic Systems	MAM 204	3	2	2	0	4	2 Hr	30	--	20	10	40	100
MAE 303	Power Electronics	MAE 211	3	2	2	0	4	2 Hr	30	--	20	10	40	100
MAX xxx	Elective II		3	2	0	2	4	2 Hr	30	20	--	10	40	100
MAM 309	Technical Reports		1	0	2	0	2	2 Hr	30	--	20	10	40	100
UHS 4XX	Humanities Elective III		2	2	0	0	2	2 Hr	30	20	--	10	40	100
Total			18											600

Level 3-2															
Code	Course Title	Pre-Req	Cr. Hrs.	Ct. Hr.				Final Exam Time	Assessment					
				Lec	Lab	Tut	Sum		MT1	MT2	PE/ OE	SA	Final	Sum
MAM 302	CAD/CAM	MAM 207	3	2	2	0	4	2 Hr	30	20	--	10	40	100
MAE 304	Microprocessors & Microcontrollers	MAE 206	3	2	1	1	4	2 Hr	30	--	20	10	40	100
MAX xxx	Elective III		3	2	0	2	4	2 Hr	30	20	--	10	40	100
MAX xxx	Elective IV		3	2	0	2	4	2 Hr	30	20	--	10	40	100
MAM 390	Senior Design Project I		2	2	0	0	2	-	-	-	--	50	50	100
MAM 306	Engineering Economics		2	2	0	1	3	2 Hr	30	20	--	10	40	100
Total			16											600

Level 4-1														
Code	Course Title	Pre-Req	Cr. Hrs.	Ct. Hr.				Final Exam Time	Assessment					
				Lec	Lab	Tut	Sum		MT1	MT2	PE/ OE	SA	Final	Sum
MAE 405	Electric Drives	MAE 303	3	2	3	0	5	2 Hr	30	--	20	10	40	100
MAE 403	Programmable Logic Controllers	MAE 206	3	2	2	0	4	2 Hr	30	--	20	10	40	100
MAX xxx	Elective V		3	2	0	2	4	2 Hr	30	20	--	10	40	100
MAX xxx	Elective VI		3	2	0	2	4	2 Hr	30	20	--	10	40	100
MAE 401	Artificial Intelligence	MAE 304	2	1	2	1	4	2 Hr	30	--	20	10	40	100
MAM 490	Senior Design Project II	MAM 390	3	0	6	0	6	-	-	-	--	50	50	100
Total			17											600

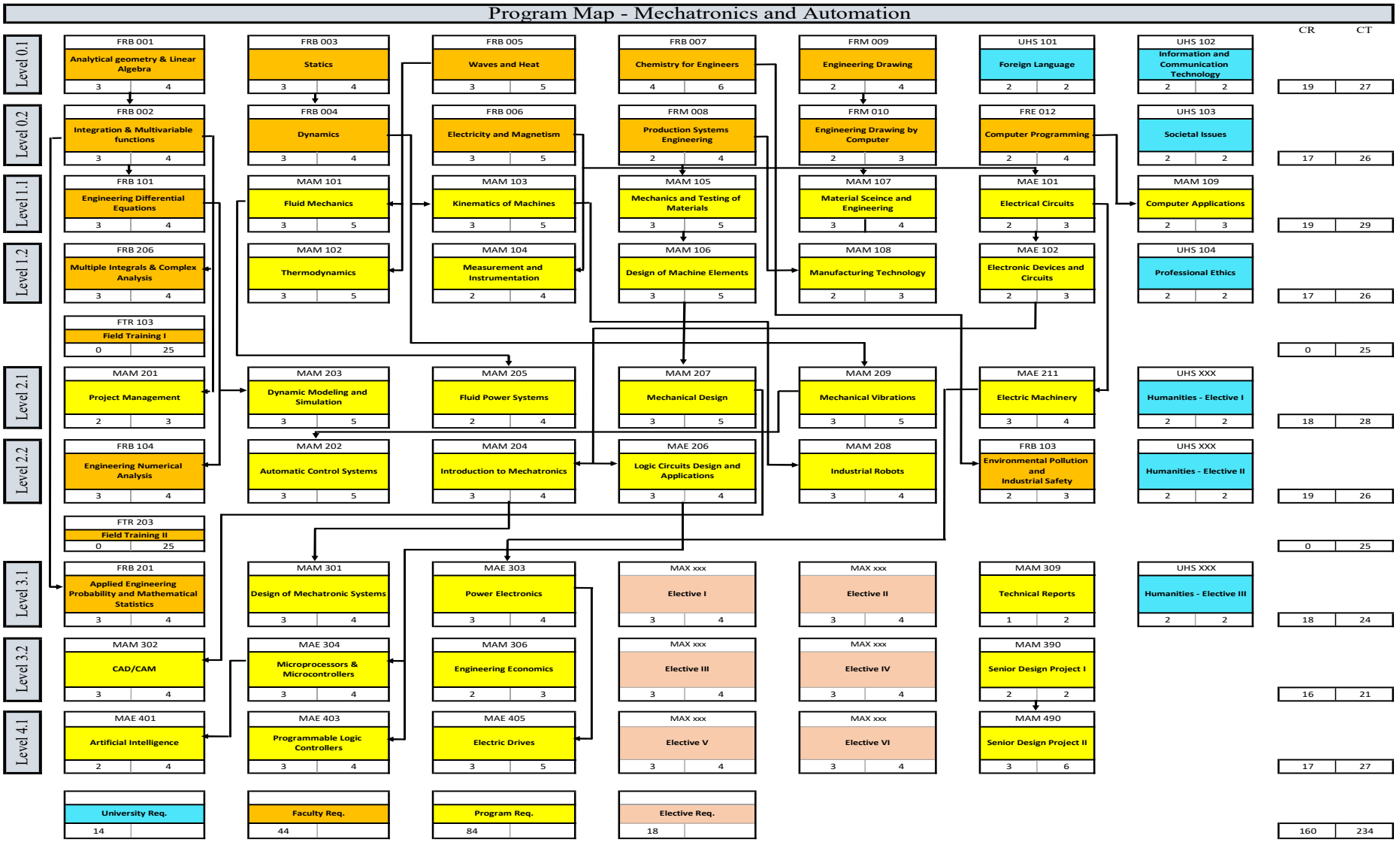
Matching Mechatronics Engineering Program Courses with ABET Requirements

ABET Program Criteria for Mechanical and Similarly Named Engineering Programs
Lead Society: American Society of Mechanical Engineers

Mechatronics Engineering Program Courses Required to Cover ABET Criteria				
ABET Criteria		**CODE**	**Course Name**	Cr. Hrs.
A minimum of 30 semester credit hours (or equivalent) of a combination of college-level mathematics and basic sciences with experimental experience appropriate to the program.	basic science, and mathematics (including multivariate calculus and differential equations);	FRB 001	Analytical geometry & Linear Algebra	3
		FRB 002	Integration & Multivariable functions	3
		FRB 206	Multiple Integrals & Complex Analysis	3
		FRB 101	Engineering Differential Equations	3
		FRB 104	Engineering Numerical Analysis	3
		FRB 201	Applied Engineering Probability and Mathematical Statistics	3
	principles of engineering	FRB 007	Chemistry for Engineers	4
		FRB 003	Statics	3
		FRB 004	Dynamics	3
		FRB 103	Environmental Pollution and Industrial Safety	2
		FRB 005	Waves and Heat	3
		FRB 006	Electricity and Magnetism	3
Total				**36**
ABET Criteria		**CODE**	**Course Name**	Cr. Hrs.
A minimum of 45 semester credit hours (or equivalent) of engineering topics appropriate to the program, consisting of engineering and computer sciences and engineering design and utilizing modern engineering tools.	Courses that cover Engineering fundamental principles of Mechanics, Thermodynamics, Fluid, Control, Electric & Electronic circuits.	FRM 009	Engineering Drawing	2
		FRM 008	Production Systems Engineering	2
		MAM 101	Fluid Mechanics	3
		MAM 102	Thermodynamics	3
		MAM 104	Measurement and Instrumentation	2
		MAM 107	Materials Science and Engineering	3
		MAM 108	Manufacturing Technology	2
		MAM 202	Automatic Control Systems	3
		MAM 205	Fluid Power Systems	2

		MAM 209	Mechanical Vibrations	3
		MAE 101	Electric Circuits	2
		MAE 102	Electronic Devices and Circuits	3
		MAE 211	Electric Machinery	2
		MAE 303	Power Electronics	3
		MAE 405	Electric Drives	3
	Courses that cover Computer science and computer-based topics	FRM 010	Engineering Drawing by Computer	2
		MAM 109	Computer Applications	2
		MAE 335	Computer Interfacing	3
		MAM 302	CAD/CAM	3
		MAE 304	Microprocessors & Microcontrollers	3
		MAE 403	Programmable Logic Controllers	3
		MAM 445	Computer Numerical Control (CNC)	3
	Courses that cover Design topics in Mechatronics program	MAM 103	Kinematics of Machines	3
		MAM 106	Design of Machine Elements	3
		MAM 207	Mechanical Design	3
		MAM 204	Introduction to Mechatronics	3
		MAM 301	Design of Mechatronic Systems	3
	Courses that cover modern engineering tools	MAM 208	Industrial Robots	3
		MAE 334	Micro Electromechanical Systems (MEMS)	3
		MAE 401	Artificial Intelligence	3
		MAE 431	Embedded System Design	3
		MAM 435	Autotronics	3
		MAE 443	Internet of things	3
Total				**88**

Courses Plan and Matrix



Course/Learning Outcomes Matrix

Learning Outcomes				PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO 11	PLO12	PLO13	PLO14	PLO15	PLO16
Level 0	Level 0-1	FRB 001	Analytical geometry & Linear Algebra	●		●													
		FRB 003	Statics	●	●														
		FRB 005	Waves and Heat	●	●														
		FRB 007	Chemistry for Engineers	●	●														
		FRM 009	Engineering Drawing						●		●								
		UHS 101	Foreign Language								●		●						
		UHS 102	Information & Communication Technology				●		●				●						
	Level 0-2	FRB 002	Integration & Multivariable functions	●		●													
		FRB 004	Dynamics	●	●														
		FRB 006	Electricity and Magnetism	●	●														
		FRM 008	Production Systems Engineering				●		●										
		FRM 010	Engineering Drawing by Computer				●				●								
		FRE 012	Computer Programming	●		●													
		UHS 103	Societal Issues							●			●						
Level 1	Level 1-1	FRB 101	Engineering Differential Equations	●	●														

		MAM 101	Fluid Mechanics	•										•				
		MAM 103	Kinematics of Machines											•	•			
		MAM 105	Mechanics and Testing of Materials		•									•				
		MAM 107	Materials Science and Engineering											•	•			
		MAE 101	Electerical Circuits															
		MAM 109	Computer Applications			•									•			
	Level 1-2	FRB 206	Multiple Integrals & Complex Analysis	•	•													
		MAM 102	Thermodynamics											•	•			
		MAM 104	Measurement and Instrumentation		•												•	•
		MAM 106	Design of Machine Elements			•									•			
		MAM 108	Manufacturing Technology											•	•			
		MAE 102	Electronic Devices and Circuits													•	•	
		UHS 104	Profession Ethics				•	•										
		FT 103	Field Training I							•			•					
Level 2	Level 2-1	MAM 201	Project Management					•			•	•						
		MAM 203	Dynamic Modeling and Simulation											•				•
		MAM 205	Fluid Power Systems	•	•									•				

		MAM 207	Mechanical Design			●								●				
		MAM 209	Mechanical Vibrations	●	●									●	●			
		MAE 211	Electric Machinery													●	●		
		UHS XXX	Humanities - Elective I			●	●												
	Level 2-2	FRB 104	Engineering Numerical Analysis	●	●														
		MAM 202	Automatic Control Systems			●								●					
		MAM 204	Introduction to Mechatronics															●	●
		MAE 206	Logic Circuits Design & Applications													●	●		
		MAM 208	Industrial Robots											●					●
		BES 241	Environmental Pollution and Industrial Safety	●		●	●												
		UHS XXX	Humanities - Elective II							●	●								
		FT 203	Field Training II					●	●	●		●	●						
Level 3	Level 3-1	FRB 201	Applied Engineering Probability and Mathematical Statistics	●	●														
		MAM 301	Design of Mechatronic Systems															●	●
		MAE 303	Power Electronics													●	●		
		MAX xxx	Elective I															●	●
		MAX xxx	Elective II															●	●

		MAM 309	Techincal Reports					●		●	●							
		UHS XXX	Humanities Elective III								●	●						
	Level 3-2	MAM 302	CAD/CAM											●			●	
		MAE 304	Microprocessors & Microcontrollers												●	●		
		MAM 306	Engineering Economics			●				●								
		MAX xxx	Elective III														●	●
		MAX xxx	Elective IV														●	●
		MAM 390	Senior Design Project I				●	●	●	●	●	●	●		●	●		●	●
Level 4	Level 4-1	MAE 401	Artificial Intelligence														●	●
		MAE 403	Programmable Logic Controllers												●	●		●
		MAE 405	Electric Drives												●	●	●	●
		MAX xxx	Elective V														●	●
		MAX xxx	Elective VI														●	●
		MAM 490	Senior Design Project II				●	●	●	●	●	●	●		●	●		●	●

Mechatronics & Automation Engineering Program Courses
Course Coding System

Each course has a code that is consisted of:

- 3 letters that denotes the department who offers the course, followed by
- 3 digits; where:
  - the first digit from left represents the course level,
  - the middle digit represents the program who offers the course in the department, and
  - the right digit represents the course sequence (odd digits for the fall semester and even digit for spring semester).

The coding system is demonstrated in the following table:

UHS 1xx, 2xx	University Requirement Compulsory Courses
UHS xxx	University Requirement Elective Courses
FRB XXX	Courses offered by Basic Engineering Science Department
FRM XXX	Faculty requirement course offered by Mechanical Engineering Department
FRE XXX	Course offered by Electrical Engineering Department
MAM xxx	Course offered by Mechanical Engineering Department
MAE xxx	Course offered by Electrical Engineering Department
MAX x3x	Elective Courses offered for Mechatronics Concentration
MAX x4x	Elective Courses offered for Automation Concentration

The following Abbreviation are used in the contents table:

Pre-req	Prerequisite	**Cr. Hrs.**	Credit Hours	**SA**	Student Activity
MT1	First Midterm Exam	**MT2**	Second Midterm Exam	**Final**	Final Exam

Program Requirements Courses

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab	Tut	Sum	MT1	MT2	SA	Final
FRB 101	Engineering Differential Equations	FRB 002	3	2	0	2	4	30	20	10	40
Course Content	**Basic Concepts of Ordinary and Partial differential equations (ODEs & PDEs):** Oder, Degree, Linearity, Formation, Geometric and physical applications (Newtons law of cooling, electric circuits), Types of solutions, Existence and uniqueness of solutions. **ODEs:** Solution of first order ODEs (Separable, Homogeneous, Exact, Integrating factor, Linear and Bernoulli equations). Orthogonal trajectories. Solution of nth order ODEs (homogeneous and non-homogeneous). System of first order linear differential equations. Laplace transforms and inverse Laplace transforms with applications. Fourier series with applications. Gamma and Beta functions **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. Hr.				Assessment			
				Lec.	Lab	Tut	Sum	MT1	MT2	SA	Final
FRB 206	Multiple Integrals & Complex Analysis	FRB 002	3	2	0	2	4	30	20	10	40
Course Content	**Multiple Integrals:** Double integrals (Areas, Volumes, Moments, Double integrals in polar form). Triple integrals (Volumes, Masses and Moments in three dimensions, Triple integrals in cylindrical and spherical coordinates). Substitution in multiple integrals. line and surface integrals, Green, Stock's and Divergence theorems. **Complex Analysis:** Complex Numbers, Complex plane, Polar form of complex number, Powers and roots, Complex Function, Limit, Continuity, Derivative, Cauchy-Riemann equations, Laplace's Equation, Complex integration. Taylor and Laurent Series. Residue Integration. Conformal Mapping (linear function, Linear Fractional Transformations (or Möbius transformations), irrational functions, the exponential function, trigonometric functions).										
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	MT1	PE/ OE	SA	Final
FRB 104	Engineering Numerical Analysis	FRB 101	2	2	2	0	4	30	20	10	40
Course Content	**Numeric in General:** Solution of linear systems by iterative methods (Jacobi Iteration, Gauss–Seidel Iteration Method, Convergence and Matrix Norms). Solution of nonlinear equations (Fixed-Point Iteration, Newton–Raphson's method, Sufficient Convergence Condition). Curve fitting (Least square method). Interpolations (Lagrange Interpolation, Newton's Forward and Backward Interpolations). Numerical differentiation. Numerical integration (Rectangular Rule, Trapezoidal Rule, Simpson's Rule). **Numeric for ODEs and PDEs:** Solution of first-order ODEs (Euler's method, Runge–Kutta Methods). Solution of higher order ODEs. Boundary and initial-boundary value problems for ODEs, Elliptic and parabolic PDEs (Finite difference methods, Explicit method, Crank–Nicolson Method). 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. Hr.				Assessment			
				Lec.	Lab	Tut	Sum	MT1	PE/OE	SA	Final
FRB 201	Applied Engineering Probability and Mathematical Statistics	FRB 002	3	2	2	0	4	30	20	10	40
Course Content	**Probability:** Basic Theorems of Probability. Conditional Probability. Independent Events. Discrete and Continuous Random Variables. Mean and Variance of Distributions. Discrete Distributions (Binomial, Poisson and Hypergeometric Distribution). Continuous Distributions (Normal and Exponential Distribution). Distributions of Several Random Variables (Discrete and Continuous Two-Dimensional Distributions). **Mathematical Statistics:** Random Sampling. Sample mean and variance. Point Estimation of Parameters. Confidence Intervals. Simple and multiple Linear Regression and Correlation. Testing of Hypotheses. Markov chains. Quality Control. Engineering Applications. 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			
FRB 103	Environmental Pollution and Industrial Safety	FRB 007	2	Lec.	Lab	Tut	Sum	MT1	PE/ OE	SA	Final
				2	1	-	3	30	20	10	40
Course Content	- Air pollution-Adverse effects -ozone depletion – green house effects- Acid rain and global warming - measurement and control methods. - Water pollution- constituents of wastewater- primary treatment: various pre-treatment methods - Advanced Treatment: chemical oxidation, precipitation, air stripping **Construction Engineering and Managment 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. **Electromechanical 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. 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	Cr. Hrs.	Ct. Hr.				Assessment			
MAE 101	Electrical Circuits	FRB 006	2	Lec.	Lab	Tut	Sum	MT1	MT2	SA	Final
				1	0	2	3	30	20	10	40
Course Content	DC circuit analysis: Circuit Variables, Kirchhoff's Laws, Simple Resistive Circuits, The Wheatstone Bridge, Δ to-Y (or π -to-T) Equivalent Circuits, The Node-Voltage Method and Dependent Sources, The Mesh-Current Method and Dependent Sources, The Venin 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.										
References	• James W. Nilsson, Susan A. Riedel, "Electric Circuits", Pearson educational Inc, 2012.										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
MAE 102	Electronic Devices and Circuits	MAE 101	2	Lec.	Lab	Tut	Sum	MT1	MT2	SA	Final
				1	0	2	3	30	20	10	40
Course Content	Semiconductor physics, Structure of diodes, Diode circuits and rectifiers, Structure of BJT, Biasing and operation modes of transistors, DC and small signal analysis of transistor circuits, Amplifiers circuits using BJT, Power amplifiers, Field effect transistors, Biasing of FET, Small signal model of FET. Amplifier circuits using FET, Design of amplifier circuits, Frequency response of amplifier circuits, Active filters, Feedback in electronic circuits, Different feedback configuration in electronic circuits, Oscillators circuits.										
References	• "Microelectronic Circuits", by Adel S. Sedra and Kenneth C. Smith, Oxford University press.										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
MAE 211	Electric Machinery	MAE 101	2	Lec.	Lab	Tut	Sum	MT1	PE/ OE	SA	Final
				1	2	0	3	30	20	10	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. Asynchronous motor: principle of operation, main characteristics and construction, electrical drives with asynchronous motor. Stepper motors.										
References	• "Electric machines and drives", By G.R. Slemon, Addison Wesley, MA, 1992										
Laboratory	• Experimental operations and checking the performance of various electric machines listed in the course description										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab	Tut	Sum	MT1	PE/ OE	SA	Final
MAE 206	Logic Circuits Design & Applications	MAE 102	3	2	2	0	4	30	20	10	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										
Used in Program	Mechatronics & Automation Engineering Program						Semester	6			

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab	Tut	Sum	MT1	PE/ OE	SA	Final
MAE 303	Power Electronics	MAE 211	3	2	2	0	4	30	20	10	40
Course Content	Power semiconductor devices, diodes, thyristors, and applications. Drive circuit design and protection techniques. Power converter circuits Applications of AC-DC (rectifiers and controlled rectifiers), DC-DC (Choppers), and DC-AC power converter circuits (Inverters). 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 supplie..										
References	• Rashid, M. H. (2006). Power electronics handbook: Devices, circuits, and applications. Burlington, MA: Academic										
Used in Program	Mechatronics & Automation Engineering Program						Semester	7			

Discipline Requirements of Mechanical Engineering Course Content

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab	Tut	Sum	MT1	PE/ OE	SA	Final
MAM 101	Fluid Mechanics	FRB 005	3	2	2	1	5	30	20	10	40
Course Content	Physical properties of fluids, Density, Viscosity, Surface tension. Continuum Hypothesis, Flow Classification, and Shear-Deformation Behavior of Fluids. Fluid statics (Buoyancy, Forces on submerged surfaces). Flow kinematics, Elementary fluid dynamics, Bernoulli equation. Control volume analysis (Mass conservation, Momentum conservation, Energy conservation, Practical applications). Differential fluid flow analysis (Continuity, Navier-Stokes equation). Flow in pipes (Laminar flow, turbulent flow, Frictional losses in pipes and pipe fittings). Dimensional analysis and similarity (Buckingham theorem, physical similarity). Classification of Turbomachines, Operation of centrifugal pumps, Series and Parallel Operation, Selection of Pumps.										
References	• Munson, Young, and Okiishi, 2009, "Fundamentals of Fluid Mechanics", 7th Ed., Wiley. • T. C. Clayton, F. E. Donald, and A. R. John, 2006,"Engineering Fluid Mechanics", John Wiley & Sons, Inc., 8th Ed.										
Laboratory	• Determination of fluid properties • Hydrostatic pressure measurement • Determination of pressure force on submerged surface • Application of continuity equation for the flow through pipes • Apparatus of impact water jet • Satisfying of the Bernoulli's theorem • Demonstration of the flow through orifice and free jet • Determination of the friction losses through pipes • Determination of the minor losses through pipe connections										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab	Tut	Sum	MT1	MT2	SA	Final
MAM 103	Kinematics of Machines	FRB 004	3	2	0	2	4	30	20	10	40
Course Content	Basic concepts of mobility and mechanisms – Graphical method of Kinematic analysis of mechanisms (displacement, velocity, and acceleration analysis). Computational method and computer utilization in kinematic analysis of mechanisms. Force Analysis of Mechanisms (Newton Euler formulation and principle of virtual work). Cams (types, follower types and motion, construction of cam profile, cam displacement, velocity, and acceleration diagrams). Gears, Gear trains, Balancing of rotating masses.										
References	• Norton, R.L., 2009, "Kinematics and Dynamics of Machinery", McGraw-Wiley • R. S. Khurmi, 2005, "Theory of Machines", 14th Ed., New Delhi. • H. Mabie, C. Reinholtz,"Mechanisms and Dynamics of Machinery", Wiley										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
MAM 108	Manufacturing Technology	FRM 008	2	Lec.	Lab	Tut	Sum	MT1	PE/ OE	SA	Final
				1	2	0	3	30	20	10	40
Course Content	Metal Casting Technology: solidification process, metals and alloys, production of primary metals, production of shaped casting, sand casting (moulding, melting, pouring, solidification, cleaning, defects, and inspection). Contemporary casting processes (metallic mould, electro-slag, precision, and centrifugal casting). Metal Forming Technology: Hot and cold working of metals, metal forming processes (rolling, forging, drawing, extrusion and spinning), pipe and tube manufacturing, joining technology (fastening, riveting, soldering, and brazing, welding, and adhesive bonding). Welding: submerged arc welding, spot and seam welding, plasma welding, cold pressure welding, adhesive welding, testing of welded joints. Welding operations for ferrous metals – thermal welding – Oxy-Acy welding Metal cutting technology: Cutting tools, metal cutting machine tools (turning, drilling, boring, milling, shaping, planning, broaching, grinding, special purpose, gear and thread cutting and super finishing machine tools).										
References	• Rajender Singh, 2006, " Introduction to basic manufacturing processes and workshop technology ", New age international publishers.										
Laboratory	Students make different mechanical models in all the following workshops: • Casting workshop • Metal forming technology • Welding • Metal cutting workshop										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab	Tut	Sum	MT1	PE/ OE	SA	Final
MAM 105	Mechanics and Testing of Materials	FRM 008	3	2	2	1	5	30	20	10	40
Course Content	Introduction, Concept of stress and strain, Axial loading, Stress-strain diagrams – Behavior of ductile and brittle metals. Area moments of Inertia. Torsion, Pure bending, Transverse shear, Analysis, and design of beams for bending and shearing stresses. Deflection of beams and shafts - Statically indeterminate beams and shafts. Transformations of stress and strain, Principal stresses under a given loading, Internal forces, and moments in beams (axial force – shear force bending moment), Deflection of beams. Destructive testing of materials (Tension, compression, bending, Torsion, and impact tests).										
References	• Russell C. Hibbeler, 2011, "Mechanics of Materials", 8E, Pearson. • E.P. Popov, S. Nagarajan and Z.A. Lu, Mechanics of Materials, 2nd Ed., Prentice-Hall, Inc., 1976.										
Laboratory	• Tension test, Stress-strain diagram • Compression test • Impact test • Bending test • Torsion test • Hardness test										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab	Tut	Sum	MT1	PE/ OE	SA	Final
MAM 107	Materials Science and Engineering	FRB 006	3	2	2	0	4	30	20	10	40
Course Content	Introduction to engineering materials. Structure and structural defects of metals, Phase transformation of metals, Theory of alloying and constitutional diagrams. Plastic deformation machine of metals, Strengthening mechanisms, Heat treatment of metals and alloys. Deterioration of metallic materials, selection of alloys. Non-metallic materials. Non-destructive tests of materials (Hardness, Photo elasticity, X-ray, Acoustics, and Stain gages). Failure of materials due to creep and Fatigue.										
References	• William F. Smith,1996,"Principles of Materials Science and Engineering", McGraw-Hill. • William D. Callister Jr., David G. Rethwisch, 2006, "Materials Science and Engineering: An Introduction", Wiley.										
Laboratory	• Optical microstructure • Heat treatment of metals and alloys • Hardness test • Photo elasticity • X-ray Test										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
MAM 109	Computer Applications	FRE 012	2	Lec.	Lab	Tut	Sum	MT1	PE/ OE	SA	Final
				1	2	0	3	30	20	10	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.										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
MAM 102	Thermodynamics	FRB 005	3	Lec.	Lab	Tut	Sum	MT1	PE/ OE	SA	Final
				2	1	2	5	30	20	10	40
Course Content	Definitions and basic concepts of thermodynamic systems, Properties of pure substances, phase change process, ideal gas. Work and Heat, first law of thermodynamics (closed system, unsteady and steady flow open systems, applications). Second law of thermodynamics (Heat engines and refrigerators, reversible and irreversible process, Carnot cycle). Entropy (Clausis inequality, entropy, increase of entropy principles, entropy change of pure substances, solids and liquids, entropy changes of ideal gases, adiabatic efficiency of process). Refrigeration Cycles: Refrigerators and Heat Pumps, The Reversed Carnot Cycle.										
References	• Yunus A.Cengel Michael A.Boles, 2014, "Thermodynamics An Engineering Approach", McGraw Hill Education; 8th edition.										
Laboratory	• Identification and recognition of the application of work and heat • Identification and recognition of the application of the first law • Identification and recognition of the application of the second law • Computer controlled expansion processes of a perfect gas unit • investigate the thermodynamics components such as turbine, compressor, pump, boiler, condenser, etc.										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab	Tut	Sum	MT1	PE/ OE	SA	Final
MAM 106	Design of Machine Elements	MAM 105	3	2	3	0	5	30	20	10	40
Course Content	Introduction to design process. Review of load and stress analysis, Mohr's circle for plane stress. Failures resulting from static loading, variable loading, and fatigue failure. Material selection for strength and rigidity. Design of mechanical elements: Knuckle joint - screws, fasteners - shafts and shaft components - mechanical springs - welding joints, Bonding, and permanent joints.										
Reference	• Robert L. Mott, " Machine elements in Mechanical Design", Pearson/Prentice Hall, 2004. • J.E. Shigley and C. R. Mischke, "Mechanical Engineering Design", McGraw-Hill, Last Edition.										
Laboratory	Term design projects: • Working and assembly drawing of parts and machine elements • Computer aided drafting of assembly drawings and machine elements										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab	Tut	Sum	MT1	PE/ OE	SA	Final
MAM 104	Measurement and Instrumentation	FRB 006	2	1	2	1	4	30	20	10	40
Course Content	Introduction – operating principles of sensors and transducers – general considerations for selection and evaluation of measurement equipment – statistical treatment of data – temperature sensors – pressure transducers – fluid transducers – strain gauges – load cells and force measurement – position and level measurement – uncertainty analysis of complete measurement systems – introduction to signal conditioning and data processing – Opto-electronics. Laboratory experiments on the course topics.										
References	• Richard S. Figliola and Clemson University, “Theory and Design for Mechanical Measurements”, 5th edition, John Wiley & Sons, Inc., 2011. • Alan S. Morris, “Measurement and Instrumentation Principles”, 3rd edition, Alan S. Morris, 2001.										
Laboratory	• Measuring Temperature (Mechanical Methods) • Measuring Temperature (Electrical Methods) • Measuring Pressure (Mechanical Methods) • Measuring Pressure (Electrical Methods) • Flow Measuring Instruments: Orifice Meter, Venturi Meter, Flow Nozzle, Pitot Tube, Movable Vane, ultrasonic										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab	Tut	Sum	MT1	MT2	SA	Final
MAM 201	Project Management	FRB 002	2	2	0	1	3	30	20	10	40
Course Content	Introduction to Project planning and scheduling, Project charter, Scope statement, Work Breakdown Structure, Responsibility Chart. Network diagram, Schedule analysis and possibilities using the Critical Path Method (CPM) and the Program Evaluation and Review Technique (PERT). Resource leveling and allocation, Time-cost trade off (Crashing a schedule), Gantt Chart, Time overlaps, Time and cost control, Risk monitoring and control, Computer applications										
References	• Moder J., Phillips C., and Davis E., "Project Management with CPM, PERT and Precedence Diagramming", Last Edition. • Gail Freeman-Rue & James Balkwill, "Management in Engineering, Principles & Practice", Prentice Hall, Last Edition.										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab	Tut	Sum	MT1	PE/ OE	SA	Final
MAM 205	Fluid Power Systems	MAM 101	2	1	3	0	4	30	20	10	40
Course Content	Thermal Properties of fluids, Bulk modulus, Types of Hydraulic fluids, Flow through conduits and orifices, Power losses, Pressure transients in hydraulic conduits. Hydraulic pumps, Analysis of ideal and practical pumps and motors, Performance curves. Hydraulic control valves, Spool valve analysis, Three-way spool valve, Flapper valve analysis. Hydraulic power elements, Valve controlled motors. Pump controlled motor. Pressure and flow control valves. Electro-Hydraulic operation of fluid power systems.										
References	• Herbert E. Merritt, 1991, "Hydraulic Control Systems", John Wiley & Sons. • John Watton: Fundamentals of Fluid Power Control. Cambridge University Press, 2009										
Laboratory	• Demonstrate basic hydraulic operation. • Build circuits with pumps, filters, flow and pressure-control valves and act • Analyze hydraulic systems using simulation software • Build control and automation of an application using fluid components										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab	Tut	Sum	MT1	PE/ OE	SA	Final
MAM 207	Mechanical Design	MAM 106	3	2	3	0	5	30	20	10	40
Course Content	Design methodology revision and creative problem solving, Design of chain drives selection, Belt drives, gear drives selection, shaft design, roller element bearing selection, Electric motor selection, structural issues, small collaborative project.										
References	• J.E. Shigley and C. R. Mischke, "Mechanical Engineering Design", McGraw-Hill, Last Edition. • George E. Dieter, Linda C. Schmidt, 2021, "Engineering design", 6th Edition.										
Laboratory	Students will use derived knowledge and work in groups to make an assigned projects in computer aided laboratories to demonstrate their capability of producing integrated system design, then oral discussion will be followed.										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab	Tut	Sum	MT1	PE/ OE	SA	Final
MAM 209	Mechanical Vibrations	FRB 004	3	2	2	1	5	30	20	10	40
Course Content	Foundation of mechanical systems, mathematical models of mechanical systems, systems modeling, electromechanical systems. Explore necessary algorithms to solve equations of motion, Laplace transform, matrix method, and computer generated solutions. Dynamic response and evaluation of first and second order systems, oscillating motion with single DOF, measuring and analysis methods, damping of free motion. Isolation of vibration, vibration of two DOF, vibration of multi-degree of freedom system. Numerical methods for evaluation of natural frequency and patterns, design of frequency absorbers.										
References	• Ahmed A. Shabana, "Theory of Vibration, An Introduction", Springer, 3rd edition, 2019 • Rao, S.S., and A. Weiley, “Mechanical vibrations”, 4th edition, Prentice Hall, 1995										
Laboratory	• Validation of a pendulum dynamics and estimation of gravitational acceleration. • Verification of mass-spring system and estimation of spring stiffness. • Estimation of the moment of inertia for a wheel and the damping condition. • Vibration measurement methods, Double cantilever test. • Computer-aided simulation and case studies, course project										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab	Tut	Sum	MT1	PE/ OE	SA	Final
MAM 202	Automatic Control Systems	MAM 209	3	2	2	1	5	30	20	10	40
Course Content	Introduction to feedback control systems. Modeling of dynamic systems, Laplace transform, Block diagrams, State Space. Control system characteristics: time response, steady state error, Stability. Analyze control systems using root loci - Design of feedback control systems using root locus. Polar and Nyquist plot - small gain theory - Bode plots. Linear control systems analysis in State Space. PID Controllers and Tuning. Computer simulation and case studies.										
References	• K. Ogata, 1997, "Modern control engineering", Prentice Hall. • R. C. Dorf and R. H. Bishop, "Modern Control Systems", 10th Ed., Prentice Hall, 2004. • B. C. Kuo and F. Golnaraghi, "Automatic Control Systems", 8th Ed., John Wiley & Sons Inc, 2002.										
Laboratory	• Modeling of dynamic systems using MATLAB/LabVIEW • Block diagrams Using of MATLAB / SIMULINK/LabVIEW • Modeling and Control of liquid level system • Modeling and Control of DC motor • Controller design of inverted pendulum • Modeling and Control of liquid level system										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab	Tut	Sum	MT1	PE/ OE	SA	Final
MAM 309	Technical Reports	-	1	0	2	0	2	30	20	10	40
Course Content	The student is assigned a practical problem to study and write a though report covering all its aspects. He is expected to do one or all the following: gather information, collect data, review literature, analyze or test in pursue of reliable results and solutions.										
Laboratory	Practical and Simulation experiment and data collection and writing concluding results with illustrative drawings in well-organized technical report.										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab	Tut	Sum	MT1	PE/OE	SA	Final
MAM 203	Dynamic Modeling and Simulation	FRB 101	3	2	1	2	5	30	20	10	40
Course Content	Introduction to systems: system, classification of systems, multi-domain engineering systems, linear versus non-linear systems, time-varying versus time-invariant systems, lumped versus distributed parameter systems, continuous-time versus discrete-time systems, deterministic versus stochastic systems, time-driven versus event-driven systems. Systems modeling: need of system modeling, modeling techniques and methods, classification of models (mechanical, electrical, thermal, fluidic, etc.), mathematical modeling. Simulation: introduction, advantages of simulation, applications of simulation, simulation techniques, numerical methods of simulation, characteristics of numerical models, discrete-event modeling and simulation, Hardware In the Loop simulation (HIL). Case studies for modeling and simulation of mechatronic systems, such as: physical subsystems (motor, mass-spring-damper system, etc.), longitudinal control of an aircraft, submarine depth control system, pilot ejection control system.										
References	• KLUEVER, C. A. (2015). Dynamic systems: modeling, simulation, and control.										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab	Tut	Sum	MT1	PE/OE	SA	Final
MAM 204	Introduction to Mechatronics	MAE 102	3	2	2	0	4	30	20	10	40
Course Content	Mechatronics fundamentals, Electrical actuation systems, Digital logic, combinational and sequential logic circuits. Microprocessors & Microcontrollers. System performance, System Interfacing, Instrumentation, and Control Systems, Sensor technology (Proximity switches, Photoelectric sensors, Fiber optic sensors), signal acquisition, filtering, and conditioning – Device communications, Computer simulation and Practical training, Case studies and Applications.										
References	• Robert H. Bishop, 2010, “Mechatronics: An Introduction”, CRC Press. • David, G. and Michael, B., Introduction to Mechatronics and Measurement Systems, McGraw Hill, 2003.										
Laboratory	• Control, drives and real-time interaction with mechatronic system • Transducer calibration system for certain application • Sensors for condition monitoring • Transistor Operation, Passive filters, and an Op Amp circuit experiment. • Stepper Motor Motion Control • Barcode reader • DC Motor Speed Control Using PWM										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab	Tut	Sum	MT1	PE/ OE	SA	Final
MAE 206	Logic Circuits Design & Applications	MAE 102	3	2	2	0	4	30	20	10	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	MT1	PE/ OE	SA	Final
MAM 208	Industrial Robots	MAM 103	3	2	2	0	4	30	20	10	40
Course Content	Definition of robot, areas of application, general structure of industrial robots. Geometrical Modeling of Industrial Robot Arms. Working space and working volume of industrial robots. Homogeneous Transformation Matrix (HTM), Position and Orientation of the robot arm end effector center. HTM between two adjacent links. Generalized HTMs of spatial robots. Direct Kinematic Modeling of Industrial Robot Arms. Direct kinematic position model (DKPM), direct kinematic velocity model (DKVM), robot arm Jacobian matrix, direct Kinematic acceleration Model (DKAM). Trajectory generation. Inverse Kinematic Modeling of Industrial Robot Arms. Dynamic Modeling of Industrial Robot Arms.										
References	• Megahed, S., 1993, "Principles of Robot Modelling and Simulation", John Wiley & Sons Ltd, England. • Craig, J.,2005, "Introduction to Robotics: Mechanics and Control", 3rd edition, by Addison-Wesley Publishing Company, Inc.										
Laboratory	• Computer aided analysis of kinematics of robots • Kinematic modeling of 5R articulated robot • Kinematic modeling of SCARA robot • Kinematic modeling of 6 DOFs robot • Computer aided trajectory generation between several points • Dynamic analysis of planar and spatial robots										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab	Tut	Sum	MT1	PE/ OE	SA	Final
MAM 301	Design of Mechatronic Systems	MAM 204	3	2	2	0	4	30	20	10	40
Course Content	Modeling hypothesis and mathematical models of complex mechatronics systems. Principle of operation of various sensors and transducers. Design of control strategies for vehicles and robotic systems. Adopting and designing different components of a mechatronics system. Microcontrollers and electrical components, Electromechanical actuators and control, Mechanical components and mechanisms, Programmable motion control and algorithm development, Closed loop control. Essential tools for the mechatronics system design using the V-model: MATLAB/SIMULINK, LabVIEW, PROTEUS VSM, SOLIDWORKS, etc. Case studies of various mechatronics systems. Control interface of mechatronic systems using MATLAB/LabVIEW.										
References	• Clarence W. De Silva, 2005, “Mechatronics: An integrated approach”, CRC Press, 2005. • Alciatore, D. G. and Histand, M.B., Introduction to Mechatronics and Measurement Systems, McGraw Hill,2003.										
Laboratory	• Demonstration and presentation of at least two mechatronic systems. • Performing some experiments on some basic components. • Using an ADDA card to control two types of systems through a PC, based system. • Mechatronic control in automated manufacturing • MATLAB/LabVIEW interface of mechatronic system.										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab	Tut	Sum	MT1	PE/ OE	SA	Final
MAE 303	Power Electronics	MAE 211	3	2	2	0	4	30	20	10	40
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										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab	Tut	Sum	MT1	PE/ OE	SA	Final
MAM 302	CAD/CAM	MAM 207	3	2	2	0	4	30	20	10	40
Course Content	CAD: Geometric modeling, data exchange and integration, mechanical assembly and drafting, mechanical tolerance, mechanical stress analysis. CAD/CAM: Process planning and Tool path generation, integration of CAD/CAM with the production machine. Programming for lathe, drilling and milling machines, canned cycles, subroutines, Loops, Computer assisted part programming, DNC, CNC. Group Technology: Part families, part classifications and coding systems, group technology machine. Computer Integrated Manufacturing: Types of manufacturing systems, types of CIMS, special manufacturing systems, Flexible Manufacturing Systems (FMS), Manufacturing Cells.										
References	• M.P. Groover, E.w. Zimmers, “Computer- Aided Design & Manufacturing”, Prentice-Hall, Inc, New Jersey, 1984.										
Laboratory	• Make various subroutines/program of different workpieces machining operations in CNC machine										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab	Tut	Sum	MT1	PE/ OE	SA	Final
MAE 304	Microprocessors and Microcontrollers	MAE 206	3	2	1	1	4	30	20	10	40
Course Content	Historical background - Organization & Architectural Features of Microprocessor & Micro Controllers - Instructions Set - Instruction format, addressing modes - Assembly language programming of 8085 and 8051 - Interfacing of memory devices - Data transfer techniques and I/O ports - Interfacing of keyboard and display devices; Programmable Interrupt - Interfacing of sensors, actuators, A/D & D/A Converters - Analog Signal Conditioning Circuits, Standard Interfaces – RS232, USB - Application examples.										
References	• B. Ram, "Fundamentals of Microprocessors and Microcomputers", Dhanpat Rai Publications. • A.K.Ray and K.M.Bhurchandi – “Advanced Microprocessors & Peripherals” Tata McGraw Hill. • M.A. Mazidi and J.G. Mazidi, “The 8051 Microcontroller and Embedded Systems”, Pearson Education, India.										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.							
				Lec.	Lab	Tut	Sum	MT1	PE/OE	SA	Final
MAE 405	Electric Drives	MAE 303	3	2	3	0	5	30	20	10	40
Course Content	Electric drives block diagram, criteria for selecting drive components, Dynamics of Motor-Load system, Motor-load Operating point, stability check, Operation of motors: starting, speed and braking control techniques, DC drives, AC drives, basics of industrial motor control, DC motor drives, equivalent circuit of dc motors, permanent magnet DC motors, DC servomotors, adjustable speed DC drives, industrial examples, electric traction examples, induction motor drives, slip power recovery from induction motor, variable frequency AC motor drives, injection braking of induction motors, synchronous motor drives, stepper motor drives, computer controlled drives										
References	• El-Sharkawi, M. A. (2000). Fundamentals of electric drives. Pacific Grove, CA: Brooks/Cole.										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab	Tut	Sum	MT1	PE/ OE	SA	Final
MAE 403	Programmable Logic Controllers	MAE 206	3	2	2	0	4	30	20	10	40
Course Content	Basic theory and applications of programmable logic controllers (PLCs). Processor units, numbering systems, memory organization, relay type devices, timers, counters, data manipulators, and programming. Explain the architecture and operation of industrial PLC's. Integration of PLCs with electro-mechanical systems. Develop, troubleshoot, test, and optimize PLC programs. Use of industrial data monitoring and supervision systems. Networking, building simple supervisory control and data acquisition (SCADA) system integrated with a PLC for sequential control problems.										
References	• Dag H. Hanssen, Programmable Logic Controllers: A Practical Approach to IEC 61131-3 using CoDeSys, 2015, Wiley.										
Laboratory	• Program logic functions in PLC's using both graphical and text-based languages • Use timers, counters, and shift-registers to achieve sequential functionality • Monitoring and Control of filling a tank • Case study project to solve problems encountered in industry • Examine a communication protocol used with PLC's • Hybrid boat control system										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab	Tut	Sum	MT1	PE/ OE	SA	Final
MAE 401	Artificial Intelligence	MAE 304	2	1	2	1	4	30	20	10	40
Course Content	Basics of intelligent control. Design of simple intelligent controllers. Basics of Artificial intelligence, Fuzzy set theory, Fuzzy logic, Fuzzy reasoning, Fuzzy controllers, Fuzzy PID control. Introduction to Neural networks, perception model, classification problem, multilayer networks, Feed forward networks, back propagation learning algorithms, recurrent networks, radial basis networks, neural network control. Neuro-fuzzy systems, introduction to optimization methods such as swarm optimizations and ants colony.										
References	• Y. Sin and C. Xu, Intelligent Systems: Modeling, Optimization, and Control, CRC Press, 2008 Jinkun, Liu, "Intelligent Control Design and MATLAB Simulation"										
Laboratory	• Design a fuzzy controller for the system using MATLAB/LabVIEW • Design a neural controller for simple control system using MATLAB/LabVIEW • Training a multilayer perceptron with the MATLAB/LabVIEW Neural Networks Toolbox • Investigate the performance of a neural network on the 2D XOR problem • Fuzzy model reference learning control for a tanker ship • Train Convolutional Neural Network for Regression using MATLAB/LabVIEW										

Contents of Elective Courses

Elective Courses – Mechatronics track (MAX x3x)

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab	Tut	Sum	MT1	MT2	SA	Final
MAM 331	Mobile Robots	MAM 208	3	2	0	2	4	30	20	10	40
Course Content	Introduction to mobile robots, Mobile robot hardware: locomotion, Mobile robot hardware: sensors, Mobile robot control system: hardware and software, Navigation I: localization and mapping, Navigation II: reasoning and motion planning, Wireless communication for mobile robots, Advanced topics: multiple robots' coordination. Design software structures and user interfaces for mobile robots.										
References	• Introduction to Autonomous Mobile Robots", Seigwart et al, 2004.										
Laboratory	• Select and implement planning algorithms • Design and implement a robot or autonomous system • Design navigation algorithms for a specific selection of sensors • Design and implement user interfaces • Path Planning and Navigation for Autonomous Robots										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab	Tut	Sum	MT1	MT2	SA	Final
MAE 333	Digital Control	MAM 202	3	2	0	2	4	30	20	10	40
Course Content	Introduction to digital control systems, AD/DA conversion. Conversion of linear time invariant systems from continuous-time to discrete-time. Identification of unknown systems. Design of digital controllers and filters. Sampling continuous-time systems, time-delay systems, transfer functions in z-domain, block diagram simplification, stability analysis of digital systems, transformation techniques, compensator designs, PID controllers, digital filters, state space models,controllability, observability, state feedback, output feedback, and introduction to system identification. Laboratory experiments on the course topics.										
References	• Ioan D. Landau and GianlucaZito, Digital Control Systems Design, Identification and Implementation, springer, 2006.										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab	Tut	Sum	MT1	MT2	SA	Final
MAE 335	Computer Interfacing	MAE 206	3	2	0	2	4	30	20	10	40
Course Content	Computer Interfacing: Architecture of a virtual instrument, data-flow techniques, graphical programming. Development of Virtual Instruments (VIs) using GUI, Real-time systems. Loops, charts, arrays, clusters and graphs, structures, formula nodes, local and global variables, string and file I/O. Instrument Drivers, Introduction to data acquisition on PC, Sampling fundamentals, Input/ Output techniques and buses. ADC, DAC, Digital I/O, counters and timers, DMA, Software and hardware installation, Calibration, Resolution, Data acquisition interface requirements. Common Instrument Interfaces.										
References	• Wells, L.K. and Travis, J., LabVIEW for Everyone, Prentice Hall Inc. (1996). • Sokoloft, L., Basic Concepts of LabVIEW 4, Prentice Hall Inc. (2004).										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab	Tut	Sum	MT1	MT2	SA	Final
MAM 332	Autonomous systems	MAM 208	3	2	0	2	4	30	20	10	40
Course Content	Autonomous versus automatic systems, Advanced topics in autonomous systems, including filters for localization, probabilistic map-based localization and mapping, motion planning and navigation algorithms. Design exception handling systems for autonomous systems. Select and implement planning algorithms. Knowledge-base: facts and procedures, acquisition, exploration, skill transfer, learning. Autonomous systems architecture: behavioral principles, expert systems, knowledge-bases, multi-level control concepts. Applications of autonomous systems.										
References	• Seigwart et al, 2004, Introduction to Autonomous Mobile Robots", Wiley.										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab	Tut	Sum	MT1	MT2	SA	Final
MAE 334	Micro Electromechanical Systems (MEMS)	MAM 301	3	2	0	2	4	30	20	10	40
Course Content	Introduction to Micro and Nano-Electromechanical Systems (MEMS/NEMS). Design of MEMS/NEMS; Fabrication of MEMS/NEMS; Principles of sensing and actuation in MEMS/NEMS: Electrostatic – Piezoresistive - Magnetic; Applications of MEMS/NEMS; Computer Simulations and Course Project.										
References	• Adim Maluf, Kirt Williams, 2004, "An Introduction to MEMs Engineering", Artech House										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab	Tut	Sum	MT1	MT2	SA	Final
MAM 336	Automotive Engineering	MAM 301	3	2	0	2	4	30	20	10	40
Course Content	Characteristics of Ground Vehicle, Classification of Motor Vehicle. Manual and automatic Transmission Systems, Propeller Shaft and Drive Shaft. Tires, Construction of Tire, Tire Dynamics. Types of Suspension System: Mechanical, Pneumatic and Hydraulic suspension systems. Design Analysis of Suspension System, Braking System, Steering System, introduction of hybrid cars, autonomous cars.										
References	• Abubakar, S.; Alammari, Youssef; Kaisan, M. U.; Mahroogi, Faisal O.; Narayan, S.; Sakthivel, R, 2019, " An introduction to automotive engineering", John Wiley & Sons & Scrivener Publishing.										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab	Tut	Sum	MT1	MT2	SA	Final
MAE 431	Embedded System Design	MAE 304	3	2	0	2	4	30	20	10	40
Course Content	Fundamentals of embedded system hardware and firmware. Embedded processor selection, glue logic, circuit design, circuit layout, circuit debugging, development tools, firmware architecture, firmware design, and firmware debugging. Microcontrollers family, architecture of microcontroller, wire wrapped microcontroller board. Development of embedded software using C language. The students will be able to grasp the main principles of embedded system design and understand the concept of hardware-software co-design.										
References	• Embedded systems design with the Atmel AVR microcontroller, Barrett, Steven F., and Steven Frank Barrett, Morgan & Claypool Publishers, 2010. • AVR Microcontroller and Embedded Systems, Mazidi, The. Pearson India, 2010.										
Laboratory	• Testing of microcontrollers IO pins • Generation of different signals using Microcontroller. • Microcontroller interface with sensors. • Microcontroller interface with actuators and motors (DC and servo motors) • Microcontroller interface with peripheral devices and communication. • Digital function implementation using digital blocks										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
MAM 433	Biomechatronic	MAM 301	3	Lec.	Lab	Tut	Sum	MT1	MT2	SA	Final
				2	0	2	4	30	20	10	40
Course Content	Fundamentals of embedded system hardware and firmware. Embedded processor selection, glue logic, circuit design, circuit layout, circuit debugging, development tools, firmware architecture, firmware design, and firmware debugging. Microcontrollers family, architecture of microcontroller, wire wrapped microcontroller board. Development of embedded software using C language. The students will be able to grasp the main principles of embedded system design and understand the concept of hardware-software co-design.										
References	• Embedded systems design with the Atmel AVR microcontroller, Barrett, Steven F., and Steven Frank Barrett, Morgan & Claypool Publishers, 2010. • AVR Microcontroller and Embedded Systems, Mazidi, The. Pearson India, 2010.										
Laboratory	• Testing of microcontrollers IO pins • Generation of different signals using Microcontroller. • Microcontroller interface with sensors. • Microcontroller interface with actuators and motors (DC and servo motors) • Microcontroller interface with peripheral devices and communication. • Digital function implementation using digital blocks										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
MAM 435	Autotronics	MAM 301	3	Lec.	Lab	Tut	Sum	MT1	MT2	SA	Final
				2	0	2	4	30	20	10	40
Course Content	Basics of control and electronic systems. Introduction to Autotronics, Vehicle main components and subsystems: propulsion systems, suspension systems, braking systems, steering systems, Engine starting system, fuel supply system and ignition system. Advanced vehicle systems: Anti-lock Braking system, Brake-By-Wire system, semi-active and active suspension systems, driving assistance systems, drive-By-Wire system, passive and active driving safety systems, and Steering-By-Wire systems. Electric vehicles and hybrid vehicles.										
References	• Konrad Reif, 2019, " Automotive Mechatronics: Automotive Networking, Driving Stability Systems, Electronics", Bosch Professional Automotive Information.										

Elective Courses – Automation track (MAX x4x)

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab	Tut	Sum	MT1	MT2	SA	Final
MAE 341	Industrial Automation	MAM 208	3	2	0	2	4	30	20	10	40
Course Content	Principles of integrating robots in factories, emphasizing computer numerical control (NC, CNC, DNC), computer aided design (CAD), and computer integrated manufacturing (CIM). Computer aided process planning, Process Systems and automated machinery, Automated material handling and storage systems, Simulation of automated Systems. Components of automation lines, industrial robot programming, system drivers and sensors. Construction of 3D CAD drawings of mechanical parts of automated manufacturing systems. Study of famous applications such as: Binder-Processing machine, Sagger load station, Tray handlers, Cotton classing system.										
References	• Chanchal Dey, Sunit Kumar Sen, 2020, " Industrial Automation Technologies", CRC press										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab	Tut	Sum	MT1	MT2	SA	Final
MAE 343	Machine Vision Systems	MAM 204	3	2	0	2	4	30	20	10	40
Course Content	Machine Vision Systems: Image understanding and image representation, feature extraction, segmentation, optical flow, and structure from motion. Image processing algorithms and traditional computer vision approaches. Use of image information to control a robot. Camera calibration, Artificial vision, Motion detection, Object tracking, Motion capture. Three-dimensional imaging, Epipolar geometry, Stereoscopic vision, Active range imaging, structured lighting. Visual servoing, target tracking, Mapping and robot guidance, activity monitoring, motion estimation, autonomous systems, biomedical imaging devices.										
References	• "Robotics, Vision and Control, Fundamental Algorithms in MATLAB", By Peter Corke, Springer										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab	Tut	Sum	MT1	MT2	SA	Final
MAM 345	Playware Technology	MAM 208	3	2	0	2	4	30	20	10	40
Course Content	Fundamental principles and tools for the development of entertainment and educational robotics. Adaptivity, embodied artificial intelligence, hardware and software adaptivity, modularity, distributed processing, tangible interfaces, man-machine interaction, human-robot interaction, interaction design, play and play dynamics. Integrate knowledge on play and interaction in synthesis. Design of a modular robotic playware platform. Playful interaction with voice sensing modular robots. Adaptivity and implementations of adaptivity in playware.										
References	• S. Papert. Mindstorms: children, computers, and powerful ideas. New York, NY, USA: Basic Books, Inc., 1980. • Standard Guide for Rapid Prototyping of Information Systems, ASTM, 2010.										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
MAE 342	Theory of Automata	MAM 202	3	Lec.	Lab	Tut	Sum	MT1	MT2	SA	Final
				2	0	2	4	30	20	10	40
Course Content	Fundamental concepts in automata theory and formal languages including grammar, finite automaton, regular expression, formal language, pushdown automaton. Deterministic finite automaton and nondeterminism. Minimization of automata and applications. Turing machines and (un)decidability. Form basic models of computation. Foundation of computer science, compilers, software engineering, concurrent systems. The properties of these models will be studied and various rigorous techniques for analyzing and comparing them will be discussed, by using both formalism and examples.										
References	• John E. Hopcroft, Rajeev Motwani, Jeffrey D. Ullman, 2001, "Introduction to automata theory, languages, and computation", Addison-Wesley										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
MAM 344	Sensors and Actuators	MAM 208	3	Lec.	Lab	Tut	Sum	MT1	MT2	SA	Final
				2	0	2	4	30	20	10	40
Course Content	Sensors: Sonar and Optical Sensors, Inertial Measurement Units, Temperature, Pressure, and Tactile Sensing, Body-Surface Biopotential Electrodes. Actuators: Solenoids, DC Motors, Stepper Motors, Servo Motors, Linear Actuators, Pneumatic Muscles, Shape Memory Alloys.										
References	• Clarence W. de Silva,2015, “Sensors and Actuators Engineering System Instrumentation”, Second Edition, CRC press.										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
MAM 346	Industrial Material Flow Management	MAM 301	3	Lec.	Lab	Tut	Sum	MT1	MT2	SA	Final
				2	0	2	4	30	20	10	40
Course Content	Sensors: Sonar and Optical Sensors, Inertial Measurement Units, Temperature, Pressure, and Tactile Sensing, Body-Surface Biopotential Electrodes. Actuators: Solenoids, DC Motors, Stepper Motors, Servo Motors, Linear Actuators, Pneumatic Muscles, Shape Memory Alloys.										
References	• Bernd Wagner, Stefan Enzler, 2005, "Material Flow Management: Improving Cost Efficiency and Environmental Performance", Springer Science										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab	Tut	Sum	MT1	MT2	SA	Final
MAM 441	Hydraulic Servo Control	MAM 205	3	2	0	2	4	30	20	10	40
Course Content	Fields of applications of hydraulic servo systems –Hydraulic servo systems versus proportional systems and electric servo systems – Hydraulic servo valves; types, static characteristics, valves coefficients, lapping conditions – Transient and steady state flow forces acting on spools and flappers – Pilot operated servo valves and types of feedback – Dynamic characteristics of servo valves and fluid lines – Hydro mechanical and electro-hydraulic servo systems; loop gain, stability, dynamics – Course project.										
References	• John Watton, 2009, "Fundamentals of Fluid Power Control", Cambridge University Press.										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab	Tut	Sum	MT1	MT2	SA	Final
MAE 443	Internet of Things	MAE 304	3	2	0	2	4	30	20	10	40
Course Content	Introduction to Internet of Things, physical design of IOT. Logical design of IOT, IOT enabling technologies, IOT Levels. Interconnection and integration of the physical world and the cyber space. Home automation, cities, environment, energy, retail, logistics. Agriculture, industry, Health and Lifestyle. Simple Network Management Protocol (SNMP), Limitations of SNMP, Network Operator Requirements. IOT design and Methodology. IOT Devices, exemplary device, Board, Linux on Raspberry Pi, Interfaces, and Programming & IOT Devices										
References	• Jamil Y. Khan, Mehmet R. Yuce, 2019, "Internet of things: Systems and Applications", Jenny Stanford Publishing.										

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab	Tut	Sum	MT1	MT2	SA	Final
MAM 445	Computer Numerical Control (CNC)	MAM 302	3	2	0	2	4	30	20	10	40
Course Content	Numerical Theory – Control Units of Me anical Systems – Control of Manufacturing processes – Sensing Elements – Programming Languages of Numerical Control Machines – Programming Applications in Manufacturing – Computer Control in Manufacturing Machines – CAM software e.g. Artcam - CNC-PLC integration and communication										
References	• Peter Smid, "CNC Programming Handbook", Third Edition, Industrial press inc. • Michael Fitzpatrick, Keith Smith, "Machining and CNC Technology" 4th Edition, Mc Graw Hill.										