جـــــــــامـــعة بنـــهـا

كـــــلية الهندســـــــة ببنـــــــها

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


وقل
رب زدني علما

أولا: مقدمة

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

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

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

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

الرؤية والرسالة وأوجه التميز

أ. الرؤية

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

ب. الرسالة

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

ت. أوجه التميز في هذه الخطة

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

1 ـ برامج دراسية حديثة تتوافق مع احتياجات سوق العمل.

2 ـ محتوى علمى يركز على الجوانب الهندسية والتطبيقية.

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

4 ـ التركيز على استخدام تطبيقات الحاسب الآلى فى الهندسة.

5 ـ إثراء الطالب باللغة الأجنبية الفنية.

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

تطور إنشاء الكلية وأقسامها العلمية

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

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

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

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

وتضم الكلية الأقسام العلمية التالية :

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

النظرة المستقبلية

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

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

الأهداف الأستراتيجية للكلية

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

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

ثانيا: الأحكام العامة و الانتقالية و مواد اللائحة

مادة (1) أحكام عامة

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

مادة (2) أحكام إنتقالية

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

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

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

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

مادة (3) منح الدرجات العلمية

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

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

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

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

1- بكالوريوس العلوم في الهندسة الميكانيكية

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

2- بكالوريوس العلوم في الهندسة الكهربية

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

3- بكالوريوس العلوم في الهندسة المدنية

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

4- بكالوريوس العلوم في الهندسة المعمارية

- برنامج الهندسة المعمارية.

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

مادة(4) الأقسام العلمية

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

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

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

تقع مسؤولية القسم العلمي كالتالي:

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

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

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

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

3. قسم الهندسة الكهربية:

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

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

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

ثالثا: لائحة الدراسة بنظام الساعات المعتمدة

مادة(5) نظام الدراسة بالبرامج الأكاديمية

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

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

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

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

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

مادة(7) رئيس القسم العلمى

يقوم رئيس القسم العلمى بالمهام التالية:

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

10- الإشراف على عملية معادلة المقررات الدراسية في القسم.

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

مادة (8) منسق البرنامج

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

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

ويقوم منسق البرنامج بالمهام التالية :

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

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

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

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

9- عرض خطة المقررات في بداية كل فصل دراسي.

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

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

12- متابعة انتظام العملية التعليمية والجداول الدراسية.

13- .تطبيق نظم ولوائح الجودة والتقويم والاعتماد الأكاديمي .

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

مادة (9) لجنة شئون الطلاب

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

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

2- تنظيم التدريب العملي للطلاب.

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

4- تنظيم المكافأت و المنح الدراسية.

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

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

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

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

مادة (10) المنسق العام للتحول الرقمي بالبرامج

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

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

مادة (11) مجلس إدارة البرامج

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

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

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

مادة (12) إجراءات إضافة / تجميد البرامج

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

مادة (13) شروط القيد ومتطلبات الإلتحاق

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

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

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

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

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

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

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

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

مادة (16) قواعد التحويل من الجامعات الأخرى

يتم تقديم طلبات التحويل من جامعات أخرى طبقا للشروط التالية :

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

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

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

مادة (17) الدراسة فى جامعات اخرى

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

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

مادة (18) متطلبات الحصول على الدرجة

يشترط لحصول الطالب على درجة بكالوريوس العلوم في الهندسة:

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

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

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

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

جدول (4) توزيع المقررات الدراسية داخل البرنامج

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

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

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

مادة (19) مدة الدراسة

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

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

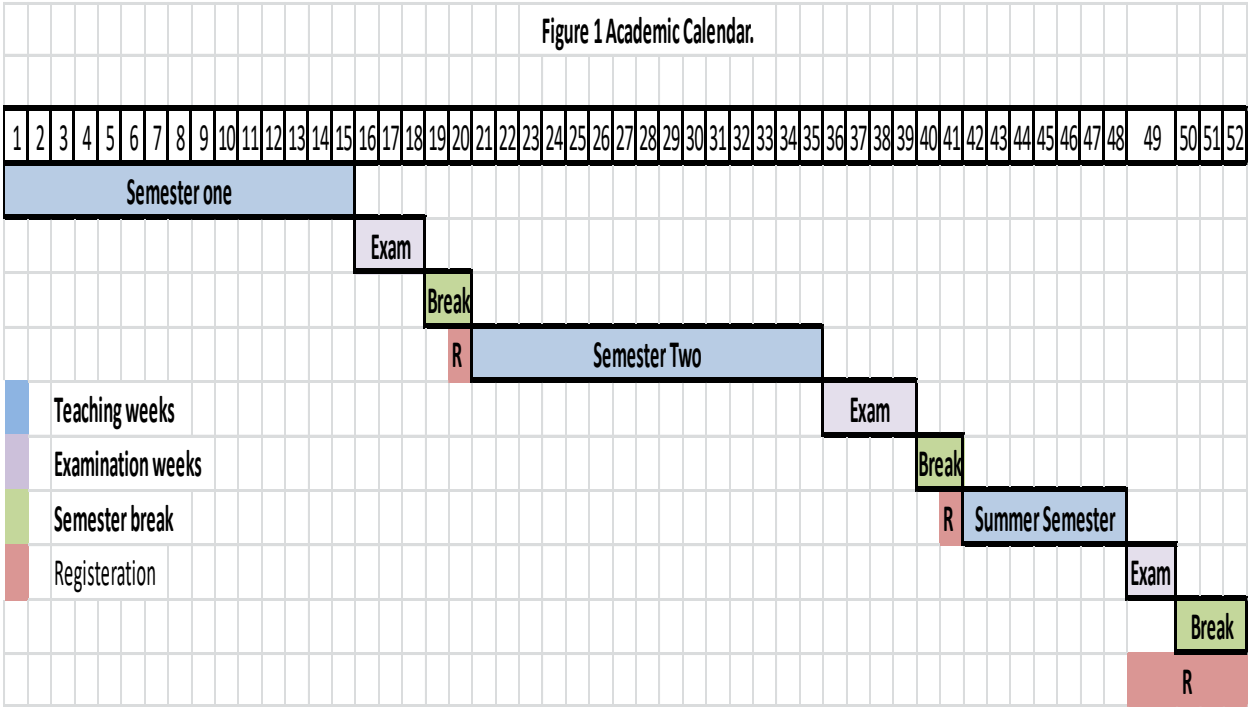
مادة(20) مواعيد الدراسة

تنقسم السنة الأكاديمية إلى ثلاثة فصول كالتالى:

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

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

Figure 1 Academic Calendar.



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

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

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

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

مادة (22) طرق التدريس والوسائل التعليمية

تعتمد الكلية على طرق التدريس التقليدية والحديثة على النحو التالى:

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

مادة (23) قواعد الإنتظام فى الدراسة

الطلاب المسجلين بالبرامج عليهم الالتزام بالقواعد التالية:

(1) سداد الرسوم الدراسية

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

(2) انتظام الحضور

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

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

(3) إيقاف قيد الطالب

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

(4) تغيير عنوان الطالب

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

مادة (24) الفصل من الدراسة والإنذار الأكاديمى

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

مادة (25) شروط تسجيل المقررات الدراسية

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

مادة (26) مستويات الدراسة

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

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

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

مادة (27) التدريب الميداني

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

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

مادة(28) إضافة وحذف المقررات الدراسية

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

مادة(29) الانسحاب من المقررات الدراسية

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

مادة(30) المقررات الدراسية غير المكتملة

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

مادة(31) إعادة المقررات الدراسية

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

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

مادة(32) الامتحانات والتقييم للمقررات الدراسية

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

جدول رقم (6) توزيع درجات المقرر للبرامج التخصصية

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

جدول رقم (7) توزيع درجات المقرر للبرامج متعددة التخصصات

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

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

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

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

مادة(33) تقديرات المقررات الدراسية

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

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

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

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

مادة (34) المرشد الأكاديمى

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

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

مادة (35) حساب المعدل التراكمى (GPA)

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

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

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

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

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

مادة (36) مرتبة الشرف لطلبة البكالوريوس

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

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

مادة (37) تكليف خريجى البرامج فى وظيفة معيد

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

جدول رقم (9) تقدير المقررات وعدد النقاط المناظر

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

مادة (38) الإدارة الإلكترونية

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

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

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

رابعا: تفاصيل البرامج المقدمة

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

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

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

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

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

جدول (10) تقسيم الساعات المعتمدة بين المتطلبات الأربعة.

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

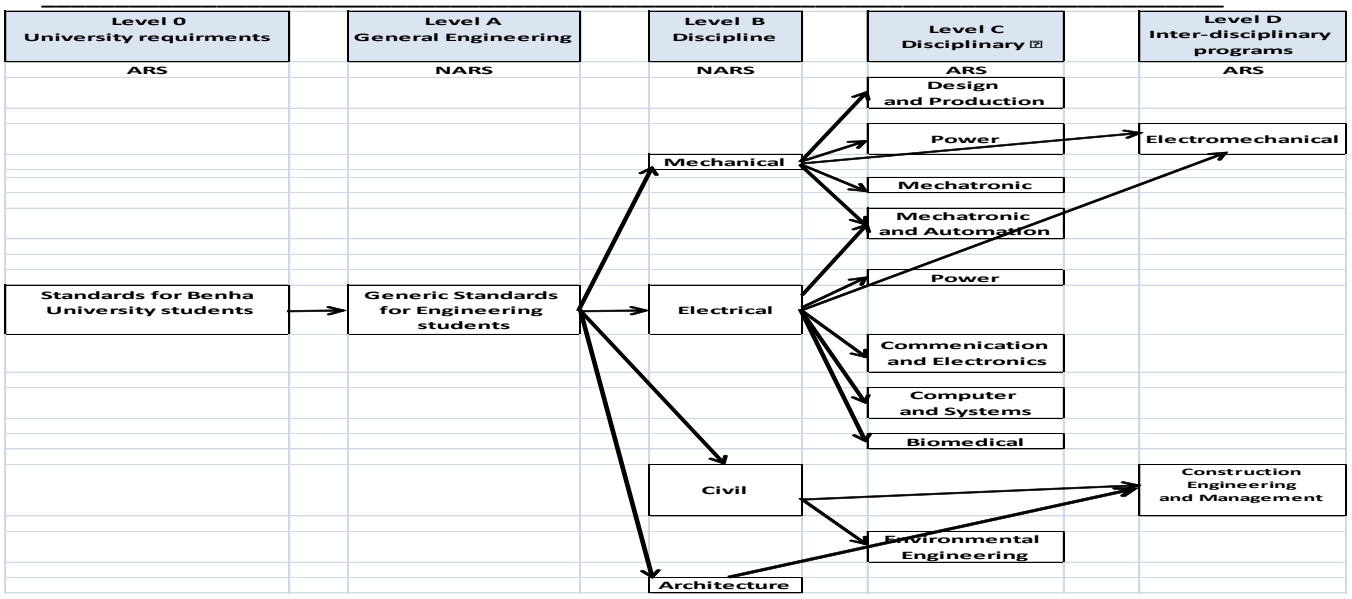


Figure 2 Different Levels of Competencies as per NARS 2018, as published by NAQAAE

ملخص البرامج الدراسية:

Table 11 List of overall data about the programs.

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

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

Checklist for each program:

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

متطلبات الجامعة

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

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

جدول (11) قائمة مقررات متطلبات الجامعة

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

Table 11 List of University Requirements Courses

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

جدول (12) قائمة المقررات الإختيارية لمتطلبات الجامعة

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

Table 12 List of Humanities Elective Courses

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

University Requirements Compulsory Courses

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

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

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

Code	Course Title	Pre-req.	CH	Ct. Hr.				Assessment			
				Lec.	Lab.	Tut.	Sum	SA	MT	PE/ OE	Final
UHS 104	Professional Ethics	-	2	2	-	-	2	30%	30%	-	40%
Course Contents	يقدم المقرر الخلفية اللازمة لمناقشة المواضيع الأساسية للأخلاقيات المهنية مع التركيز على الموضوعات الأخلاقية التي تواجه الخريجيين في مجال العمل. ويحتوي المقرر على التعريف بالمقومات العامة لأخلاقيات المهنة ومراعاة المصلحة العامة واللوائح والانظمة، الالتزامات تجاه المجتمع والحقوق والواجبات مع دراسة أمثلة من مجال عمل الخريج في كل كلية. The course offers the background necessary to discuss the core issues of professional ethics facing graduates in their field of work. The course contains the definition of the general ingredients of professional ethics, and taking into account the public interest, rules and regulations, obligation towards society, rights and duties, with a study of example from the graduate's field of work in each college.										
References	John Rowan & Samuel Zinaich, Jnr., "Ethics for the Professions", 1st edition, 2002, ISBN-13 : 978-0155069992										

University Requirements Elective Courses

Code	Course Title	Pre-req	CH	Ct. Hr.				Assessment			
				Lec.	Lab	Tut	Sum	SA	MT	PE/O E	Final
UHS 201	Principles of Entrepreneurship and Project Management	-	2	2	-	-	2	30	30	-	40
Course Content	مفاهيم في ريادة الأعمال، ريادة الأعمال والمنشآت الصغيرة، توليد الأفكار للمشاريع الريادية، الجامعة وريادة الأعمال فرص وتحديات، الخطة التسويقية، الخطة التشغيلية، الخطة المالية، كتابة خطة العمل، البيئة التكنولوجية للمشروع الريادي، بيئة الاعمال الخارجية للمشروعات الريادية، برامج دعم المشاريع الرائدة في الاقتصاد المصري، مهارات عرض المشروع الريادي، مقدمة في إدارة المشروعات، الهيكل التنظيمي للمشروعات، تقييم النجاح، التخطيط، قراءة البيانات، مخطط الشبكات، تحليل المسار الحرج للشبكات، تخصيص المصادر والقيود، إدارة التكلفة، إدارة المخاطر، قياس ومراقبة أداء المشروعات. Concepts in entrepreneurship – entrepreneurship and small enterprises – Idea generation of entrepreneurial projects – The university and entrepreneurship opportunities and challenges – Marketing plan – operational plan – financial plan – Writing the business plan – The technological environment for entrepreneurship projects – External business environment for pioneering projects – Egyptian economy programs to support leading projects – entrepreneurial project presentation skills – Introduction to project management – The organizational structure – Success assessment – Planning – data reading – network planning – critical path analysis of networks – resource allocation and constraints – cost management – risk management – measurement and control of project performance.										
References	• Alexander Osterwalder, Yves Pigneur, "Business model generation: A handbook for visionaries, game changers, and challengers", 1st edition, 2010, ISBN-13 : 978-0470876411 • Eric Ries, "The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses", 1st edition, 2011, ISBN-13 : 978-0307887894 • https://designthinking.ideo.com/										

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

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

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

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

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

Faculty Requirements for Desplinary Programs ***متطلبات الكلية***

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

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

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

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

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

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

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

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

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

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

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

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

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

Table 12 List of Faculty requirements courses.

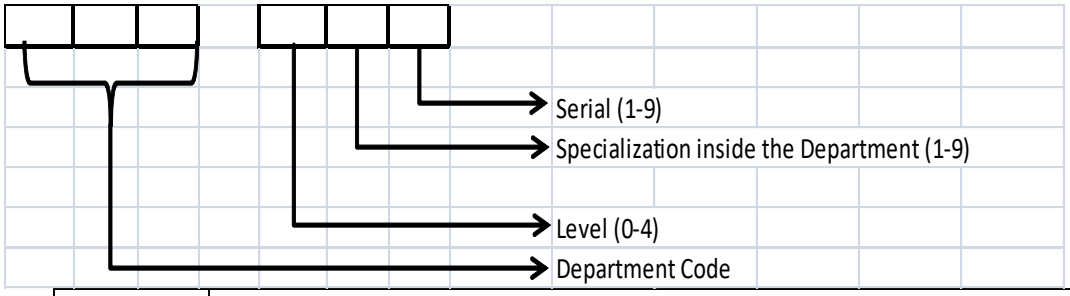
Code	Course	Pre-requisites	Cr. Hrs.	Ct. Hr.			
				Lec	Lab	Tut	Sum
BES 011	Mathematics I	-----	3	2	0	2	4
BES 021	Mechanics I	-----	3	2	0	2	4
BES 031	Physics I	-----	3	2	2	1	5
BES 041	General Chemistry	-----	4	3	2	1	6
MEC 011	Engineering Graphics	-----	2	0	0	4	4
BES 012	Mathematics II	BES 011	3	2	0	2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

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

Faculty Requirement Courses

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

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



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

The following abbreviations are the legend for the courses:

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Programs Requirements

According to the National Academic Reference Standards (NARS-2018), each discipline graduate (Mechanical – Electrical – Civil – Architectural), has to meet specific Competencies.

Part A: Disciplinary programmes

Program # 1 Mechanical Design and Production Engineering Program

Program Description

The Design & Production Engineering program is one of the oldest engineering programs in Egypt. The program progressed with the growth in Egyptian industry during the sixties of the twentieth century. Recently, there has been an increasing need for the modernization of industry in Egypt to carry on with the global challenges of designing and fabricating cost-effective products that can compete with the international market. Consequently, the Design & Production Engineering program needs to be modernized as well. The program developed at Benha Faculty of Engineering - Benha University equips students with necessary competencies contemporary with the current industry. It also inspires graduates for self-learning to cope with the requirements of the ever-changing career path after their graduation.

The program offers a bachelor's degree in Mechanical Engineering where students can choose one of three tracks to specialize in. The three tracks offered are Product Design, Manufacturing &Materials, and Industrial & Management Engineering.

Basic Information

Program Mission

The Mechanical Design and Production Engineering Program aims to prepare an outstanding engineer to apply scientific methods to daily practical problems. The program deepens students' knowledge in mechanics, design, manufacturing processes, and material science. Graduates of this program are distinguished by their creativity, innovation, and scientific research, and they add a clear contribution to their industrial environment.

Program Objectives

The objectives of the B.Sc. in Mechanical Design and Production Engineering program are to enable its graduates 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 a real-life situation.

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. 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. Participate as leaders in addressing the social, economic, and environmental issues involved in mechanical design, material science, and manufacturing technologies.

PO7. Stimulate the graduate's scientific curiosity and passion for continuous research to participate in the evolution of the promising design and manufacturing of new and robust engineering innovative products with contemporary technology.

Graduate Attributes

By the completion of the MDP program of study, and according to NARS 2018, the graduate will be capable 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 critically and creatively.

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

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

GA11. Handle professionally different engineering processes, including materials selection, design, analysis, synthesis, modern and classical fabrication techniques, nanotechnology, and experimental techniques.

GA12. Demonstrate the ability to design, develop, implement, and improve integrated systems, including people, materials, information, equipment, and energy.

GA13. Comprehend and handle the integration of management systems based on various industrial standards.

Program Learning Outcomes

The program courses fulfill the NARS 2018

Level A: The Engineering Graduate must be able to:

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

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

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

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

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

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

Level B: The Engineering Graduate must be able to:

In addition to the Competencies for All Engineering Programs, the BASIC MECHANICAL Engineering graduate and similar programs must be able to:

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 mechanical systems and machine elements designs using appropriate materials, both traditional means and computer-aided tools and software contemporary to the mechanical engineering field.
PLO13. Select conventional mechanical equipment according to the required performance.
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.

Level C: The Engineering Graduate must be able to:

In addition to competencies for all engineering programs (Level A, NARS 2018), and Mechanical Engineering competencies (Level B, NARS 2018), Design & Production engineer must be able to:

PLO15. Implement new technologies in manufacturing to select suitable processes and their variables for specific products.
PLO16. Design machines, tools, and products with industrial standards and develop the necessary calculations, construction, and working drawings.
PLO17. Implement basics of industrial engineering to analyze, plan and design production systems.
PLO18. Demonstrate additional abilities to model, analyze, and design mechanical components and systems using advanced tools of integrated systems.
PLO19. Demonstrate additional abilities to select, prepare, analyze, treat, and test materials for specific applications.
PLO20. Demonstrate additional abilities to analyze, design, integrate, operate, evaluate, control, automate, and implement methods and techniques to manage industrial systems.

Benchmark:

Benha University	**Oregon State University** (https://mime.oregonstate.edu/student-outcomes-manufacturing-engineering-program)
PLO15. Implement new technologies in manufacturing to select suitable processes and their variables for specific products.	Ability to measure manufacturing process variables and develop technical inferences about the process.
PLO16. Design machines, tools, and products with industrial standards and develop the necessary calculations, construction and working drawings.	An ability to design products and the equipment, tooling, and environment necessary for their manufacture.

PLO17. Implement basics of industrial engineering to analyze, plan and design production systems.	An ability to develop and conduct appropriate experimentation, analyze, and interpret data, and use engineering judgment to draw conclusions.
PLO18: Demonstrate additional abilities to model, analyze, and design mechanical components and systems using advanced tools of integrated systems.	An ability to design products and the equipment, tooling, and environment necessary for their manufacture.
PLO19: Demonstrate additional abilities to select, prepare, analyze, treat, and test materials for specific applications.	An ability to design manufacturing processes that result in products that meet specific material and other requirements.
PLO20: Demonstrate additional abilities to analyze, design, integrate, operate, evaluate, control, automate, and implement methods and techniques to manage industrial systems.	An ability to analyze, synthesize, and control manufacturing operations using statistical methods. An ability to create competitive advantage through manufacturing planning, strategy, quality, and control.

Faculty Mission vs. Program Mission Matrix

Faculty Mission		Program Mission		
		The Mechanical Design and Production Engineering Program aims to prepare an outstanding engineer to apply scientific methods to daily practical problems. The program deepens students' knowledge in mechanics, design, manufacturing processes, and material science. Graduates of this program are distinguished by their creativity, innovation, and scientific research, and they add a clear contribution to their industrial environment.		
		Prepare an outstanding engineer to apply scientific methods to daily practical problems.	Deepens students' knowledge in mechanics, design, manufacturing processes, and material science.	contribution to their industrial environment.
Benha University is committed to graduate well prepared engineers equipped with knowledge and skills necessary to compete in labor market, and capable of using and developing modern technology, and providing research in engineering fields to serve society and community.	Graduate well prepared engineers equipped with knowledge and skills	√		
	Compete in labor market capable of using and developing modern technology, and providing research in engineering fields		√	
	Serve society and community.			√

Program Mission vs. Program Objectives Matrix

Program Mission		Program Objectives						
		PO1	PO2	PO3	PO4	PO5	PO6	PO7
The Mechanical Design and Production Engineering Program aims to prepare an outstanding engineer to apply scientific methods to daily practical problems. The program deepens students' knowledge in mechanics, design, manufacturing processes, and material science. Graduates of this program are distinguished by their creativity, innovation, and scientific research, and they add a clear contribution to their industrial environment.	Prepare an outstanding engineer to apply scientific methods to daily practical problems.	√	√	√	√			
	Deepens students' knowledge in mechanics, design, manufacturing processes, and material science.					√	√	√
	contribution to their industrial environment.					√	√	√

Program Learning Outcomes vs. Program Objectives Matrix

Program Objectives	Program Competencies																			
	Level A										Level B				Level C					
	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	B1	B2	B3	B4	C1	C2	C3	C4	C5	C6
PO1	√	√	√								√	√	√	√	√	√				
PO2				√	√	√	√	√												
PO3					√	√	√	√	√											
PO4				√				√		√	√	√	√	√	√	√				
PO5													√	√	√	√	√	√	√	√
PO6															√	√	√	√	√	√
PO7															√	√	√	√	√	√

Program Objectives vs. Graduate Attributes Matrix

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

Career Prospects

Design & Production Engineering is one of the most recognized disciplines in Egyptian industry. Design & Production engineers are needed in many industries intending to design and manufacture various products, machines and equipment. Graduates well serve in all industrial sectors, including metallurgical, petrochemical, textiles, furniture, etc. They can work as engineers in research and development, operations' management, quality control, tool design, work study, cost analysis, process control, heat treatment, etc. Graduates can be specialized in a specific field of the following concentrations: Manufacturing engineering, Mechanical design, Industrial engineering and operations' management, or Material engineering.

Program Concentrations

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

1. Product Design
2. Manufacturing & Materials Engineering
3. Industrial & Management Engineering

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

List of Design and Production Engineering Requirement Courses

Requirement	Cr. Hr.	Ct. Hr.			
		Lec.	Lab	Tut	Sum
Benha University Requirements	14	14	0	0	14
Benha Faculty of Engineering Requirements	32	21	33	46	50
Discipline Requirements	66	42	38	22	102
Major Mechanical Design & Production Program Requirements	30	17	25	3	45
Concentration of Product Design Requirements	18	12	0	12	24
Concentration of Manufacturing & Materials Requirements					
Concentration of Industrial & Management Requirements					
Total	160	106	96	83	235

Basic Science Requirements of Mechanical Design and Production Engineering

Code	Course Title	Pre-Req	Cr. Hr.	Ct. Hr.			
				Lec	Lab	Tut	Sum
BES 011	Mathematics I		3	2	0	2	4
BES 041	General Chemistry		4	3	2	1	6
BES 031	Physics I		3	2	2	1	5
BES 012	Mathematics II	BES 011	3	2	0	2	4
BES 032	Physics II		3	2	2	1	5
BES 111	Differential Equations	BES 012	3	2	0	2	4
BES 112	Numerical Analysis	BES 111	3	2	2	0	4
BES 113	Mathematics III	BES 012	3	2	0	2	4
*BES 141	Pollution and Industrial Safety	BES 041	2	2	1	0	3
BES 211	Engineering Statistics and Probability	BES 012	3	2	2	0	4
Total			**30**	**21**	**11**	**11**	**43**

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

** One credit hour from the Program courses (MEC314) has been encountered to the basic science courses. The total hours of basic sciences are 30 Hours.

Discipline Requirements of Mechanical Design and Production Engineering

Code	Course Title	Pre-Req	Cr. Hr.	Ct. Hr.			
				Lec.	Lab.	Tut.	Sum
BES 111	Differential Equations	BES 012	3	2	0	2	4
BES 112	Numerical Analysis	BES 111	3	2	2	0	4
BES 113	Mathematics III	BES 012	3	2	0	2	4
BES 211	Engineering Statistics and Probability		2	2	1	1	4
MEC 121	Fluid Mechanics	BES 031	3	2	2	1	5
MEC 111	Kinematics of Machines	BES 022	3	2	1	2	5
MEC 113	Mechanics and Testing of Materials	MEC 012	3	2	2	1	5
MEC 123	Materials Science and Engineering	BES 032	3	2	2	0	4
ELE 103	Electrical Circuits	BES 032	2	1	0	2	3
MEC 131	Computer Applications	ELE 042	2	1	2	0	3
MEC 122	Thermodynamics	BES 031	3	2	1	2	5
MEC 112	Design of Machine Elements	MEC 113	3	2	3	0	5
MEC 114	Measurement and Instrumentation	BES 032	2	1	2	1	4
MEC 116	Manufacturing Technology	MEC 012	2	1	3	0	4
ELE 104	Electronic Devices and Circuits	ELE 103	2	1	0	2	3
MEC 211	Project Management	BES 012	3	2	2	0	4
MEC 221	Heat Transfer	MEC 122	3	2	1	2	5
MEC 223	Fluid Power Systems	MEC 121	2	1	3	0	4
MEC 215	Mechanical Design	MEC 113	3	2	3	0	5
MEC 213	Mechanical Vibrations	BES 022	3	2	2	1	5
ELE 201	Electric Machinery	ELE 103	2	1	2	0	3
MEC 214	Automatic Control Systems	MEC 213	3	2	2	1	5
MEC 312	Engineering Economics		2	2	0	1	3
MEC 314	Advanced Topics in Control Engineering	MEC 314	3	2	2	0	4
MEC 301	Technical Reports		2	1	2	0	3
Total			**66**	**42**	**38**	**22**	**103**

*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 Mechanical Design and Production Engineering

Code	Course Title	Pre-Req	Cr. Hr.	Ct. Hr.			
				Lec	Lab	Tut	Sum
MEC 212	Metal Cutting Processes	MEC 012	3	2	2	0	4
MEC 216	Computer Aided Design	MEC 112	3	2	2	0	4
MEC 218	Material Engineering	MEC 123	3	2	2	0	4
MEC 311	Advanced Machining Processes	MEC 214	3	2	2	0	4
MEC 313	Computer-Aided Manufacturing	MEC 212	3	2	2	0	4
MEC 31x1	Elective I		3	2	0	2	4
MEC 31x2	Elective II		3	2	0	2	4
MEC 416	Operations Research	MEC 311	3	2	2	0	4
MEC 316	Operations Researches	MEC 211	3	2	0	2	4
MEC 31x3	Elective III		3	2	0	2	4
MEC 31x4	Elective IV		3	2	0	2	4
MEC 411	Materials Handling	MEC 313	3	2	3	0	5
MEC 413	Production Aids Design	MEC 216	3	2	2	0	4
MEC 415	Machine Tool Design	MEC 311	2	1	2	0	3
MEC 43x5	Elective V		3	2	0	2	4
MEC 43x6	Elective VI		3	2	0	2	4
MEC 302	Senior Design Project I		2	2	0	0	2
MEC 401	Senior Design Project II	MEC 302	3	0	6	0	6
Total			**48**	**29**	**25**	**15**	**69**

* Elective courses are selected from three concentrations (x, y, and z)

Concentration Requirements of Product Design Engineering (concentration "x")

Code	Course Title	Pre-Req	Cr. Hr.	Ct. Hr.			
				Lec	Lab	Tut	Sum
Pool Courses for Elective I, Elective II							
MEC 31x1	Finite Element Analysis	MEC 216	3	2	0	2	4
MEC 31x2	Product Design & Development	MEC 215	3	2	0	2	4
Pool Courses for Elective III, Elective IV							
MEC 31x3	Failure Analysis	MEC 31x1 MEC 31x2	3	2	0	2	4
MEC 31x4	Design of Experiments	MEC 31x1 MEC 31x2	3	2	0	2	4
MEC 31x5	Tribology	MEC 31x1 MEC 31x2	3	2	0	2	4
Pool Courses for Elective V, Elective VI							
MEC 41x6	Special Topics in Mechanical Design	MEC 31x1 MEC 31x2	3	2	0	2	4
MEC 41x7	Pressure Vessels and Piping	MEC 31x1 MEC 31x2	3	2	0	2	4
MEC 41x8	Ergonomics and Human Factor	MEC 31x1 MEC 31x2	3	2	0	2	4
MEC 41x9	Computer Integrated Manufacturing	MEC 31x1 MEC 31x2	3	2	0	2	4
MEC 41x10	Process Control with applications	MEC 31x1	3	2	0	2	4

		MEC 31x2					
MEC 41x11	Sheet Metal processes and design	MEC 31x1 MEC 31x2	3	2	0	2	4
MEC 41x12	Material selection in Design	MEC 31x1 MEC 31x2	3	2	0	2	4
MEC 41x13	Design for Manufacture	MEC 31x1 MEC 31x2	3	2	0	2	4
MEC 41x14	Mechanism Design	MEC 31x1 MEC 31x2	3	2	0	2	4
MEC 41x15	Advanced Hydraulic and pneumatic control	MEC 31x1 MEC 31x2	3	2	0	2	4

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

Concentration Requirements of Manufacturing & Materials Engineering (concentration "y")

Code	Course Title	Pre-Req	Cr. Hr.	Ct. Hr.			
				Lec	Lab	Tut	Sum
Pool Courses for Elective I, Elective II							
MEC 31y1	Advanced Composite Materials	MEC 218	3	2	0	2	4
MEC 31y2	Manufacturing Systems	MEC 214	3	2	0	2	4
Pool Courses for Elective III, Elective IV							
MEC 31y3	Process Control with applications	MEC 31y1 MEC 31y2	3	2	0	2	4
MEC 31y4	Welding Technology	MEC 31y1 MEC 31y2	3	2	0	2	4
MEC 31y5	Casting Processes	MEC 31y1 MEC 31y2	3	2	0	2	4
Pool Courses for Elective V, Elective VI							
MEC 41y6	Powder Metallurgy	MEC 31y1 MEC 31y2	3	2	0	2	4
MEC 41y7	Polymers Engineering & Manufacturing	MEC 31y1 MEC 31y2	3	2	0	2	4
MEC 41y8	Special Topics in Materials Engineering	MEC 31y1 MEC 31y2	3	2	0	2	4
MEC 41y9	Computer Integrated Manufacturing	MEC 31y1 MEC 31y2	3	2	0	2	4
MEC 41y10	Special Topics in Manufacturing	MEC 31y1 MEC 31y2	3	2	0	2	4
MEC 41y11	Design for Manufacture	MEC 31y1 MEC 31y2	3	2	0	2	4
MEC 41y12	Sheet Metal processes	MEC 31y1 MEC 31y2	3	2	0	2	4
MEC 41y13	Design of Experiments	MEC 31y1 MEC 31y2	3	2	0	2	4
MEC 41y14	Ergonomics and Human Factor	MEC 31y1 MEC 31y2	3	2	0	2	4
MEC 41y15	Industrial Information systems	MEC 31y1 MEC 31y2	3	2	0	2	4

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

Concentration Requirements of Industrial & Management Engineering (concentration "z")

Code	Course Title	Pre-Req	Cr. Hr.	Ct. Hr.			
				Lec	Lab	Tut	Sum
Pool Courses for Elective I, Elective II							
MEC 31z1	Industrial Automation	MEC 214	3	2	0	2	4
MEC 31z2	Motion and Time Study	MEC 214	3	2	0	2	4
Pool Courses for Elective III, Elective IV							
MEC 31z3	Quality Control	MEC 31z1 MEC 31z2	3	2	0	2	4
MEC 31z4	Lean Manufacturing Systems	MEC 31z1 MEC 31z2	3	2	0	2	4
MEC 31z5	Industrial Market analysis	MEC 31z1 MEC 31z2	3	2	0	2	4
Pool Courses for Elective V, Elective VI							
MEC 41z6	Advanced Operations Research	MEC 31z1 MEC 31z2	3	2	0	2	4
MEC 41z7	Total Quality Management	MEC 31z1 MEC 31z2	3	2	0	2	4
MEC 41z8	Work & Work System	MEC 31z1 MEC 31z2	3	2	0	2	4
MEC 41z9	Computer Integrated Manufacturing	MEC 31z1 MEC 31z2	3	2	0	2	4
MEC 41z10	Process Control with applications	MEC 31z1 MEC 31z2	3	2	0	2	4
MEC 41z11	Special Topics in Industrial Engineering	MEC 31z1 MEC 31z2	3	2	0	2	4
MEC 41z12	Facilities Planning and Design	MEC 31z1 MEC 31z2	3	2	0	2	4
MEC 41z13	Ergonomics and Human Factor	MEC 31z1 MEC 31z2	3	2	0	2	4
MEC 41z14	Design of Experiments	MEC 31z1 MEC 31z2	3	2	0	2	4
MEC 41z15	Financial and accounting Management	MEC 31z1 MEC 31z2	3	2	0	2	4

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

Proposed Study Plan for Mechanical Design and Production Engineering

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

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

Level 1- 1													
Code	Course Title	Pre-Req	Cr. Hr.	Ct. Hr.				Final Exam Time HR.	Assessment				
				Lec	Lab	Tut	Sum		SA	MT	PE/ OE	Final Exam	Sum
BES 111	Differential Equations	BES 012	3	2	0	2	4	2	30	30	-	40	100
MEC 121	Fluid Mechanics	BES 031	3	2	2	1	5	2	10	30	20	40	100
MEC 111	Kinematics of Machines	BES 022	3	2	0	2	4	2	30	30	-	40	100
MEC 113	Mechanics and Testing of Materials	MEC 012	3	2	2	1	5	2	10	30	20	40	100
MEC 123	Materials Science and Engineering	BES 032	3	2	2	0	4	2	10	30	20	40	100
ELE 103	Electrical Circuits	BES 032	2	1	0	2	3	2	30	30	-	40	100
MEC 131	Computer Applications	ELE 042	2	1	2	0	3	2	10	30	20	40	100
Total			19										700

Level 1- 2													
Code	Course Title	Pre-Req	Cr. Hr.	Ct. Hr.				Final Exam Time HR.	Assessment				
				Lec	Lab	Tut	Sum		SA	MT	PE/ OE	Final Exam	Sum
BES 113	Mathematics III	BES 012	3	2	0	2	4	2	30	30	-	40	100
MEC 122	Thermodynamics	BES 031	3	2	1	2	5	2	10	30	20	40	100
MEC 112	Design of Machine Elements	MEC 113	3	2	3	0	5	2	10	30	20	40	100
MEC 114	Measurement and Instrumentation	BES 032	2	1	2	1	4	2	10	30	20	40	100
MEC 116	Manufacturing Technology	MEC 012	2	1	3	0	4	2	10	30	20	40	100
ELE 104	Electronic Devices and Circuits	ELE 103	2	1	0	2	3	2	30	30	-	40	100
UHS 104	Professional Ethics		2	2	0	0	2	2	30	30	-	40	100
Total			17										700

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

Level 2- 1													
Code	Course Title	Pre-Req	Cr. Hr.	Ct. Hr.				Final Exam Time HR.	Assessment				
				Lec	Lab	Tut	Sum		SA	MT	PE/ OE	Final Exam	Sum
MEC 211	Project Management	BES 012	3	2	2	0	4	2	10	30	20	40	100
MEC 221	Heat Transfer	MEC 122	3	2	1	2	5	2	10	30	20	40	100
MEC 223	Fluid Power Systems	MEC 121	2	1	3	0	4	2	10	30	20	40	100
MEC 215	Mechanical Design	MEC 113	3	2	3	0	5	2	10	30	20	40	100
MEC 213	Mechanical Vibrations	BES 022	3	2	2	1	5	2	10	30	20	40	100
ELE 201	Electric Machinery	ELE 103	2	1	2	0	3	2	10	30	20	40	100
UHS 3XX	Humanities - Elective I		2	2	0	0	2	2	30	30	-	40	100
Total			18										700

Level 2- 2														
Code	Course Title	Pre-Req	Cr. Hr.	Ct. Hr.				Final Exam Time HR	Assessment				
				Lec	Lab	Tut	Sum		SA	MT	PE/ OE	Final Exam	Sum
BES 112	Numerical Analysis	BES 111	3	2	2	0	4	2	10	30	20	40	100
MEC 212	Metal Cutting Processes	MEC 012	3	2	2	0	4	2	10	30	20	40	100
MEC 216	Computer Aided Design	MEC 112	3	2	2	0	4	2	10	30	20	40	100
MEC 218	Material Engineering	MEC 123	3	2	2	0	4	2	10	30	20	40	100
MEC 214	Automatic Control Systems	MEC 213	3	2	2	1	5	2	10	30	20	40	100
BES 141	Pollution and Industrial Safety	BES 041	2	2	1	0	3	2	10	30	20	40	100
UHS 3XX	Humanities Elective II		2	2	0	0	2	2	30	30	-	40	100
Total			19										700

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

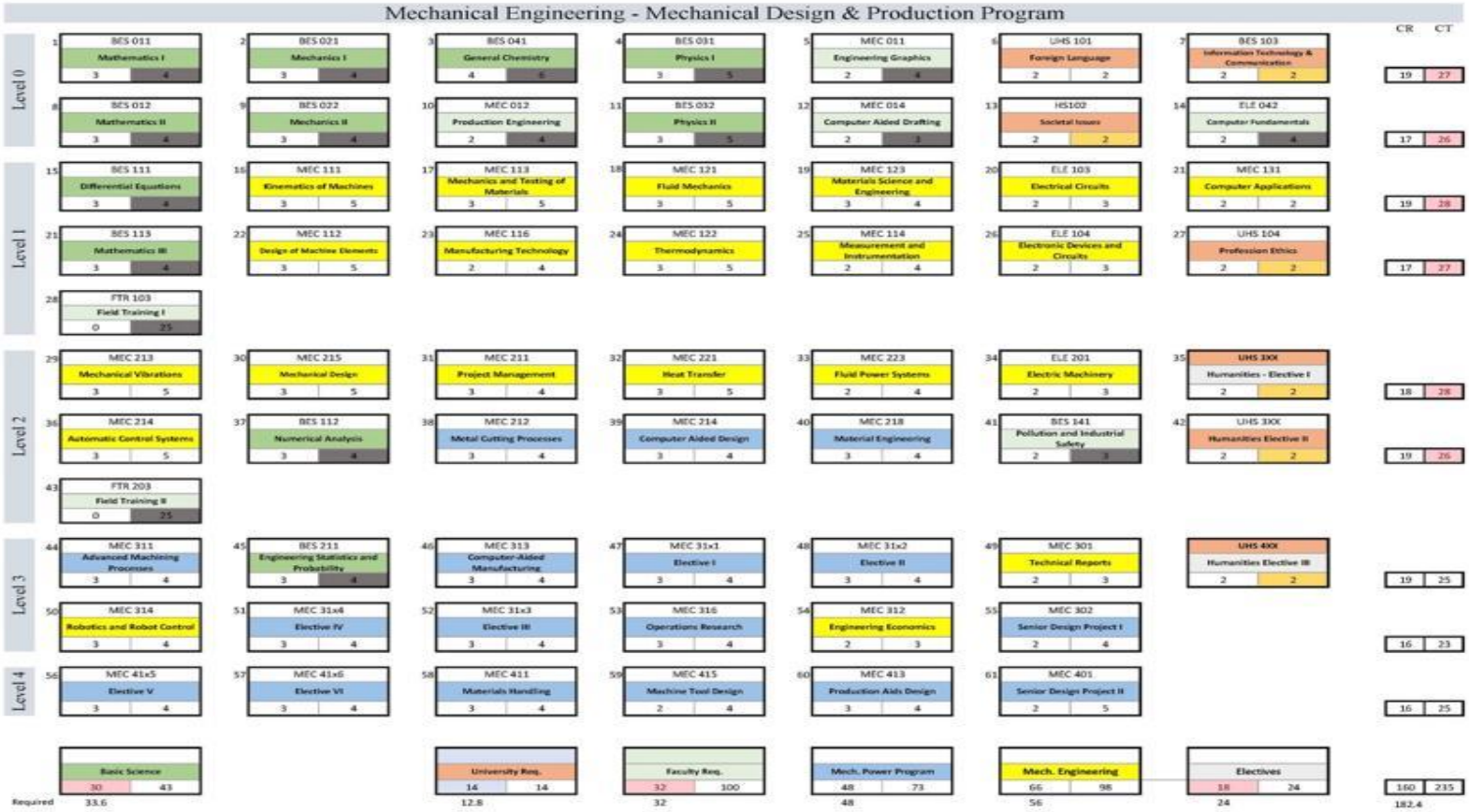
Level 3- 1													
Code	Course Title	Pre-Req	Cr. Hr.	Ct. Hr.				Final Exam Time HR	Assessment				
				Lec	Lab	Tut	Sum		SA	MT	PE/ OE	Final Exam	Sum
BES 211	Engineering Statistics and Probability	BES 012	3	2	2	0	4	2	10	30	20	40	100
MEC 31x1	Elective I		3	2	0	2	4	2	30	30	-	40	100
MEC 311	Advanced Machining Processes	MEC 214	3	2	2	0	4	2	10	30	20	40	100
MEC 313	Computer-Aided Manufacturing	MEC 212	3	2	2	0	4	2	10	30	20	40	100
MEC 31x2	Elective II		3	2	0	2	4	2	30	30	-	40	100
MEC 301	Technical Reports		2	1	2	0	3	2	50	-	50	--	100
UHS 4XX	Humanities Elective III		2	2	0	0	2	2	30	30	-	40	100
Total			19										700

Level 3- 2														
Code	Course Title	Pre-Req	Cr. Hr.	Ct. Hr.				Final Exam Time HR	Assessment				
				Lec	Lab	Tut	Sum		SA	MT	PE/ OE	Final Exam	Sum
MEC 314	Robotics and Robot Control	MEC 214	3	2	2	0	4	2	10	30	20	40	100
MEC 316	Operations Research	MEC 211	3	2	0	2	4	2	30	30	-	40	100
MEC 31x3	Elective III		3	2	0	2	4	2	30	30	-	40	100
MEC 31x4	Elective IV		3	2	0	2	4	2	30	30	-	40	100
MEC 302	Senior Design Project I		2	0	4	0	4	-	50	-	50	--	100
MEC 312	Engineering Economics		2	2	0	1	3	2	30	30	--	40	100
Total			16										600

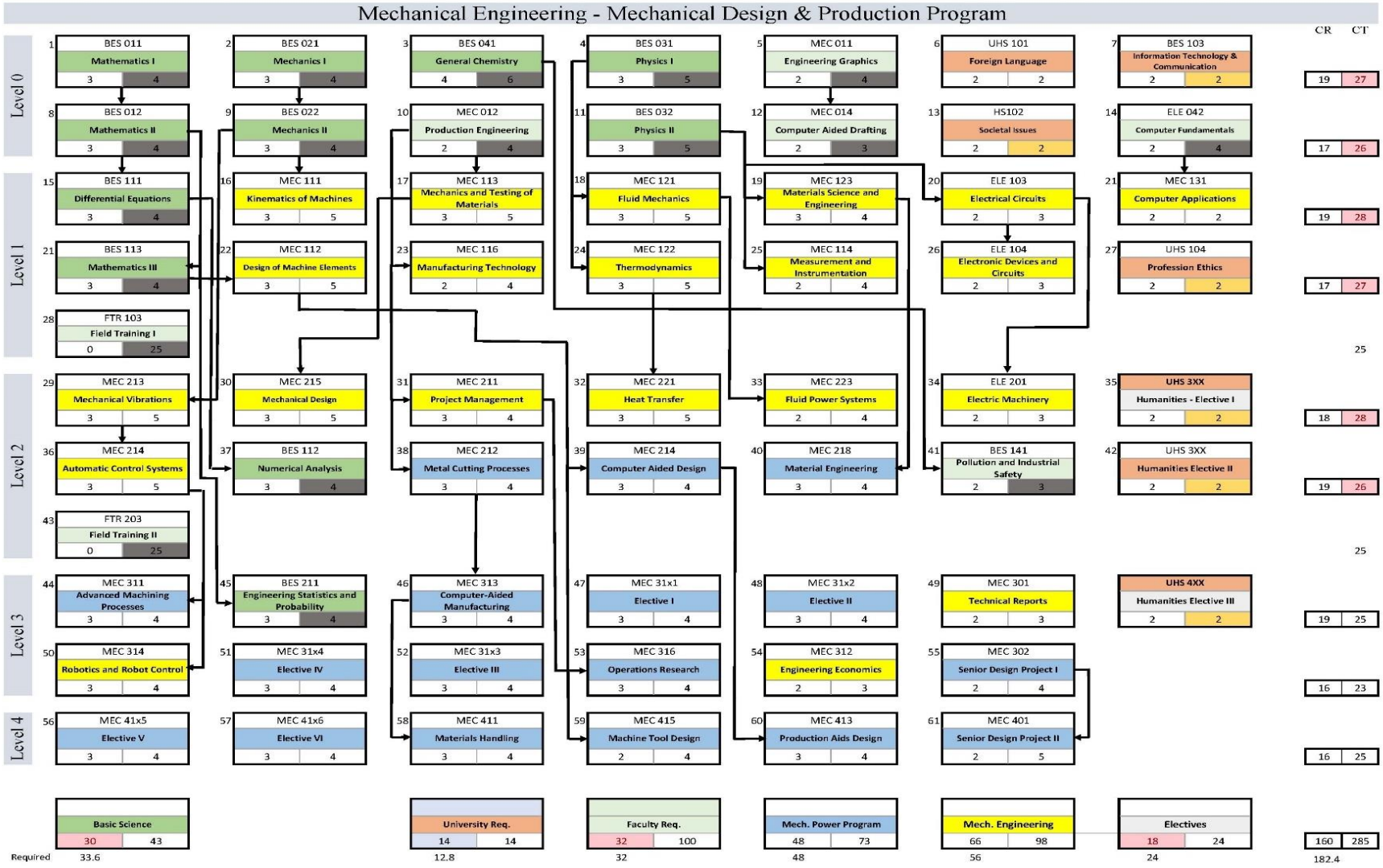
Level 4- 1														
Code	Course Title	Pre-Req	Cr. Hr.	Ct. Hr.				Final Exam Time HR	Assessment				
				Lec	Lab	Tut	Sum		SA	MT	PE/ OE	Final Exam	Sum
MEC 411	Materials Handling	MEC 313	3	2	2	0	4	2	10	30	20	40	100
MEC 413	Production Aids Design	MEC 216	3	2	2	0	4	2	10	30	20	40	100
MEC 41x5	Elective V		3	2	0	2	4	2	30	30	-	40	100
MEC 41x6	Elective VI		3	2	0	2	4	2	30	30	-	40	100
MEC 415	Machine Tool Design	MEC 311	2	1	2	1	4	2	10	30	20	40	100
MEC 401	Senior Design Project II	MEC 302	2	0	5	0	5	-	50	-	50	--	100
Total			16										600

Courses Plan and Matrix

Curriculum Plan for Mechanical Design and Production Engineering



Curriculum Plan for Mechanical Design and Production Engineering Program



Program Learning Outcomes to Program Courses Matrix

			Competency	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12	PLO13	PLO14	PLO15	PLO16	PLO17	PLO18	PLO19	PLO20
Level 0	Semester 1	BES 011	Mathematics I	•		•																	
		BES 021	Mechanics I	•	•																		
		BES 041	General Chemistry	•	•																		
		BES 031	Physics I	•	•																		
		MEC 011	Engineering Graphics						•		•												
		UHS 101	Foreign Language								•		•										
		UHS 102	Information Technology & Communication				•		•				•										
	Semester 2	BES 012	Mathematics II	•		•																	
		BES 022	Mechanics II	•	•																		
		MEC 012	Production Engineering				•		•														
		BES 032	Physics II	•	•																		
		MEC 014	Computer Aided Drafting				•					•											
		ELE 042	Computer Fundamentals	•		•																	
		UHS 103	Societal Issues							•			•										
Level 1	Semester 3	BES 111	Differential Equations	•	•																		
		MEC 121	Fluid Mechanics											•		•							
		MEC 111	Kinematics of Machines											•	•	•							
		MEC 113	Mechanics and Testing of Materials		•									•									
		MEC 123	Materials Science and Engineering											•	•								
		ELE 103	Electrical Circuits											•	•								
		MEC 131	Computer Applications			•									•								
	Semester 4	BES 113	Mathematics III	•	•																		
		MEC 122	Thermodynamics											•	•								
		MEC 112	Design of Machine Elements			•	•								•		•						
		MEC 114	Measurement and Instrumentation		•		•							•									
		MEC 116	Manufacturing Technology											•	•		•						
		ELE 104	Electronic Devices and Circuits											•	•								
		UHS 201	Profession Ethics				•	•															
		FTR 103	Field Training I							•			•										

		Competency	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12	PLO13	PLO14	PLO15	PLO16	PLO17	PLO18	PLO19	PLO20
Level 2	Semester 5	MEC 211	Project Management					•			•	•											
		MEC 221	Heat Transfer											•		•							
		MEC 223	Fluid Power Systems											•		•							
		MEC 215	Mechanical Design			•					•				•		•						
		MEC 213	Mechanical Vibrations											•	•		•						
		ELE 201	Electric Machinery																				
		HS 3XX	Humanities - Elective I			•	•																
	Semester 6	BES 112	Numerical Analysis	•	•																		
		MEC 212	Metal Cutting Processes													•		•				•	
		MEC 216	Computer Aided Design																•		•		
		MEC 218	Material Engineering																•			•	
		MEC 214	Automatic Control Systems			•								•			•						
		BES 141	Pollution and Industrial Safety	•		•	•																
		HS 304	Legalisation & Human Rights							•	•												
		FTR 203	Field Training II					•	•	•		•	•										
Level 3	Semester 7	BES 211	Engineering Statistics	•	•																		
		MEC 31x1	Elective I															•		•	•	•	•
		MEC 311	Advanced Machining Processes															•	•			•	
		MEC 313	Computer-Aided Manufacturing													•		•	•		•	•	
		MEC 31x2	Elective II															•		•	•	•	•
		MEC 301	Techincal Reports					•		•	•												
		HS 4XX	Humanities Elective 2								•	•											
	Semester 8	MEC 314	Robotics and Robot Control											•	•		•				•		
		MEC 316	Operations Researches																	•			•
		MEC 31x3	Elective III																•		•	•	•
		MEC 31x4	Elective IV																•		•	•	•
		MEC 302	Senior Design Project I				•	•	•	•		•	•						•	•	•	•	•	•
		MEC 312	Engineering Economics			•				•														
Level 4	Semester 9	MEC 411	Materials Handling													•		•		•		•	•
		MEC 413	Production Aids Design													•		•	•		•	•	
		MEC 41x5	Elective V																•		•	•	•
		MEC 41x6	Elective VI																•		•	•	•
		MEC 415	Machine Tool Design																•		•	•	
		MEC 401	Senior Design Project II				•	•	•	•		•	•					•	•	•	•	•	•

Matching Mechanical Design and Production Engineering Program Courses with ABET Requirements

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

Mechanical Power 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);	BES 011	Mathematics I	3
		BES 012	Mathematics II	3
		BES 113	Mathematics III	3
		BES 111	Differential Equations	3
		BES 112	Numerical Analysis	3
		BES 211	Engineering Statistics and Probability	2
	principles of engineering	BES 041	General Chemistry	4
		BES 021	Mechanics I	3
		BES 022	Mechanics II	3
		BES 141	Pollution and Industrial Safety	2
		BES 031	Physics I	3
		BES 032	Physics II	3
Total				**35**
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.	applications of these topics to modeling, analysis, design, and realization of physical systems, components, or processes.	MEC 011	Engineering Graphics	2
		MEC 012	Production Engineering	2
		MEC 014	Computer Aided Drafting	2
		MEC 111	Kinematics of Machines	3
		MEC 112	Design of Machine Elements	3
		MEC 116	Manufacturing Technology	2
		MEC 123	Materials Science and Engineering	3
		MEC 215	Mechanical Design	3
		MEC 131	Computer Applications	2
	coverage of both Production and mechanical systems.	MEC 122	Thermodynamics	3
		MEC 223	Fluid Power Systems	2
		MEC 121	Fluid Mechanics	3
		MEC 221	Heat Transfer	3
		MEC 114	Measurement and Instrumentation	2
		MEC 213	Mechanical Vibrations	3
		MEC 214	Automatic Control Systems	3
	in-depth coverage of either Production or mechanical systems.	MEC 212	Metal Cutting Processes	3
		MEC 216	Computer Aided Design	3
		MEC 218	Material Engineering	3

		MEC 311	Advanced Machining Processes	3
		MEC 313	Computer-Aided Manufacturing	3
		MEC 31x1	Elective I	3
		MEC 31x2	Elective II	3
		MEC 314	Robotics and robot control	3
		MEC 316	Operation Research	3
		MEC 31x3	Elective III	3
		MEC 31x4	Elective IV	3
		MEC 411	Materials Handling	3
		MEC 413	Production Aids Design	3
		MEC 415	Machine Tool Design	2
		MEC 33x5	Elective V	3
		MEC 33x6	Elective VI	3
	Explain basic concepts in project management, business, public policy, and leadership.	MEC 301	Technical Reports	2
		MEC 312	Engineering Economics	2
		MEC 211	Project Management	3
		UHS 103	Societal Issues	2
		UHS 3XX	Humanities Elective I	2
		UHS 3XX	Humanities Elective II	2
		UHS 4XX	Humanities Elective III	2
	Analyze issues in professional ethics and explain the importance of professional licensure.	UHS 104	Professional Ethics	2
Total				**105**

Program #2 Mechanical Power Engineering Program

Program Description

The program aims to study both conventional energy and renewable sources energy. Energy's flows, constraints, generation, transmission, distribution, consumption, and management knowledge are acquired through the period of study. Students are provided with a deep knowledge of conventional and renewable energy technologies generation and applications. Thermal power plants, machine construction, design, and stability are topics covered. Solar photovoltaic, solar thermal, concentrated solar power, and others are studied. Renewable energy applications are illustrated and evaluated both theoretically and economically. Energy management is discussed in detail using demand side management, energy efficiency, and energy consumption and audit are explained. Finally, the program encourages problem identification and solving as well as critical thinking skills. All topics under study prepare the program graduates for the national, regional, and international energy job market.

Basic Information

Program Mission

Deliver high quality engineers equipped with the required skills in the various fields of mechanical power engineering, to engage in engineering professions and high-quality research and development of national and regional relevance, and to provide expert consultancy on energy issues.

Program Objectives

The objectives of the B.Sc. in mechanical power engineering program are to enable its graduates 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. Participate as leaders in addressing the social, economic, and environmental issues involved in energy technologies.
PO7. Design and develop various types of mechanical power generation, energy transfer equipment and air-conditioning & refrigeration systems in addition to the automatic control devices involved in all such systems.

Graduate Attributes

By the completion of the MPE program of study, and according to NARS 2018, the graduate will be capable 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 graduate attributes defined by NARS 2018, MPE graduate should be able to:

GA11. Design, develop, operate and to maintain various types of mechanical power generation, energy transfer equipment and air-conditioning & refrigeration systems in addition to the automatic control devices involved in all such systems.
GA12. Describe the physical laws and resources that constrain energy systems.
GA13. Identify all aspects of the issues of environmental pollution problems concerning emissions of power generation, wastewater, and air pollution.

Program Learning Outcomes

The program courses fulfill the NARS 2018

Level A: The Engineering Graduate must be able to:

PLO1. Identify, formulate, and solve complex engineering problems by applying engineering fundamentals, basic science, and mathematics.
PLO2. Develop and conduct appropriate experimentation and/or simulation, analyze and interpret data, assess, and evaluate findings, and use statistical analyses and objective engineering judgment to draw conclusions.
PLO3. Apply engineering design processes to produce cost-effective solutions that meet specified needs with consideration for global, cultural, social, economic, environmental, ethical, and other aspects as appropriate to the discipline and within the principles and contexts of sustainable design and development.
PLO4. Utilize contemporary technologies, codes of practice and standards, quality guidelines, health and safety requirements, environmental issues, and risk management principles.
PLO5. Practice research techniques and methods of investigation as an inherent part of learning.
PLO6. Plan, supervise and monitor implementation of engineering projects, taking into consideration other trades requirements.
PLO7. Function efficiently as an individual and as a member of multi-disciplinary and multi-cultural teams.
PLO8. Communicate effectively – graphically, verbally and in writing – with a range of audiences using contemporary tools.
PLO9. Use creative, innovative, and flexible thinking and acquire entrepreneurial and leadership skills to anticipate and respond to new situations.
PLO10. Acquire and apply new knowledge, and practice self, lifelong and other learning strategies.

Level B: The Engineering Graduate must be able to:

In addition to the Competencies for All Engineering Programs the BASIC MECHANICAL Engineering graduate and similar programs must be able to:

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 conventional mechanical equipment according to the required performance.

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.

Level C: The Engineering Graduate must be able to:

In addition to competencies for all engineering programs (Level A, NARS 2018), and Mechanical Engineering competencies (Level B, NARS 2018), mechanical power engineer must be able to:

PLO15. Describe the physical laws and resources that constrain energy systems.

PLO16. Use Engineering software to simulate the flow field, predict the thermal behaviors, and analysis of conventional and non-conventional mechanical power systems.

PLO17. Identify the functional relationships of the mechanical system components installed to adopt the input/output of thermal power systems and equipment.

PLO18. Optimize the operating conditions and describe the performance parameters of energy absorbing/ producing machines, power stations, mechanical plants, and cells.

PLO19. Looking at ways of improving the design of wind turbines, improvements in solar and geothermal power, as well as every stage of renewable energy development.

PLO20. Design, develop, operate and to maintain various types of energy transfer equipment and air-conditioning & refrigeration systems in addition to the automatic control devices involved in all such systems.

PLO21. Identify all aspects of the issues of environmental pollution problems concerning emissions and air pollution. Design, develop and implement the appropriate vehicle and transport solutions.

Benchmark:

Benha University	**Illinois state University https://tec.illinoisstate.edu/renewable-energy/curriculum/**
PLO15. Describe the physical laws and resources that constrain energy systems.	- Describe the physical laws and resources that constrain our energy systems.
PLO16. Use Engineering software to simulate the flow field, predict the thermal behaviors, and analysis of conventional and non-	- Analyze wind data using professional software.

conventional mechanical power systems.	
PLO19. Looking at ways of improving the design of wind turbines, improvements in solar and geothermal power, as well as every stage of renewable energy development.	- Design residential and commercial solar photovoltaic (PV) systems using renewable energy software. - Optimize renewable energy business decision-making. - Develop a business case for a commercial renewable energy project.

Benha University	**Elgin Community College https://catalog.elgin.edu/degree-programs-certificates/career-technical/career-technical-degrees-certificates/energy-management/#learningoutcomestext**
PLO15. Describe the physical laws and resources that constrain energy systems. PLO16. Use Engineering software to simulate the flow field, predict the thermal behaviors, and analysis of conventional and non-conventional mechanical power systems. PLO17. Identify the functional relationships of the mechanical system components installed to adopt the input/output of thermal power systems and equipment.	- Evaluate the energy use patterns for residential and commercial structures and recommend energy efficiency and alternative energy solutions for optimization of evaluated buildings.
PLO18. Optimize the operating conditions and describe the performance parameters of energy absorbing/ producing machines, power stations, mechanical plants, and cells. PLO20. Design, develop, operate and to maintain various types of energy transfer equipment and air-conditioning & refrigeration systems in addition to the automatic control devices involved in all such systems.	- Program building automation systems for heating, ventilating, air conditioning, and exterior lighting service independently; and determine whether to dispatch appropriate staff or to resolve problems remotely via the energy management system.

Benha University	**Marathwada Mitra Mandal's Polytechnic.** **http://mmpolytechnic.edu.in/index.php/automobile-eng/automobile-engineering/learning-outcomes**

PLO21. Identify all aspects of the issues of environmental pollution problems concerning emissions and air pollution. Design, develop and implement the appropriate vehicle and transport solutions.	- Maintenance and Testing of automobile components: Make the use of Automobile equipment competently for vehicle maintenance, automotive Electronics, and testing. - Modern software usage: Use of latest software for simple design drafting, manufacturing, maintenance and documentation of automobile engineering components and processes. - Skill sets for entrepreneurs: Build the skill sets for entrepreneurs in Automobile service sectors.

Faculty Mission vs. Program Mission Matrix

Faculty Mission		Program Mission		
		The mission of the Mechanical Power Engineering Program is to deliver high quality engineers equipped with the required skills in the various fields of mechanical power engineering, to engage in engineering professions and high-quality research and development of national and regional relevance, and to provide expert consultancy on energy issues.		
		Deliver high quality engineers equipped with the required skills in the various fields of mechanical power engineering	Engage in engineering professions and high-quality research and development of national and regional relevance	Provide expert consultancy on energy issues
Benha University is committed to graduate well prepared engineers equipped with knowledge and skills necessary to compete in labor market, and capable of using and developing modern technology, and providing research in engineering fields to serve society and community.	Graduate well prepared engineers equipped with knowledge and skills	√		
	Compete in labor market capable of using and developing modern technology, and providing research in engineering fields		√	
	Serve society and community.			√

Program Mission vs. Program Objectives Matrix

Program Mission		Program Objectives						
		PO1	PO2	PO3	PO4	PO5	PO6	PO7
The mission of the Mechanical Power Engineering Program is to deliver high quality engineers equipped with the required skills in the various fields of mechanical power engineering, to engage in engineering professions and high-quality research and development of national and regional relevance, and to provide expert consultancy on energy issues.	Deliver high quality engineers equipped with the required skills in the various fields of mechanical power engineering	√	√	√	√			
	Engage in engineering professions and high-quality research and development of national and regional relevance					√	√	√
	Provide expert consultancy on energy issues					√	√	√

Program Objectives vs. Graduate Attributes Matrix

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

Program Outcomes vs. Program Objectives Matrix

Program Objectives	Program Competencies																			
	Level A										Level B				Level C						
	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	B1	B2	B3	B4	C1	C2	C3	C4	C5	C6	C7
PO1	√	√	√								√	√	√	√	√	√					
PO2				√	√	√	√	√													
PO3					√	√	√	√	√												
PO4				√				√		√	√	√	√	√	√	√					
PO5													√	√	√	√	√	√	√	√	√
PO6															√	√	√	√	√	√	√
PO7															√	√	√	√	√	√	√

Career Prospects

This program qualifies its graduates to work in mechanical power engineering, energy, and renewable energy engineering fields. Graduates can join electrical sector entities such as generation (conventional and renewable), public or private Power plants, control centers, petroleum industry, factories, maintenance applications, and energy management sectors can be a target for the program's graduates. Distribution installations, refrigeration and air conditioning, water desalination and distillation applications, and solar pumping fields are candidate jobs for the energy graduates.

Program Concentrations

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

1. Sustainable & Renewable Energy
2. Energy management and HVAC Engineering
3. Vehicle 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 Mechanical Power Engineering Requirement Courses

Requirement	Cr. Hr.	Ct. Hr.			
		Lec.	Lab	Tut	Sum
Benha University Requirements	14	14	0	0	14
Benha Faculty of Engineering Requirements	32	19	34	47	50
Discipline Requirements	66	42	38	22	102
Major Mechanical Power Program Requirements	30	17	27	1	45
Concentration of Sustainable & Renewable Energy Requirements	18	12	0	12	24
Concentration of Energy management and HVAC Requirements					
Concentration of Vehicle Engineering Requirements					
Total	**160**	**104**	**99**	**82**	**235**

Basic Science Requirements of Mechanical Power Engineering

Code	Course	Pre-Req	Cr. Hr.	Ct. Hr.			
				Lec	Lab	Tut	Sum
BES 011	Mathematics I		3	2	0	2	4
BES 041	General Chemistry		4	3	2	1	6
BES 031	Physics I		3	2	2	1	5
BES 012	Mathematics II	BES 011	3	2	0	2	4
BES 032	Physics II		3	2	2	1	5
BES 111	Differential Equations	BES 012	3	2	0	2	4
BES 112	Numerical Analysis	BES 111	3	2	2	0	4
BES 113	Mathematics III	BES 012	3	2	0	2	4
*BES 141	Pollution and Industrial Safety	BES 041	2	2	1	0	3
BES 211	Engineering Statistics and Probability	BES 012	3	2	2	0	4
Total			**30**	**21**	**11**	**11**	**43**

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

Mechanical Engineering Discipline Requirements

Code	Course	Pre-Req	Cr. Hr.	Ct. Hr.			
				Lec.	Lab.	Tut.	Sum
BES 113	Mathematics III	BES 012	3	2	0	2	4
BES 111	Differential Equations	BES 012	3	2	0	2	4
BES 112	Numerical Analysis	BES 111	3	2	2	0	4
BES 211	Engineering Statistics and Probability		3	2	2	0	4
MEC 121	Fluid Mechanics	BES 031	3	2	2	1	5
MEC 111	Kinematics of Machines	BES 022	3	2	0	2	4
MEC 113	Mechanics and Testing of Materials	MEC 012	3	2	2	1	5
MEC 123	Materials Science and Engineering	BES 032	3	2	2	0	4
ELE 103	Electrical Circuits	BES 032	2	1	0	2	3
MEC 131	Computer Applications	ELE 042	2	1	2	0	3
MEC 122	Thermodynamics	BES 031	3	2	1	2	5
MEC 112	Design of Machine Elements	MEC 113	3	2	3	0	5
MEC 114	Measurement and Instrumentation	BES 032	2	1	2	1	4
MEC 116	Manufacturing Technology	MEC 012	2	1	3	0	4
ELE 104	Electronic Devices and Circuits	ELE 103	2	1	0	2	3
MEC 211	Project Management	BES 012	3	2	2	0	4
MEC 221	Heat Transfer	MEC 122	3	2	1	2	5
MEC 223	Fluid Power Systems	MEC 121	2	1	3	0	4
MEC 215	Mechanical Design	MEC 113	3	2	3	0	5
MEC 213	Mechanical Vibrations	BES 022	3	2	2	1	5
ELE 201	Electric Machinery	ELE 103	2	1	2	0	3
MEC 214	Automatic Control Systems	MEC 213	3	2	2	1	5
MEC 312	Engineering Economics		2	2	0	1	3
MEC 421	Advanced Topics in Control Engineering	MEC 314	3	2	2	0	4
MEC 301	Technical Reports		2	1	2	0	3
Total			**66**	**42**	**38**	**22**	**102**

*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 Mechanical Power Engineering

Code	Course	Pre-Req	Cr. Hr.	Ct. Hr.			
				Lec	Lab	Tut	Sum
MEC 222	Applied Thermodynamics	MEC 122	3	2	2	0	4
MEC 224	Fluid Dynamics	MEC 121	3	2	2	0	4
MEC 226	Refrigeration	MEC 122	3	2	2	0	4
MEC 323	Combustion	MEC 222	3	2	2	0	4
MEC 325	Air Conditioning	MEC 222	3	2	2	0	4
MEC 41x1	Elective I		3	2	0	2	4
MEC 41x2	Elective II		3	2	0	2	4
MEC 322	Internal Combustion Engines	MEC 222	3	2	2	0	4
MEC 324	Power System Components	MEC 222	3	2	2	0	4
MEC 41x3	Elective III		3	2	0	2	4
MEC 41x4	Elective IV		3	2	0	2	4
MEC 423	Turbomachinery	MEC 221	3	2	2	0	4
MEC 425	Power Stations	MEC 322	2	1	2	1	4
MEC 43x5	Elective V		3	2	0	2	4
MEC 43x6	Elective VI		3	2	0	2	4
MEC 302	Senior Design Project I		2	0	4	0	4
MEC 401	Senior Design Project II	MEC 302	2	0	5	0	5
Total			**48**	**29**	**27**	**13**	**69**

* Elective courses are selected from three concentrations (x, y, and z)

Concentration Requirements of Sustainable & Renewable Energy (concentration "x")

Code	Course	Pre-Req	Cr. Hr.	Ct. Hr.			
				Lec	Lab	Tut	Sum
Pool Courses for Elective I, Elective II							
MEC 32x1	Introduction to Renewable Energy	MEC 222	3	2	0	2	4
MEC 32x2	Hydroelectric Energy Systems	MEC 222	3	2	0	2	4
Pool Courses for Elective III, Elective IV							
MEC 32x3	Wind Energy System Design	MEC 32x1 MEC 32x2	3	2	0	2	4
MEC 32x4	Fundamentals and Applications of Solar Energy	MEC 32x1 MEC 32x2	3	2	0	2	4
MEC 32x5	Nuclear Power Stations	MEC 222	3	2	0	2	4
Pool Courses for Elective V, Elective VI							
MEC 42x5	Essentials of Energy Management	MEC 32x1 MEC 32x2	3	2	0	2	4
MEC 42x6	Biomass and waste Conversion Technology	MEC 221 , MEC 323	3	2	0	2	4
MEC 42x7	Design of Renewable Energy Equipment	MEC 32x1 MEC 32x2	3	2	0	2	4
MEC 42x8	Geothermal Energy Systems	MEC 32x1 MEC 32x2	3	2	0	2	4

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

Concentration Requirements of Energy management and HVAC Engineering (concentration "y"

Code	Course	Pre-Req	Cr. Hr.	Ct. Hr.			
				Lec	Lab	Tut	Sum
Pool Courses for Elective I, Elective II							
MEC 32y1	Industrial Refrigeration	MEC 226	3	2	0	2	4
MEC 32y2	Fire Fighting & Water Distribution Systems	MEC 222	3	2	0	2	4
Pool Courses for Elective III, Elective IV							
MEC 32y3	Refrigeration & Air Conditioning Equipment	MEC 32y1	3	2	0	2	4
MEC 32y4	Fire Extinguishing Systems	MEC 32y2	3	2	0	2	4
MEC 32y5	Air Filtration	MEC 32y1 MEC 32y2	3	2	0	2	4
Pool Courses for Elective V, Elective VI							
MEC 42y6	Essentials of Energy Management	MEC 32y1 MEC 32y2	3	2	0	2	4
MEC 42y7	Special HVAC design applications	MEC 32y1 MEC 32y2	3	2	0	2	4
MEC 42y8	Energy Storage	MEC 222	3	2	0	2	4
MEC 42y9	Air-Conditioning Systems	MEC 32y1 MEC 32y2	3	2	0	2	4

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

Concentration Requirements of Vehicle Engineering (concentration "z")

Code	Course	Pre-Req	Cr. Hr.	Ct. Hr.			
				Lec	Lab	Tut	Sum
Pool Courses for Elective I, Elective II							
MEC 32z1	Vehicle Dynamics	MEC 213	3	2	0	2	4
MEC 32z2	Automotive Engineering	MEC 214	3	2	0	2	4
Pool Courses for Elective III, Elective IV							
MEC 32z3	Electric vehicles	MEC 32z1 MEC 32z2	3	2	0	2	4
MEC 32z4	Vehicle design & Manufacturing	MEC 32z2	3	2	0	2	4
MEC 32z5	Vehicle maintenance Technology	MEC 32z1 MEC 32z2	3	2	0	2	4
Pool Courses for Elective V, Elective VI							
MEC 42z6	Engine Testing and Pollution Control	MEC 32z1 MEC 32z2	3	2	0	2	4
MEC 42z7	Fundamental of hybrid vehicles	MEC 32z1 MEC 32z2	3	2	0	2	4
MEC 42z8	Aerodynamics of Road Vehicles	MEC 32z1 MEC 32z2	3	2	0	2	4
MEC 42z9	Mechatronics for Automotive (Autotronics)	MEC 32z1 MEC 32z2	3	2	0	2	4

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

Proposed Study Plan for Mechanical Power Engineering

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

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

Level 1- 1														
Code	Course Title	Pre-Req	Cr. Hr.	Ct. Hr.				Final Exam Time HR.	Assessment				
				Lec	Lab	Tut	Sum		SA	MT	PE/ OE	Final Exam	Sum
BES 111	Differential Equations	BES 012	3	2	0	2	4	2	30	30	-	40	100
MEC 121	Fluid Mechanics	BES 031	3	2	2	1	5	2	10	30	20	40	100
MEC 111	Kinematics of Machines	BES 022	3	2	0	2	4	2	30	30	-	40	100
MEC 113	Mechanics and Testing of Materials	MEC 012	3	2	2	1	5	2	10	30	20	40	100
MEC 123	Materials Science and Engineering	BES 032	3	2	2	0	4	2	10	30	20	40	100
ELE 103	Electrical Circuits	BES 032	2	1	0	2	3	2	30	30	-	40	100
MEC 131	Computer Applications	ELE 042	2	1	2	0	3	2	10	30	20	40	100
Total			19										700

Level 1- 2														
Code	Course Title	Pre-Req	Cr. Hr.	Ct. Hr.				Final Exam Time HR.	Assessment				
				Lec	Lab	Tut	Sum		SA	MT	PE/ OE	Final Exam	Sum
BES 113	Mathematics III	BES 012	3	2	0	2	4	2	30	30	-	40	100
MEC 122	Thermodynamics	BES 031	3	2	1	2	5	2	10	30	20	40	100
MEC 112	Design of Machine Elements	MEC 113	3	2	3	0	5	2	10	30	20	40	100
MEC 114	Measurement and Instrumentation	BES 032	2	1	2	1	4	2	10	30	20	40	100
MEC 116	Manufacturing Technology	MEC 012	2	1	3	0	4	2	10	30	20	40	100
ELE 104	Electronic Devices and Circuits	ELE 103	2	1	0	2	3	2	30	30	-	40	100
UHS 104	Profession Ethics		2	2	0	0	2	2	30	30	-	40	100
Total			19										700

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

Level 2- 1													
Code	Course Title	Pre-Req	Cr. Hr.	Ct. Hr.				Final Exam Time HR.	Assessment				
				Lec	Lab	Tut	Sum		SA	MT	PE/ OE	Final Exam	Sum
MEC 211	Project Management	BES 012	3	2	2	0	4	2	10	30	20	40	100
MEC 221	Heat Transfer	MEC 122	3	2	1	2	5	2	10	30	20	40	100
MEC 223	Fluid Power Systems	MEC 121	2	1	3	0	4	2	10	30	20	40	100
MEC 215	Mechanical Design	MEC 113	3	2	3	0	5	2	10	30	20	40	100
MEC 213	Mechanical Vibrations	BES 022	3	2	2	1	5	2	10	30	20	40	100
ELE 201	Electric Machinery	ELE 103	2	1	2	0	3	2	10	30	20	40	100
UHS 3XX	Humanities - Elective I		2	2	0	0	2	2	30	30	-	40	100
Total			18										700

Level 2- 2													
Code	Course Title	Pre-Req	Cr. Hr.	Ct. Hr.				Final Exam Time HR.	Assessment				
				Lec	Lab	Tut	Sum		SA	MT	PE/ OE	Final Exam	Sum
BES 112	Numerical Analysis	BES 111	3	2	2	0	4	2	10	30	20	40	100
MEC 222	Applied Thermodynamics	MEC 122	3	2	2	0	4	2	10	30	20	40	100
MEC 224	Fluid Dynamics	MEC 121	3	2	2	0	4	2	10	30	20	40	100
MEC 226	Refrigeration	MEC 122	3	2	2	0	4	2	10	30	20	40	100
MEC 214	Automatic Control Systems	MEC 213	3	2	2	1	5	2	10	30	20	40	100
BES 141	Pollution and Industrial Safety	BES 041	2	2	1	0	3	2	10	30	20	40	100
UHS 3XX	Humanities Elective II		2	2	0	0	2	2	30	30	-	40	100
Total			19										700

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

Level 3- 1														
Code	Course Title	Pre-Req	Cr. Hr.	Ct. Hr.				Final Exam Time HR.	Assessment				
				Lec	Lab	Tut	Sum		SA	MT	PE/ OE	Final Exam	Sum
BES 211	Engineering Statistics and probability	BES 012	2	2	1	1	4	2	10	30	20	40	100
MEC 32x1	Elective I		3	2	0	2	4	2	30	30	-	40	100
MEC 323	Combustion	MEC 222	3	2	2	0	4	2	10	30	20	40	100
MEC 325	Air Conditioning	MEC 222	3	2	2	0	4	2	10	30	20	40	100
MEC 32x2	Elective II		3	2	0	2	4	2	30	30	-	40	100
MEC 301	Technical Reports		2	1	2	0	3	2	50	-	50	--	100
UHS 4XX	Humanities Elective III		2	2	0	0	2	2	30	30	-	40	100
Total			19										600

Level 3- 2													
Code	Course Title	Pre-Req	Cr. Hr.	Ct. Hr.				Final Exam Time HR.	Assessment				
				Lec	Lab	Tut	Sum		SA	MT	PE/ OE	Final Exam	Sum
MEC 322	Internal Combustion Engines	MEC 222	3	2	2	0	4	2	10	30	20	40	100
MEC 324	Power System Components	MEC 222	3	2	2	0	4	2	10	30	20	40	100
MEC 32x3	Elective III		3	2	0	2	4	2	30	30	-	40	100
MEC 32x4	Elective IV		3	2	0	2	4	2	30	30	-	40	100
MEC 302	Senior Design Project I		2	2	0	0	2	-	50	-	50	--	100
MEC 312	Engineering Economics		2	2	0	1	3	2	30	30	-	40	100
Total			16										600

Level 4- 1													
Code	Course Title	Pre-Req	Cr. Hr.	Ct. Hr.				Final Exam Time HR.	Assessment				
				Lec	Lab	Tut	Sum		SA	MT	PE/ OE	Final Exam	Sum
MEC 421	Control Application for Energy Systems	MEC 214	3	2	1	2	5	2	10	30	20	40	100
MEC 423	Turbomachinery	MEC 121	3	2	2	0	4	2	10	30	20	40	100
MEC 42x5	Elective V		3	2	0	2	4	2	30	30	-	40	100
MEC 42x6	Elective VI		3	2	0	2	4	2	30	30	-	40	100
MEC 425	Power Stations	MEC 222	2	1	2	0	3	2	10	30	20	40	100
MEC 401	Senior Design Project II	MEC 302	3	0	6	0	6	-	50	-	50	--	100
Total			16										600

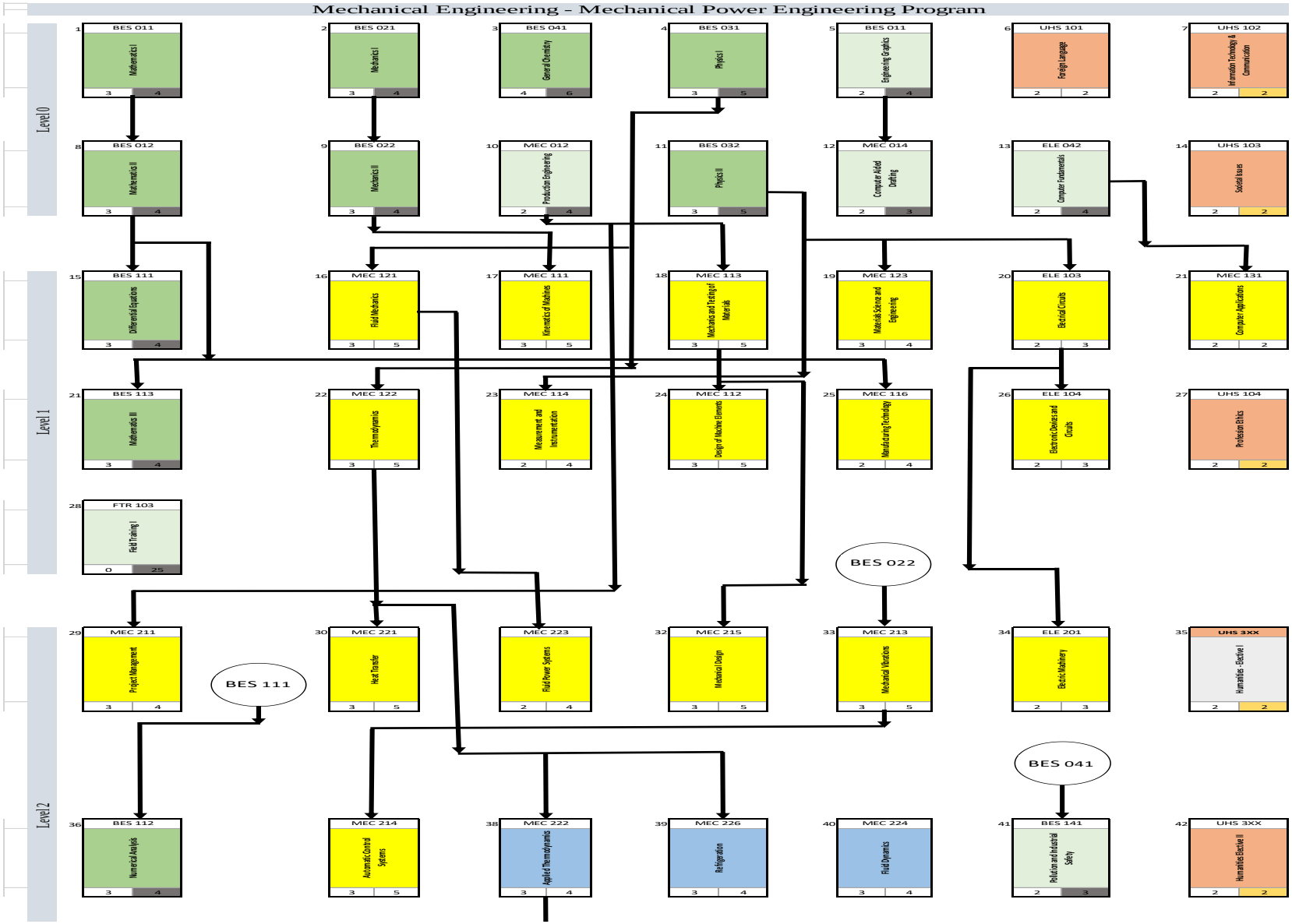
Courses Plan and Matrix

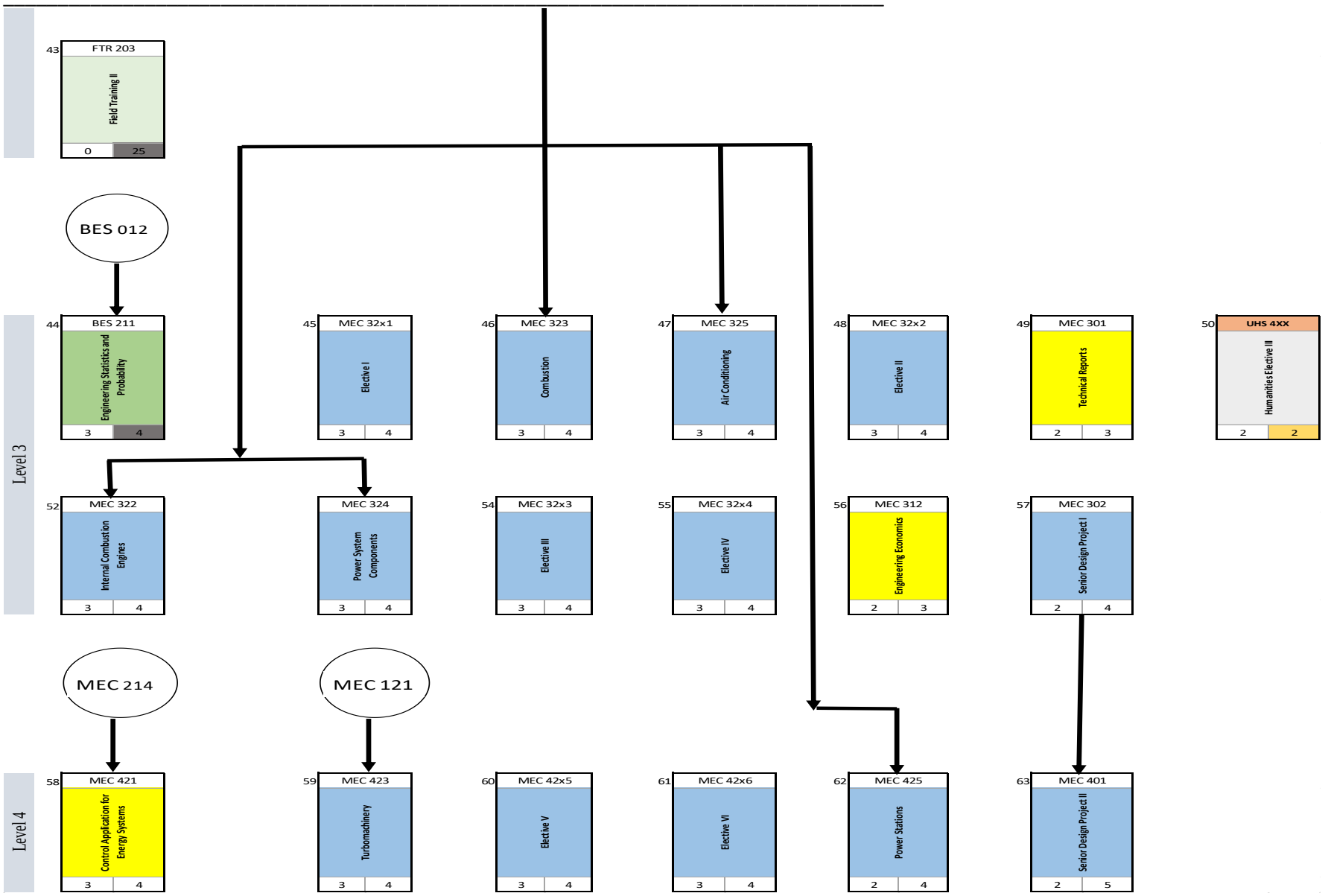
Curriculum Plan for Mechanical Power Engineering

Mechanical Engineering - Mechanical Power Engineering Program

								CR	CT
Level 0	1 BES 011 Mathematics I 3 4	2 BES 021 Mechanics I 3 4	3 BES 041 General Chemistry 4 6	4 BES 041 Physics I 3 5	5 BES 011 Engineering Graphics 2 4	6 UHS 101 Foreign Language 2 2	7 UHS 102 Information Technology & Communication 2 2	19	27
	8 BES 012 Mathematics II 3 4	9 BES 022 Mechanics II 3 4	10 MEC 012 Production Engineering 2 4	11 BES 032 Physics II 3 5	12 MEC 014 Computer Aided Drafting 2 3	13 ELE 042 Computer Fundamentals 2 4	14 UHS 103 Societal Issues 2 2	17	26
Level 1	15 BES 111 Differential Equations 3 4	16 MEC 121 Fluid Mechanics 3 5	17 MEC 111 Kinematics of Machines 3 5	18 MEC 113 Mechanics and Testing of Materials 3 5	19 MEC 123 Materials Science and Engineering 3 4	20 ELE 103 Electrical Circuits 2 3	21 MEC 131 Computer Applications 2 2	19	28
	21 BES 113 Mathematics III 3 4	22 MEC 122 Thermodynamics 3 5	23 MEC 114 Measurement and Instrumentation 2 4	24 MEC 112 Design of Machine Elements 3 5	25 MEC 116 Manufacturing Technology 2 4	26 ELE 104 Electronic Devices and Circuits 2 3	27 UHS 104 Profession Ethics 2 2	17	27
	28 FTR 103 Field Training I 0 25								
Level 2	29 MEC 211 Project Management 3 4	30 MEC 221 Heat Transfer 3 5	31 MEC 223 Fluid Power Systems 2 4	32 MEC 215 Mechanical Design 3 5	33 MEC 213 Mechanical Vibrations 3 5	34 ELE 201 Electric Machinery 2 3	35 UHS 3XX Humanities - Elective I 2 2	18	28
	36 BES 112 Numerical Analysis 3 4	37 MEC 214 Automatic Control Systems 3 5	38 MEC 222 Applied Thermodynamics 3 4	39 MEC 226 Refrigeration 3 4	40 MEC 224 Fluid Dynamics 3 4	41 BES 141 Pollution and Industrial Safety 2 3	42 UHS 3XX Humanities Elective II 2 2	19	26
	43 FTR 203 Field Training II 0 25								
Level 3	44 BES 211 Engineering Statistics and Probability 3 4	45 MEC 32x1 Elective I 3 4	46 MEC 323 Combustion 3 4	47 MEC 325 Air Conditioning 3 4	48 MEC 32x2 Elective II 3 4	49 MEC 301 Technical Reports 2 3	50 UHS 4XX Humanities Elective III 2 2	19	25
	52 MEC 322 Internal Combustion Engines 3 4	53 MEC 324 Power System Components 3 4	54 MEC 32x3 Elective III 3 4	55 MEC 32x4 Elective IV 3 4	56 MEC 312 Engineering Economics 2 3	57 MEC 302 Senior Design Project I 2 4		16	23
Level 4	58 MEC 421 Control Application for Energy Systems 3 4	59 MEC 423 Turbomachinery 3 4	60 MEC 42x5 Elective V 3 4	61 MEC 42x6 Elective VI 3 4	62 MEC 425 Power Stations 2 4	63 MEC 401 Senior Design Project II 2 5		16	25
	Basic Science 30 43		University Req. 14 14	Faculty Req. 32 100	Mech. Power Program 48 73	Mech. Engineering 66 98	Electives 18 24	160	235

Curriculum Plan for Mechanical Power Engineering




Level 3
Level 4
43 FTR 203 Field Training II 0 25
BES 012
44 BES 211 Engineering Statistics and Probability 3 4
45 MEC 32x1 Elective I 3 4
46 MEC 323 Combustion 3 4
47 MEC 325 Air Conditioning 3 4
48 MEC 32x2 Elective II 3 4
49 MEC 301 Technical Reports 2 3
50 UHS 4XX Humanities Elective III 2 2
52 MEC 322 Internal Combustion Engines 3 4
MEC 324 Power System Components 3 4
54 MEC 32x3 Elective III 3 4
55 MEC 32x4 Elective IV 3 4
56 MEC 312 Engineering Economics 2 3
57 MEC 302 Senior Design Project I 2 4
MEC 214
MEC 121
58 MEC 421 Control Application for Energy Systems 3 4
59 MEC 423 Turbomachinery 3 4
60 MEC 42x5 Elective V 3 4
61 MEC 42x6 Elective VI 3 4
62 MEC 425 Power Stations 2 4
63 MEC 401 Senior Design Project II 2 5

Program Learning Outcomes to Program Courses Matrix

Courses				Program Learning Outcomes																			
Levels		Code	Title	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12	PLO13	PLO14	PLO15	PLO16	PLO17	PLO18	PLO19	PLO20	PLO21
Level 0	Level 0-1	BES 011	Mathematics I	●		●																		
		BES 021	Mechanics I	●	●																			
		BES 041	General Chemistry	●	●																			
		BES 031	Physics I	●	●																			
		MEC 011	Engineering Graphics						●		●													
		UHS 101	Foreign Language								●		●											
		UHS 102	Information Technology & Communication				●		●				●											
	Level 0-2	BES 012	Mathematics II	●		●																		
		BES 022	Mechanics II	●	●																			
		MEC 012	Production Engineering				●		●															
		BES 032	Physics II	●	●																			
		MEC 014	Computer Aided Drafting				●					●												
		ELE 042	Computer Programming Fundamentals	●		●																		

		UHS 103	Societal Issues							●			●										
Level 1	Level 1-1	BES 111	Differential Equations	●	●																		
		MEC 121	Fluid Mechanics											●		●							
		MEC 111	Kinematics of Machines											●	●	●							
		MEC 113	Mechanics and Testing of Materials		●									●									
		MEC 123	Materials Science and Engineering											●	●								
		ELE 103	Electrical Circuits											●	●								
		MEC 131	Computer Applications			●									●								
	Level 1-2	BES 113	Mathematics III	●	●																		
		MEC 122	Thermodynamics											●	●								
		MEC 112	Design of Machine Elements			●	●								●		●						
		MEC 114	Measurement and Instrumentation		●		●							●									
		MEC 116	Manufacturing Technology											●	●		●						
		ELE 104	Electronic Devices and Circuits											●	●								
		UHS 201	Profession Ethics				●	●															
		FTR 103	Field Training I							●			●										
Level 2	Level 2-1	MEC 211	Project Management					●			●	●											

		MEC 221	Heat Transfer											●		●						
		MEC 223	Fluid Power Systems											●		●						
		MEC 215	Mechanical Design			●					●				●		●					
		MEC 213	Mechanical Vibrations											●	●		●					
		ELE 201	Electric Machinery											●	●							
		UHS 3XX	Humanities - Elective I			●	●															
	Level 2-2	BES 112	Numerical Analysis	●	●																	
		MEC 222	Applied Thermodynamics																	●	●	●
		MEC 224	Fluid Dynamics															●			●	●
		MEC 226	Refrigeration																	●	●	
		MEC 214	Automatic Control Systems			●								●			●					
		BES 141	Pollution and Industrial Safety	●		●	●															
		UHS 304	Legalization & Human Rights							●	●											
		FTR 203	Field Training II					●	●	●		●	●									
Level 3	Level 3-1	BES 211	Engineering Statistics	●	●																	
		MEC 32x1	Elective I															●			●	●
		MEC 323	Combustion																●	●		●

		MEC 325	Air Conditioning																●	●	●		●	
		MEC 32x2	Elective II															●				●	●	●
		UHS 4XX	Humanities Elective 2								●	●												
		MEC 301	Techincal Reports					●		●	●													
	Level 3-2	MEC 322	Internal Combustion Engines																	●				●
		MEC 324	Power System Components															●	●	●	●			●
		MEC 32x3	Elective III															●				●	●	●
		MEC 32x4	Elective IV															●				●	●	●
		MEC 302	Senior Design Project I				●	●	●	●		●	●					●	●	●	●	●	●	●
		MEC 312	Engineering Economics			●				●														
Level 4	Level 4-1	MEC 421	Control Application for Energy Systems					●						●	●		●							
		MEC 423	Turbomachinery															●		●				●
		MEC 42x5	Elective V															●				●	●	●
		MEC 42x6	Elective VI															●				●	●	●
		MEC 425	Power Stations																●	●	●			
		MEC 401	Senior Design Project II				●	●	●	●		●	●					●	●	●	●	●	●	●

Matching Mechanical Power Engineering Program Courses with ABET Requirements

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

Mechanical Power Engineering Program Courses Required to Cover ABET Criteria				
ABET Criteria		**CODE**	**Course Name**	**Cr. Hrs.**
A minimum of 30 semester Cr. Hrs. (or equivalent) of a combination of college-level mathematics and basic sciences with experimental experience appropriate to the program.	basic science, and mathematics (including multivariate calculus and differential equations);	BES 011	Mathematics I	3
		BES 012	Mathematics II	3
		BES 113	Mathematics III	3
		BES 111	Differential Equations	3
		BES 112	Numerical Analysis	3
		BES 211	Engineering Statistics and Probability	2
	principles of engineering	BES 041	General Chemistry	4
		BES 021	Mechanics I	3
		BES 022	Mechanics II	3
		BES 141	Pollution and Industrial Safety	2
		BES 031	Physics I	3
		BES 032	Physics II	3
Total				**35**
ABET Criteria		**CODE**	**Course Name**	**Cr. Hrs.**
A minimum of 45 semester Cr. Hrs. (or equivalent) of engineering topics appropriate to the program, consisting of engineering and computer sciences and engineering design and utilizing modern engineering tools.	applications of these topics to modeling, analysis, design, and realization of physical systems, components, or processes.	MEC 011	Engineering Graphics	2
		MEC 012	Production Engineering	2
		MEC 014	Computer Aided Drafting	2
		MEC 111	Kinematics of Machines	3
		MEC 112	Design of Machine Elements	3
		MEC 116	Manufacturing Technology	2
		MEC 123	Materials Science and Engineering	3
		MEC 215	Mechanical Design	3
		MEC 131	Computer Applications	2
	coverage of both thermal and mechanical systems.	MEC 122	Thermodynamics	3
		MEC 223	Fluid Power Systems	2
		MEC 121	Fluid Mechanics	3
		MEC 221	Heat Transfer	3
		MEC 114	Measurement and Instrumentation	2
		MEC 213	Mechanical Vibrations	3
		MEC 214	Automatic Control Systems	3
	in-depth coverage of either thermal or mechanical systems.	MEC 222	Applied Thermodynamics	3
		MEC 224	Fluid Dynamics	3
		MEC 226	Refrigeration	3

		MEC 323	Combustion	3
		MEC 325	Air Conditioning	3
		MEC 31x1	Elective I	3
		MEC 31x2	Elective II	3
		MEC 322	Internal Combustion Engines	3
		MEC 324	Power System Components	3
		MEC 31x3	Elective III	3
		MEC 31x4	Elective IV	3
		MEC 421	Control Application for Energy Systems	3
		MEC 423	Turbomachinery	3
		MEC 425	Power Stations	2
		MEC 33x5	Elective V	3
		MEC 33x6	Elective VI	3
	Explain basic concepts in project management, business, public policy, and leadership.	MEC 301	Technical Reports	2
		MEC 312	Engineering Economics	2
		MEC 211	Project Management	3
		UHS 103	Societal Issues	2
		UHS 3XX	Humanities Elective I	2
		UHS 3XX	Humanities Elective II	2
		UHS 4XX	Humanities Elective III	2
	Analyze issues in professional ethics and explain the importance of professional licensure.	UHS 104	Professional Ethics	2
Total				**105**

Program# 3 Mechatronics Engineering Program

Program Description

Mechatronics engineering is considered recently the keystone of automation and technology all over the world. Mechatronics Engineering is a multidisciplinary science that blends mechanical engineering, electrical engineering, and computer science to develop intelligent systems and convert conventional machines into smart machines. The integration among these several sciences empowered the mechatronics engineering to be utilized in various applications like industrial automation, automotive, robotics, drones, 3d printers and more.

Basic Information

Program Mission

The mission of mechatronics program is to prepare a skillful engineer that possesses analytical and technical skills to fulfill the market needs and to provide innovative solutions for multidisciplinary engineering applications that serve the society and promote the scientific research.

Program Objectives (PO)

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 Assist students in becoming acquainted with the foundations of modern technologies like as Artificial Intelligence, IoT, and Autotronics.

PO7 Control Mechatronics applications using current engineering techniques, talents, and procedures.

Graduate Attributes (GA)

Graduate attributes are the academic abilities, personal qualities, and skills which mechatronics Engineering graduates should have. Mechatronics engineering graduates should be always aware of the everlasting updates in the field since that mechatronics engineering is one of the fast and non-stopping disciplines of engineering. The wide range of engineering fields that are integrated within the mechatronics engineering requires that mechatronics graduates should possess self-learning philosophy to keep up with the technology evolution.

According to NARS 2018, all engineering graduates must:

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 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

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.
PLO 3. 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.
PLO 4. Utilize contemporary technologies, codes of practice and standards, quality guidelines, health and safety requirements, environmental issues and risk management principles.
PLO 5. Practice research techniques and methods of investigation as an inherent part of learning.
PLO 6. Plan, supervise and monitor implementation of engineering projects, taking into consideration other trades requirements.
PLO 7. Function efficiently as an individual and as a member of multi-disciplinary and multi-cultural teams.

PLO 8. Communicate effectively – graphically, verbally and in writing – with a range of audiences using contemporary tools.
PLO 9. Use creative, innovative, and flexible thinking and acquire entrepreneurial and leadership skills to anticipate and respond to new situations.
PLO 10. Acquire and apply new knowledge, and practice self, lifelong and other learning strategies.

Level B

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

PLO 11. 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.
PLO 12. 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.
PLO 13. Select conventional mechanical equipment according to the required performance.
PLO 14. 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.

Level C

In addition to the Competencies for all Engineering Programs (Level A, NARS 2018) and the competencies for the Mechanical Discipline (Level B, NARS 2018), the Mechatronics Engineering Program graduate must be able to (C Level):

PLO 15. Determine the tools needed to maximize the design while designing, modelling, and analyzing an electrical, electronic, or digital system or component for a particular application.
PLO 16. Calculate and quantify an electrical, electronic, or digital system's performance under a certain input excitation, and assess the system's appropriateness for a given application.
PLO 17. Adopt suitable national and international standards and codes to design, build, operate, inspect, and maintain electrical / electronic / digital equipment, systems, and services.
PLO 18. Determine the design, production, interface, and software requirements for various Mechatronics system components at the appropriate level.
PLO 19. Create innovative solutions to mechatronics systems challenges, especially those involving production, maintenance, and interfaces, while taking into consideration industrial and commercial restrictions.

Benchmark:

Benha University	**Heliopolis University at - https://www.hu.edu.eg/Competencies-of-mechatronics-engineers/**
PLO 15. Determine the tools needed to maximize the design while designing, modelling, and analyzing an electrical, electronic, or digital system or component for a particular application.	Design, model and analyze an electrical/electronic/digital system or component for a specific application; and identify the tools required to optimize this design
PLO 16. Calculate and quantify an electrical, electronic, or digital system's performance under a certain input excitation, and assess the system's appropriateness for a given application	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 ANU
Benha University	**NARS 2018**
PLO 17. Adopt suitable national and international standards and codes to design, build, operate, inspect, and maintain electrical / electronic / digital equipment, systems, and services	Adopt suitable national and international standards and codes to design, build, operate, inspect, and maintain electrical / electronic / digital equipment, systems, and services
Benha University	**College of Engineering and Technology | AASTMT at - https://aast.edu/en/colleges/coe/southValley /dept/contenttemp.php?page_id=64800008**
PLO 18. Determine the design, production, interface, and software requirements for various Mechatronics system components at the appropriate level.	Identify at an appropriate level the design, production, interfacing and software needs of different parts of Mechatronics systems
PLO 19. Create innovative solutions to mechatronics systems challenges, especially those involving production, maintenance, and interfaces, while taking into consideration industrial and commercial restrictions.	Create solutions to mechatronics systems especially to manufacturing, maintenance and interfacing Problems in a creative way, taking account of industrial and commercial constraints.

Faculty Mission vs. Program Mission Matrix

Faculty Mission		Program Mission		
		The mission of mechatronics program is to prepare a skillful engineer that possesses analytical and technical skills to fulfill the market needs and to provide innovative solutions for multidisciplinary engineering applications that serve the society and promote the scientific research.		
		prepare a skillful engineer that possesses analytical and technical skills	to fulfill the market needs and to provide innovative solutions for multidisciplinary engineering applications	that serve the society and promote the scientific research.
Benha University is committed to graduate well prepared engineers equipped with knowledge and skills necessary to compete in labor market, and capable of using and developing modern technology, and providing research in engineering fields to serve society and community.	graduate well prepared engineers equipped with knowledge and skills	√		
	compete in labor market capable of using and developing modern technology, and providing research in engineering fields		√	
	serve society and community.			√

Program Mission vs. Program Objectives Matrix

Program Mission		Program Objectives						
		PO1	PO2	PO3	PO4	PO5	PO6	PO7
The mission of mechatronics program is to prepare a skillful engineer that possesses analytical and technical skills to fulfill the market needs and to provide innovative solutions for multidisciplinary engineering applications that serve the society and promote the scientific research.	prepare a skillful engineer that possesses analytical and technical skills	√	√	√			√	
	to fulfill the market needs and to provide innovative solutions for multidisciplinary engineering applications	√			√	√	√	
	that serve the society and promote the scientific research.					√		√

Program Competencies vs. Program Objectives Matrix

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

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

Mechatronics engineering graduates of this program are expected to gain good experience in different scopes that enable them to be eligible to work in several fields including:

1- Automation and control field,
2- Maintenance field,
3- Robotics field,
4- CAD/CAM and 3D printing fields,
5- Embedded system field,
6- Intelligent control and machine learning fields,
7- Automotive field.

Program Concentrations

The graduates of mechatronics engineering program focus on two main concentrations including

1- Robotics and Control
   In this this concentration, students will study advanced topics on robotics and intelligent control.
2- Advanced Mechatronics and Automotive
   In this concentration, students will study foundations of automotive industry and Autotronics

The concentration focus is achieved by 23 Cr. Hrs. including 18 Cr. Hrs. of elective courses and 4 Cr. Hrs. as the graduation project, all related to the specific concentration.

List of Mechatronics Engineering Requirement Courses

Requirement	Cr. Hr.	Ct. Hr.			
		Lec.	Lab	Tut	Sum
Benha University Requirements	14	14	0	0	14
Benha Faculty of Engineering Requirements	32	19	34	47	50
Discipline Requirements	66	42	38	22	102
Major Mechatronics Program Requirements	30	17	25	3	45
Concentration of Sustainable & Renewable Energy Requirements Concentration of Energy management and HVAC Requirements Concentration of Vehicle Engineering Requirements	18	12	0	12	24
Total	**160**	**104**	**97**	**84**	**235**

Basic Science Requirements of Mechatronics Engineering

Code	Course Title	Pre-Req	Cr. Hr.	Ct. Hr.			
				Lec	Lab	Tut	Sum
BES 011	Mathematics I		3	2	0	2	4
BES 041	General Chemistry		4	3	2	1	6
BES 031	Physics I		3	2	2	1	5
BES 012	Mathematics II	BES 011	3	2	0	2	4
BES 032	Physics II		3	2	2	1	5
BES 111	Differential Equations	BES 012	3	2	0	2	4
BES 113	Mathematics III	BES 012	3	2	0	2	4
BES 112	Numerical Analysis	BES 111	3	2	2	0	4
*BES 141	Pollution and Industrial Safety	BES 041	2	2	1	0	3
BES 211	Engineering Statistics and Probability	BES 012	3	2	2	0	4
Total			**30**	**21**	**11**	**11**	**43**

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

Mechanical Engineering Discipline Requirements

Code	Course	Pre-Req	Cr. Hr.	Ct. Hr.			
				Lec.	Lab.	Tut.	Sum
BES 113	Mathematics III	BES 012	3	2	0	2	4
BES 111	Differential Equations	BES 012	3	2	0	2	4
BES 112	Numerical Analysis	BES 111	3	2	2	0	4
BES 211	Engineering Statistics and Probability		3	2	2	0	4
MEC 121	Fluid Mechanics	BES 031	3	2	2	1	5
MEC 111	Kinematics of Machines	BES 022	3	2	0	2	4
MEC 113	Mechanics and Testing of Materials	MEC 012	3	2	2	1	5
MEC 123	Materials Science and Engineering	BES 032	3	2	2	0	4
ELE 103	Electrical Circuits	BES 032	2	1	0	2	3
MEC 131	Computer Applications	ELE 042	2	1	2	0	3
MEC 122	Thermodynamics	BES 031	3	2	1	2	5
MEC 112	Design of Machine Elements	MEC 113	3	2	3	0	5
MEC 114	Measurement and Instrumentation	BES 032	2	1	2	1	4
MEC 116	Manufacturing Technology	MEC 012	2	1	3	0	4
ELE 104	Electronic Devices and Circuits	ELE 103	2	1	0	2	3
MEC 211	Project Management	BES 012	3	2	2	0	4
MEC 221	Heat Transfer	MEC 122	3	2	1	2	5
MEC 223	Fluid Power Systems	MEC 121	2	1	3	0	4
MEC 215	Mechanical Design	MEC 113	3	2	3	0	5
MEC 213	Mechanical Vibrations	BES 022	3	2	2	1	5
ELE 201	Electric Machinery	ELE 103	2	1	2	0	3
MEC 214	Automatic Control Systems	MEC 213	3	2	2	1	5
MEC 312	Engineering Economics		2	2	0	1	3
MEC 314	Advanced Topics in Control Engineering	MEC 314	3	2	2	0	4
MEC 301	Technical Reports		2	1	2	0	3
Total			**66**	**42**	**38**	**22**	**102**

*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 Engineering

Code	Course	Pre-Req	Cr. Hr.	Ct. Hr.			
				Lec	Lab	Tut	Sum
MEC 232	Introduction to Mechatronics	ELE 104	3	2	2	0	4
ELE 204	Logic Circuits Design & Applications	ELE 104	3	2	2	0	4
MEC 236	Industrial Robots	MEC 121	3	2	2	0	4
MEC 331	Design of Mechatronic Systems	MEC 232	3	2	2	0	4
ELE 301	Power Electronics	ELE 204	3	2	2	0	4
MEC 31x1	Elective I		3	2	0	2	4
MEC 31x2	Elective II		3	2	0	2	4
MEC 332	CAD/CAM	MEC 215	3	2	2	0	4
ELE 404	Digital Control	MEC 214	3	2	0	2	4
MEC 31x3	Elective III		3	2	0	2	4
MEC 31x4	Elective IV		3	2	0	2	4
MEC 431	Embedded System Design	MEC 214	2	1	2	1	4
MEC 433	Programmable Logic Controllers	ELE 204	3	2	2	0	4
MEC 43x5	Elective V		3	2	0	2	4
MEC 43x6	Elective VI		3	2	0	2	4
MEC 302	Senior Design Project I		2	0	4	0	4
MEC 401	Senior Design Project II	MEC 302	2	0	5	0	5
Total			**48**	**29**	**25**	**15**	**69**

* Elective courses are selected from three concentrations (x, y, and z)

Concentration Requirements of Robotics and Control (concentration "x")

Code	Course	Pre-Req	Cr. Hr.	Ct. Hr.			
				Lec	Lab	Tut	Sum
Pool Courses for Elective I, Elective II							
MEC 33x1	Mobile Robots	MEC 236	3	2	0	2	4
MEC 33x2	Autonomous systems	MEC 236	3	2	0	2	4
Pool Courses for Elective III, Elective IV							
MEC 33x3	Robot Operating Systems (ROS)	MEC 33x1 MEC 33x2	3	2	0	2	4
MEC 33x4	Robust and Fault-tolerant Control	MEC 214 ELE 404	3	2	0	2	4
MEC 33x5	Computer Interfacing	ELE 404	3	2	0	2	4
Pool Courses for Elective V, Elective VI							
MEC 43x6	Rehabilitation Robotics	MEC 33x2	3	2	0	2	4
MEC 43x7	Medical Robotics	MEC 33x2	3	2	0	2	4
MEC 43x8	Machine Learning	MEC 232	3	2	0	2	4

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

Concentration Requirements of Advanced Mechatronics and Autotronics Engineering (concentration "y")

Code	Course	Pre-Req	Cr. Hr.	Ct. Hr.			
				Lec	Lab	Tut	Sum
Pool Courses for Elective I, Elective II							
MEC 33y1	Autotronics	MEC 232	3	2	0	2	4
MEC 33y2	Machine Vision Systems	MEC 232	3	2	0	2	4
Pool Courses for Elective III, Elective IV							
MEC 33y3	Automotive Engineering	MEC 43y1	3	2	0	2	4
MEC 33y4	Micro Electromechanical Systems (MEMS)	MEC 43y2	3	2	0	2	4
MEC 33y5	Industrial Mechanisms and Robotics	MEC 236 MEC 33y2	3	2	0	2	4
Pool Courses for Elective V, Elective VI							
MEC 43y6	Vehicle System Dynamics and Control	MEC 32y1 MEC 32y2	3	2	0	2	4
MEC 43y7	Hydraulic Servo Control	MEC 32y1 MEC 32y2	3	2	0	2	4
MEC 43y8	Playware Technology	MEC 331	3	2	0	2	4

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

Proposed Study Plan for Mechatronics Engineering

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

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

Level 1- 1													
Code	Course Title	Pre-Req	Cr. Hr.	Ct. Hr.				Final Exam Time	Assessment				
				Lec	Lab	Tut	Sum		SA	MT	PE/ OE	Final Exam	Sum
BES 111	Differential Equations	BES 012	3	2	0	2	4	2 Hr	30	30	-	40	100
MEC 121	Fluid Mechanics	BES 031	3	2	2	1	5	2 Hr	10	30	20	40	100
MEC 111	Kinematics of Machines	BES 022	3	2	1	2	5	2 Hr	30	30	-	40	100
MEC 113	Mechanics and Testing of Materials	MEC 012	3	2	2	1	5	2 Hr	10	30	20	40	100
MEC 123	Materials Science and Engineering	BES 032	3	2	2	0	4	2 Hr	10	30	20	40	100
ELE 103	Electrical Circuits	BES 032	2	1	0	2	3	2 Hr	30	30	-	40	100
MEC 131	Computer Applications	ELE 042	2	1	2	0	2	2 Hr	10	30	20	40	100
Total			19										700

Level 1-2													
Code	Course Title	Pre-Req	Cr. Hr.	Ct. Hr.				Final Exam Time	Assessment				
				Lec	Lab	Tut	Sum		SA	MT	PE/ OE	Final Exam	Sum
BES 113	Mathematics III	BES 012	3	2	0	2	4	2 Hr	30	30	-	40	100
MEC 122	Thermodynamics	BES 031	3	2	1	2	5	2 Hr	10	30	20	40	100
MEC 112	Design of Machine Elements	MEC 113	3	2	3	0	5	2 Hr	10	30	20	40	100
MEC 114	Measurement and Instrumentation	BES 032	2	1	2	1	4	2 Hr	10	30	20	40	100
MEC 116	Manufacturing Technology	MEC 012	2	1	3	0	4	2 Hr	10	30	20	40	100
ELE 104	Electronic Devices and Circuits	ELE 103	2	1	0	2	3	2 Hr	30	30	-	40	100
UHS 104	Professional Ethics		2	2	0	0	2	2 Hr	30	30	-	40	100
Total			17	11	9	7	27						700

Field Training I													
CODE	Course Name	Pre-requisites	Cr. Hrs.	Ct. Hr.				Final Exam Time	Assessment				
				Lect.	Lab.	Tut.	Sum		St. Act.	Mids.	PE/ OE	Final Exam	Sum
FTR 103	Field Training I	Completion of 65 Cr. Hrs.	0	0	0	0	0	Oral	-	-	Pass or Fail	-	-

Level 2- 1													
Code	Course Title	Pre-Req	Cr. Hr.	Ct. Hr.				Final Exam Time	Assessment				
				Lec	Lab	Tut	Sum		SA	MT	PE/ OE	Final Exam	Sum
MEC 211	Project Management	BES 012	3	2	2	0	4	2 Hr	10	30	20	40	100
MEC 221	Heat Transfer	MEC 122	3	2	1	2	5	2 Hr	10	30	20	40	100
MEC 223	Fluid Power Systems	MEC 121	2	1	3	0	4	2 Hr	10	30	20	40	100
MEC 215	Mechanical Design	MEC 113	3	2	3	0	5	2 Hr	10	30	20	40	100
MEC 213	Mechanical Vibrations	BES 022	3	2	2	1	5	2 Hr	10	30	20	40	100
ELE 201	Electric Machinery	ELE 103	2	1	2	0	3	2 Hr	10	30	20	40	100
UHS 3XX	Humanities - Elective I		2	2	0	0	2	2 Hr	30	30	-	40	100
Total			18										700

Level 2- 2													
Code	Course Title	Pre-Req	Cr. Hr.	Ct. Hr.				Final Exam Time	Assessment				
				Lec	Lab	Tut	Sum		SA	MT	PE/ OE	Final Exam	Sum
BES 112	Numerical Analysis	BES 111	3	2	2	0	4	2 Hr	10	30	20	40	100
MEC 232	Introduction to Mechatronics	ELE 104	3	2	2	0	4	2 Hr	10	30	20	40	100
ELE 204	Logic Circuits Design & Applications	ELE 104	3	2	2	0	4	2 Hr	10	30	20	40	100
MEC 236	Industrial Robots	MEC 121	3	2	2	0	4	2 Hr	10	30	20	40	100
MEC 214	Automatic Control Systems	MEC 213	3	2	2	1	5	2 Hr	10	30	20	40	100
BES 141	Pollution and Industrial Safety	BES 041	2	2	1	0	3	2 Hr	10	30	20	40	100
UHS 3XX	Humanities Elective II		2	2	0	0	2	2 Hr	30	30	-	40	100
Total			19										700

Field Training II													
CODE	Course Name	Pre-requisites	Cr. Hrs.	Ct. Hr.				Final Exam Time	Assessment				
				Lect.	Lab.	Tut.	Sum		St. Act.	Mids.	PE/ OE	Final Exam	Sum
FTR 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. Hr.	Ct. Hr.				Final Exam Time	Assessment				
				Lec	Lab	Tut	Sum		SA	MT	PE/ OE	Final Exam	Sum
BES 211	Engineering Statistics and Probability	BES 012	3	2	2	0	4	2 Hr	10	30	20	40	100
MEC 33x1	Elective I		3	2	0	2	4	2 Hr	30	30	-	40	100
MEC 331	Design of Mechatronic Systems	MEC 232	3	2	2	0	4	2 Hr	10	30	20	40	100
ELE 301	Power Electronics	ELE 204	3	2	2	0	4	2 Hr	10	30	20	40	100
MEC 33x2	Elective II		3	2	0	2	4	2 Hr	30	30	-	40	100
MEC 301	Technical Reports		2	1	2	0	3	2 Hr	50	-	50	-	100
UHS 4XX	Humanities Elective III		2	2	0	0	2	2 Hr	30	30	-	40	100
Total			19										700

Level 3- 2

Code	Course Title	Pre-Req	Cr. Hr.	Ct. Hr.				Final Exam Time	Assessment				
				Lec	Lab	Tut	Sum		SA	MT	PE/ OE	Final Exam	Sum
MEC 332	CAD/CAM	MEC 215	3	2	2	0	4	2 Hr	10	30	20	40	100
ELE 404	Digital Control	MEC 214	3	2	0	2	4	2 Hr	30	30	-	40	100
MEC 33x3	Elective III		3	2	0	2	4	2 Hr	30	30	-	40	100
MEC 33x4	Elective IV		3	2	0	2	4	2 Hr	30	30	-	40	100
MEC 302	Senior Design Project I		2	0	4	0	4	-	50	-	50	--	100
MEC 312	Engineering Economics		2	2	0	1	3	2 Hr	30	30		40	100
Total			16										600

Level 4- 1													
Code	Course Title	Pre-Req	Cr. Hr.	Ct. Hr.				Final Exam Time	Assessment				
				Lec	Lab	Tut	Sum		SA	MT	PE/ OE	Final Exam	Sum
MEC 431	Embedded System Design	MEC 214	2	1	2	1	4	2 Hr	10	30	20	40	100
MEC 433	Programmable Logic Controllers	ELE 204	3	2	2	0	4	2 Hr	10	30	20	40	100
MEC 43x5	Elective V		3	2	0	2	4	2 Hr	30	30	-	40	100
MEC 43x6	Elective VI		3	2	0	2	4	2 Hr	30	30	-	40	100
MEC 435	Artificial Intelligence	ELE 404	3	2	2	0	4	2 Hr	10	30	20	40	100
MEC 401	Senior Design Project II	MEC 302	2	0	5	0	5	-	50	-	50	--	100
Total			16										600

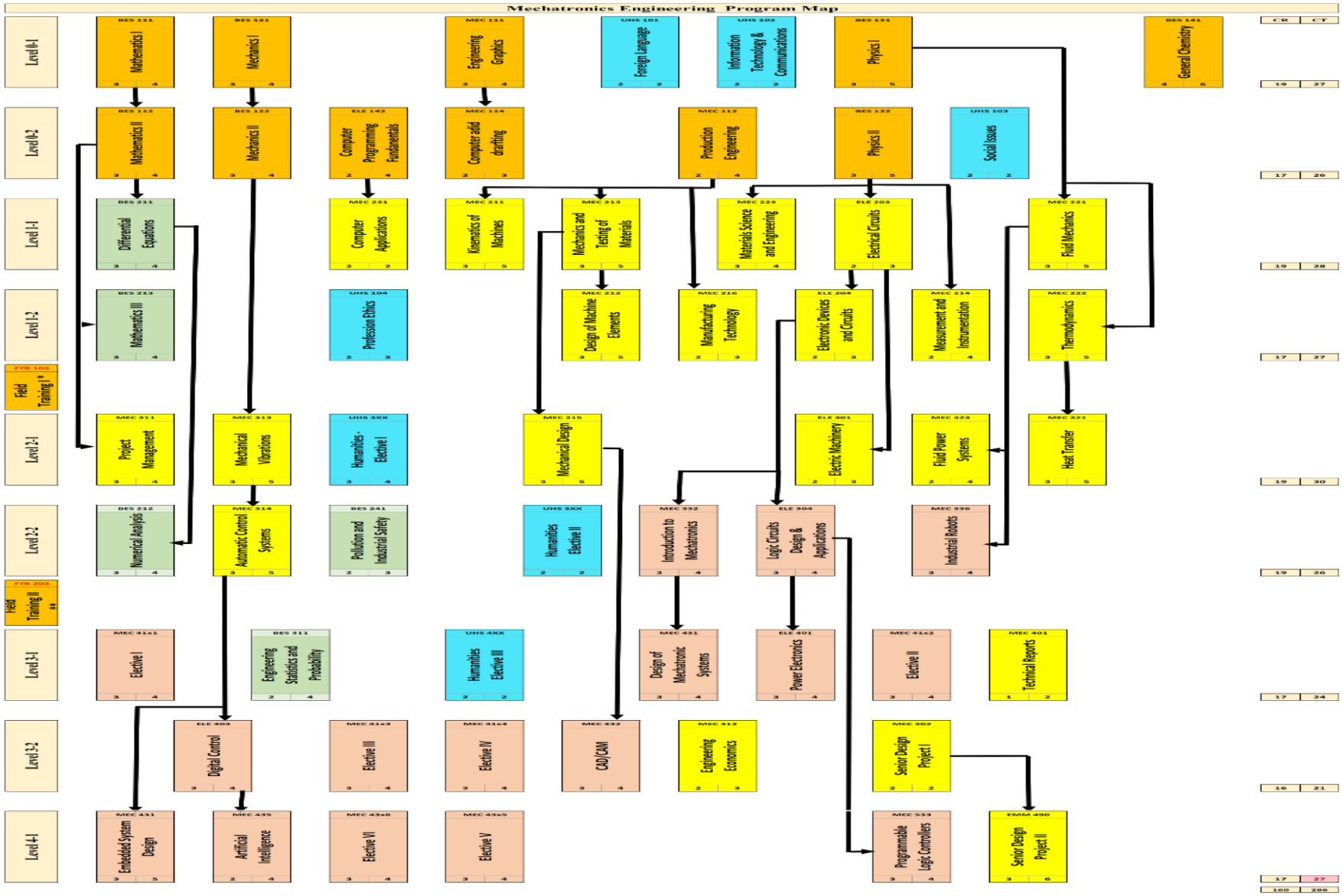
Courses Plan and Matrix

Curriculum Plan for Mechatronics Engineering

Mechanical Engineering - Mechatronics Engineering Program

													CR	CT
Level 0	1	BES 011 Mathematics I 3 4	2	BES 021 Mechanics I 3 4	3	BES 041 General Chemistry 4 6	4	BES 031 Physics I 3 5	5	MEC 011 Engineering Graphics 2 4	6	UHS 101 Foreign Language 2 2	7	UHS 102 Information Technology & Communication 2 2	19	27
	8	BES 012 Mathematics II 3 4	9	BES 022 Mechanics II 3 4	10	MEC 012 Production Engineering 2 4	11	BES 032 Physics II 3 5	12	MEC 014 Computer Aided Drafting 2 3	13	ELE 042 Computer Fundamentals 2 4	14	UHS 103 Societal Issues 2 2	17	26
Level 1	15	BES 111 Differential Equations 3 4	16	MEC 121 Fluid Mechanics 3 5	17	MEC 111 Kinematics of Machines 3 4	18	MEC 113 Mechanics and Testing of Materials 3 5	19	MEC 123 Materials Science and Engineering 3 4	20	ELE 103 Electrical Circuits 2 3	21	MEC 131 Computer Applications 2 3	19	28
	21	BES 113 Mathematics III 3 4	22	MEC 122 Thermodynamics 3 5	23	MEC 114 Measurement and Instrumentation 2 4	24	MEC 112 Design of Machine Elements 3 5	25	MEC 116 Manufacturing Technology 2 3	26	ELE 104 Electronic Devices and Circuits 2 3	27	UHS 104 Profession Ethics 2 2	17	26
	28	FTR 103 Field Training I 0 25														
Level 2	29	MEC 211 Project Management 3 4	30	MEC 221 Heat Transfer 3 5	31	MEC 223 Fluid Power Systems 2 4	32	MEC 215 Mechanical Design 3 5	33	MEC 213 Mechanical Vibrations 3 5	34	ELE 201 Electric Machinery 2 3	35	HS 3XX Humanities - Elective 1 2 2	18	28
	36	BES 112 Numerical Analysis 3 4	37	MEC 214 Automatic Control Systems 3 5	38	MEC 232 Introduction to Mechatronics 3 4	39	ELE 204 Logic Circuits Design & Applications 3 4	40	MEC 236 Industrial Robots 3 4	41	BES 141 Pollution and Industrial Safety 2 3	42	HS 304 Legalisation & Human Rights 2 2	19	26
	43	FTR 203 Field Training II 0 25														
Level 3	44	BES 211 Engineering Statistics and Probability 3 4	45	MEC 33x1 Elective I 3 4	46	MEC 331 Design of Mechatronic Systems 3 4	47	ELE 301 Power Electronics 3 4	48	MEC 33x2 Elective II 3 4	49	MEC 301 Technical Reports 2 3	50	HS 4XX Humanities Elective 2 2 2	19	25
	51	MEC 332 CAD/CAM 3 4	52	ELE 404 Digital Control 3 4	53	MEC 33x3 Elective III 3 4	54	MEC 33x4 Elective IV 3 4	55	MEC 312 Engineering Economics 2 3	56	MEC 302 Senior Design Project I 2 4			16	23
Level 4	57	MEC 431 Embedded System Design 2 4	58	MEC 433 Programmable Logic Controllers 3 4	59	MEC 43x5 Elective V 3 4	60	MEC 43x6 Elective VI 3 4	61	MEC 435 Artificial Intelligence 3 4	62	MEC 401 Senior Design Project II 2 5			16	25
		Basic Science 30 43				University Req. 14 14		Faculty Req. 32 100		Mechatronics Program 48 72		Mech. Engineering 66 97		Electives 24 30	160	234
	Required	33.6				12.8		32		48		56		24	182.4	

Mechatronics Engineering Flowchart



Program Learning Outcomes to Program Courses Matrix

		Courses		PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12	PLO13	PLO14	PLO15	PLO16	PLO17	PLO18	PLO19
Level 0	Semester 1	BES 111	Mathematics I	●		●																
		BES 121	Mechanics I	●	●																	
		BES 141	General Chemistry	●	●																	
		BES 131	Physics I	●	●																	
		MEC 111	Engineering Graphics						●		●											
		UHS 101	Foreign Language								●		●									
		UHS 102	Information and Communication Technology				●						●									
	Semester 2	BES 112	Mathematics II	●		●																
		BES 122	Mechanics II	●	●																	
		MEC 112	Production Engineering				●		●													
		BES 132	Physics II	●	●																	
		MEC 114	Computer Aided Drafting				●					●										
		ELE 142	Computer Programming Fundamentals	●		●																
		UHS 103	Societal Issues							●			●									
Level 1	Semester 3	BES 211	Differential Equations	●	●																	
		MEC 221	Fluid Mechanics	●	●									●		●						
		MEC 211	Kinematics of Machines											●	●	●						
		MEC 213	Mechanics and Testing of Materials		●									●								
		MEC 223	Materials Science and Engineering											●	●							
		ELE 203	Electrical Circuits	●														●	●			
		MEC 231	Computer Applications		●										●							
	Semester 4	BES 213	Mathematics III	●	●																	
		MEC 222	Thermodynamics	●	●									●	●							
		MEC 212	Design of Machine Elements			●					●				●	●	●					
		MEC 214	Measurement and Instrumentation		●										●		●					
		MEC 216	Manufacturing Technology	●										●		●						
		ELE 204	Electronic Devices and Circuits		●		●											●	●	●		
		UHS 104	Profession Ethics				●	●														
		FTR 103	Field Training I							●			●									

Level 2	Semester 5	MEC 311	Project Management								●	●			●						
		MEC 321	Heat Transfer	●	●									●		●					
		MEC 323	Fluid Power Systems	●	●									●		●					
		MEC 315	Mechanical Design			●					●			●	●		●				
		MEC 313	Mechanical Vibrations	●	●									●	●						
		ELE 301	Electric Machinery		●													●	●		
		UHS 3XX	Humanities - Elective I			●	●														
	Semester 6	BES 212	Numerical Analysis	●	●																
		MEC 332	Introduction to Mechatronics																	●	●
		ELE 304	Logic Circuits Design & Applications															●		●	
		MEC 336	Industrial Robots																	●	●
		MEC 314	Automatic Control Systems											●	●						
		BES 241	Pollution and Industrial Safety	●		●	●														
		UHS 3XX	Humanities Elective II							●	●										
		FTR 203	Field Training II						●			●									
Level 3	Semester 7	BES 311	Engineering Statistics and Probability	●	●																
		MEC 41x1	Elective I																	●	●
		MEC 431	Design of Mechatronic Systems														●			●	●
		ELE 401	Power Electronics															●		●	
		MEC 41x2	Elective II															●			●
		MEC 401	Technical Reports						●		●	●									
		UHS 4XX	Humanities Elective III					●					●								
	Semester 8	MEC 432	CAD/CAM											●		●		●			
		ELE 404	Digital Control															●	●		
		MEC 41x3	Elective III																	●	●
		MEC 41x4	Elective IV											●				●		●	
		MEC 402	Senior Design Project I						●		●										
		MEC 412	Engineering Economics						●		●										
Level 4	Semester 9	MEC 431	Embedded System Design																	●	●
		MEC 533	Programmable Logic Controllers															●	●		
		MEC 43x5	Elective V															●		●	
		MEC 43x6	Elective VI																	●	●
		MEC 435	Artificial Intelligence																	●	●
		MEC 501	Senior Design Project II						●		●										

Matching Mechatronics Engineering Program Courses with ABET Requirements

Mechanical and Similarly Named Engineering Programs

Lead Society: American Society of Mechanical Engineers

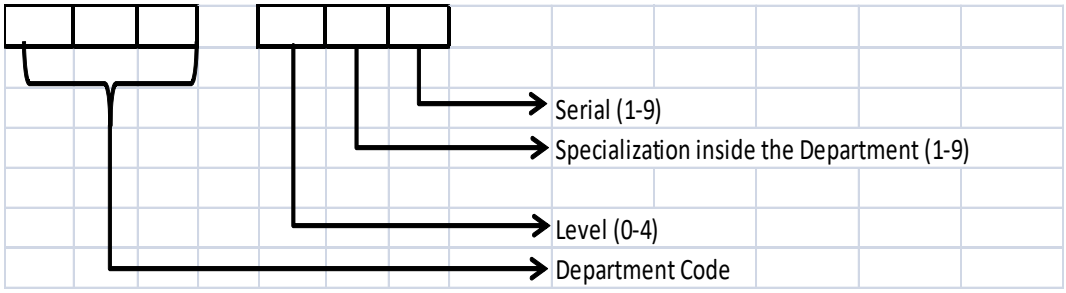
Mechatronics Engineering Program Courses Required to Cover ABET Criteria				
ABET Criteria		**CODE**	**Course Name**	**Cr. Hrs.**
A minimum of 30 semester credit hours (or equivalent) of a combination of college-level mathematics and basic sciences with experimental experience appropriate to the program.	basic science, and mathematics (including multivariate calculus and differential equations);	BES 011	Mathematics I	3
		BES 012	Mathematics II	3
		BES 113	Mathematics III	3
		BES 111	Differential Equations	3
		BES 112	Numerical Analysis	3
		BES 211	Engineering Statistics and Probability	3
	principles of engineering	BES 041	General Chemistry	4
		BES 021	Mechanics I	3
		BES 022	Mechanics II	3
		BES 141	Pollution and Industrial Safety	2
		BES 031	Physics I	3
		BES 032	Physics II	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.	applications of these topics to modeling, analysis, design, and realization of physical systems, components or processes.	MEC 011	Engineering Graphics	2
		MEC 012	Production Engineering	2
		MEC 014	Computer Aided Drafting	2
		MEC 111	Kinematics of Machines	3
		MEC 112	Design of Machine Elements	3
		MEC 116	Manufacturing Technology	2
		MEC 123	Materials Science and Engineering	3
		MEC 215	Mechanical Design	3
		MEC 131	Computer Applications	2
	coverage of both thermal	MEC 122	Thermodynamics	3

	and mechanical systems.	MEC 223	Fluid Power Systems	2
		MEC 121	Fluid Mechanics	3
		MEC 221	Heat Transfer	3
		MEC 114	Measurement and Instrumentation	2
		MEC 213	Mechanical Vibrations	3
		MEC 214	Automatic Control Systems	3
	in-depth coverage of either thermal or mechanical systems.	MEC 232	Introduction to Mechatronics	3
		MEC 236	Industrial Robots	3
		MEC 33x1	Elective I	3
		MEC 331	Design of Mechatronic Systems	3
		MEC 33x2	Elective II	3
		MEC 431	Embedded System Design	2
		MEC 332	CAD/CAM	3
		MEC 33x3	Elective III	3
		MEC 33x4	Elective IV	3
		MEC 43x5	Elective V	3
		MEC 43x6	Elective VI	3
		MEC 435	Artificial Intelligence	3
		MEC 433	Programmable Logic Controllers	3
	Explain basic concepts in project management, business, public policy, and leadership.	MEC 301	Technical Reports	2
		MEC 312	Engineering Economics	2
		MEC 211	Project Management	3
		UHS 103	Societal Issues	2
		UHS 3XX	Humanities Elective I	2
		UHS 3XX	Humanities Elective II	2
		UHS 4XX	Humanities Elective III	2
	Analyze issues in professional ethics and explain the importance of professional licensure.	UHS 104	Professional Ethics	2
Total				**96**

Courses offered to Mechanical Engineering Programs

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

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



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

1. Design and Production Engineering Program.
4. Mechanical Power Engineering Program.
5. Mechatronic Engineering Program

code	Specialization
MEC x1x	Course offered by Mechanical Engineering Department/ Mechanical Design & Production Program
MEC x2x	Course offered by Mechanical Engineering Department/ Mechanical Power Program
MEC x3x	Course offered by Mechanical Engineering Department/ Mechatronics Program
MEC x0x	Technical Report and Graduation Project I & II

The following abbreviations are the legend for the courses:

CH Credit Hour
Lec Lectures
Tut Tutorials
Lab Laboratory
Tot Total
UHS University Requirement
MT Mid-Term Exam
SA Student Activity
PE /OE Practical Exam/ Oral Exam
Final Final Exam

Code	Course Title	Pre-req	CH	Ct. Hr.				Assessment Criteria			
				Lec.	Lab	Tut	Sum	ST	MT	PE/OE	Final
MEC 111	Kinematics of Machines	BES 022	3	2	0	2	4	30	30	-	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										
Used in Program	All Mechanical Department Programs						Semester	3			

Code	Course Title	Pre-req	CH	Ct. Hr.				Assessment Criteria			
				Lec.	Lab	Tut	Sum	ST	MT	PE/OE	Final
MEC 113	Mechanics and Testing of Materials	MEC 012	3	2	2	1	5	10	30	20	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										
Used in Program	All Mechanical Department Programs						Semester	3			

Code	Course Title	Pre-req	CH	Ct. Hr.				Assessment Criteria			
				Lec.	Lab	Tut	Sum	ST	MT	PE/OE	Final
MEC 112	Design of Machine Elements	MEC 113	3	2	3	0	5	10	30	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										
Used in Program	All Mechanical Department Programs						Semester	3			

Code	Course Title	Pre-req	CH	Ct. Hr.				Assessment Criteria			
				Lec.	Lab	Tut	Sum	ST	MT	PE/OE	Final
MEC 114	Measurement and Instrumentation	BES 032	2	1	2	1	4	10	30	20	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										
Used in Program	All Mechanical Department Programs						Semester	4			

Code	Course Title	Pre-req	CH	Ct. Hr.				Assessment Criteria			
				Lec.	Lab	Tut	Sum	ST	MT	PE/OE	Final
MEC 116	Manufacturing Technology	MEC 012	2	1	2	0	3	10	30	20	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

Used in Program	All Mechanical Department Programs	Semester	3

Code	Course Title	Pre-req	CH	Ct. Hr.				Assessment Criteria			
				Lec.	Lab	Tut	Sum	ST	MT	PE/OE	Final
MEC 121	Fluid Mechanics	BES 031	3	2	2	1	5	10	30	20	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										
Used in Program	All Mechanical Department Programs			Semester	3						

Code	Course Title	Pre-req	CH	Ct. Hr.				Assessment Criteria			
				Lec.	Lab	Tut	Sum	ST	MT	PE/OE	Final
MEC 122	Thermodynamics	BES 031	3	2	1	2	5	10	30	20	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.										
Used in Program	All Mechanical Department Programs						Semester	4			

Code	Course Title	Pre-req	CH	Ct. Hr.				Assessment Criteria			
				Lec.	Lab	Tut	Sum	ST	MT	PE/OE	Final
MEC 123	Materials Science and Engineering	BES 032	3	2	2	0	4	10	30	20	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										
Used in Program	All Mechanical Department Programs						Semester	3			

Code	Course Name	Pre-req.	CH	Ct. Hr.				Assessment Criteria			
				Lec	Lab	Tut	Sum	SA	MT	PE/OE	Final
MEC 128	Thermal Power Engineering		2	2	0	1	3	30	30	0	40
Course Contents	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).										
References	• Yunus A.Cengel Michael A.Boles, 2014, "Thermodynamics An Engineering Approach", McGrawHill Education; 8th edition.										

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

Code	Course Title	Pre-req	CH	Ct. Hr.				Assessment Criteria			
				Lec.	Lab	Tut	Sum	ST	MT	PE/OE	Final
MEC 211	Project Management	BES 012	3	2	2	0	4	10	30	20	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 levelingand 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.										
Laboratory	Students will solve lecture problems and sheet problems in the computer Lab using Primavera software. Additionally at the end of the course, Each group of five students will plan and analyze a real life mini-project in the computer Lab using Primavera software and provide a Power Point presentation for oral discussion.										
Used in Program	All Mechanical Department Programs						Semester	5			

Code	Course Title	Pre-req	CH	Ct. Hr.				Assessment Criteria			
				Lec.	Lab	Tut	Sum	ST	MT	PE/OE	Final
MEC 212	Metal Cutting Processes	MEC 012	3	2	2	0	4	10	30	20	40
Course Content	Analysis of metal cutting, mechanism of chip formation, mechanics of metal cutting, experimental and theoretical determination of cutting forces, dynamometer, thermal aspects of metal cutting – tool materials, tool wear, tool life and machinability – mechanics of grinding, surface quality and dimensional control. Introduction to the theory of metal cutting, tool geometry (definitions, reference planes, geometry of single point tools, twist drills and milling cutters), Tool materials (types and applications), Chip formation (types of chips, built up edge BUE, chip compression ratio, determination of shear angle and shear strain), Mechanics of metal cutting (merchant's analysis, factors affecting cutting forces).										
References	• B. L. Juneja, "Fundamentals of Metal Cutting and Machine Tools", New Age International, 2003										
Laboratory	• Study of Tool Geometry • Study of various conventional machining processes • Experiment to Find Shear Angle • Chip Thickness Analysis • Cutting forces in orthogonal cutting • Experiment on a Drilling Tool Dynamometer • Study of Unconventional Forming										
Used in Program	Mechanical Design & Production Program						Semester	6			

Code	Course Title	Pre-req	CH	Ct. Hr.				Assessment Criteria			
				Lec.	Lab	Tut	Sum	ST	MT	PE/OE	Final
MEC 213	Mechanical Vibrations	BES 022	3	2	2	1	5	10	30	20	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										
Used in Program	All Mechanical Department Programs						Semester	5			

Code	Course Title	Pre-req	CH	Ct. Hr.				Assessment Criteria			
				Lec.	Lab	Tut	Sum	ST	MT	PE/OE	Final
MEC 214	Automatic Control Systems	MEC 213	3	2	2	1	5	10	30	20	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										
Used in Program	All Mechanical Department Programs						Semester	6			

Code	Course Title	Pre-req	CH	Ct. Hr.				Assessment Criteria			
				Lec.	Lab	Tut	Sum	ST	MT	PE/OE	Final
MEC 215	Mechanical Design	MEC 113	3	2	3	0	5	10	30	20	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 from MEC212 and MEC315, 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.										
Used in Program	All Mechanical Department Programs						Semester	5			

Code	Course Title	Pre-req	CH	Ct. Hr.				Assessment Criteria			
				Lec.	Lab	Tut	Sum	ST	MT	PE/OE	Final
MEC 216	Computer Aided Design	MEC 112	3	2	2	0	4	10	30	20	40
Course Content	Introduction to basic concepts of CAD/CAE – role of computers in synthesis and analysis – geometry description – parametric and feature-based design – geometric modeling: wireframe, surface and solid modeling (CSG & B-Rep) – curves and surfaces in modeling (Bezier and Splines interpolation curves) – computer graphics; transformations; constraints; clipping and windowing – design optimization – introduction to finite element method – application of FEA to stress analysis – applications of CAD – Individual projects.										
References	• Chinyere Okechi Onwubiko, "Foundations of Computer-Aided Design", West Group; 21st edition (March 1, 1989).										
Laboratory	The Laboratory has the following section: • Engineering graphics using C++/MATLAB or other programming language. • Transformation of objects in plane and space • Geometric Modeling • Finite Element Analysis • Rapid Prototyping										
Used in Program	Mechanical Design & Production Program						Semester	6			

Code	Course Title	Pre-req	CH	Ct. Hr.				Assessment Criteria			
				Lec.	Lab	Tut	Sum	ST	MT	PE/OE	Final
MEC 218	Material Engineering	MEC 123	3	2	2	0	4	10	30	20	40
Course Content	Ceramics – composite materials – polymeric materials – quantitative material selection – materials for low temperature applications – selection of materials to satisfy mechanical requirements including the concept of cost per unit property – experimental methods for physical examination of metals – plastic deformation, work hardening and fracture – diffusion – precipitation – martensitic transformation – new trends in materials technology (Nanomaterials).										
References	• William D. Callister, David G. Rethwisch, "Materials science and engineering: An introduction", 9th Ed. John Wiley and Sons, Inc., 2013.										
Laboratory	The Laboratory has the following section: • Find out the hardenability of steels by Jominy End Quench Test. • Find out the hardness of various treated and untreated steels. • Study of Microstructure of Composite Material subjected to tensile testing • Study of the Composite Material • Join the sheets using Ultrasonic Joining process										
Used in Program	Mechanical Design & Production Program						Semester	6			

Code	Course Title	Pre-req	CH	Ct. Hr.				Assessment Criteria			
				Lec.	Lab	Tut	Sum	ST	MT	PE/OE	Final
MEC 221	Heat Transfer	MEC 122	3	2	1	2	5	10	30	20	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										
Used in Program	All Mechanical Department Programs					Semester	5				

Code	Course Title	Pre-req	CH	Ct. Hr.				Assessment Criteria			
				Lec.	Lab	Tut	Sum	ST	MT	PE/OE	Final
MEC 222	Applied Thermodynamics	MEC 122	3	2	2	0	4	10	30	20	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", McGraw-Hill Education; 8th edition.										
Laboratory	• Simulation work and virtual laboratories of power plants and cycles.										
Used in Program	Mechanical Power Engineering program						Semester	6			

Code	Course Title	Pre-req	CH	Ct. Hr.				Assessment Criteria			
				Lec.	Lab	Tut	Sum	ST	MT	PE/OE	Final
MEC 223	Fluid Power Systems	MEC 121	2	1	3	0	4	10	30	20	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										
Used in Program	All Mechanical Department Programs						Semester	5			

Code	Course Title	Pre-req	CH	Ct. Hr.				Assessment Criteria			
MEC 224	Fluid Dynamics	MEC 121	3	Lec.	Lab	Tut	Sum	ST	MT	PE/OE	Final
				2	2	0	4	10	30	20	40
Course Content	Compressible flow: Speed of sound, Wave propagation, Mach number and Mach angle, Isentropic flow with area change, Stagnation, and sonic conditions. Shock waves: Stationary normal shock waves, Moving normal shock waves, Oblique shock waves. Flow in converging - diverging nozzles. One dimensional adiabatic flow with friction (Fanno flow). One dimensionl flow with heat transfer (Raleigh flow).										
References	• Robert D. Zucker, Oscar Biblarz, 2019, "Fundamentals of Gas Dynamics", 3rd Edition, Wiley.										
Laboratory	• Determination of Mach number with supersonic flow using supersonic wind tunnel • Supersonic shock and flow visualization of normal and oblique shocks • Supersonic probes: measurement of internal wall losses										
Used in Program	Mechanical Power Engineering program						Semester	6			

Code	Course Title	Pre-req	CH	Ct. Hr.				Assessment Criteria			
MEC 226	Refrigeration	MEC 122	3	Lec.	Lab	Tut	Sum	ST	MT	PE/OE	Final
				2	2	0	4	10	30	20	40
Course Content	Introduction to refrigeration and Refrigeration machines - Ideal and actual Vapor - compression refrigeration cycle - Refrigerants - Vapor refrigeration cycles (Single and multi-stage) - Vapor absorption systems - Gas refrigeration cycles - Thermoelectric refrigeration systems - Lubricants in refrigeration systems - Expansion devices.										
References	R.S. Khurmi and J. K. Gupta, 1992, "A textbook 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 Vapor Compression Refrigeration System • Performance Test General Cycle Refrigeration Trainer • Computer controlled refrigeration system										
Used in Program	Mechanical Power Engineering program						Semester	**6**			

Code	Course Name	Pre-req.	CH	Ct. Hr.				Assessment Criteria			
				Lec	Lab	Tut	Sum	SA	MT	PE/OE	Final
MEC 228	Power Station	MEC 128	3	2	0	2	4	30	30	-	40
Course Contents	Introduction – classification of power stations – steam power stations (Improvement of Rankine cycle efficiency, main and auxiliary systems) – gas turbine power stations (theory, components, applications, water injection) – combined cycle power stations – cogeneration – hydraulic power stations – diesel stations. Load Frequency Characteristics, Speed Regulation, Parallel Operation, Lubrication Systems, Protection and Tripping Systems, Start-Up and Shut Down Procedures. Energy storage – Economics of power stations.										
References	• El-Wakil M. M., Power Plant Technology, McGraw Hill, 1984 • Gill A. B., Power Plant Performance, Butterworth, 1984										
Used in Program	Electrical Power and Machines Engineering Program							Semester			

Code	Course Title	Pre-req	CH	Ct. Hr.				Assessment Criteria			
				Lec.	Lab	Tut	Sum	ST	MT	PE/OE	Final
MEC 232	Introduction to Mechatronics	ELE 104	3	2	2	0	4	10	30	20	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										
Used in Program	Mechatronics Engineering Program							Semester	6		

Code	Course Title	Pre-req	CH	Ct. Hr.				Assessment Criteria			
				Lec.	Lab	Tut	Sum	ST	MT	PE/OE	Final
MEC 236	Industrial Robots	MEC 121	3	2	2	0	4	10	30	20	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										
Used in Program	Mechatronics Engineering Program						Semester	6			

Code	Course Title	Pre-req	CH	Ct. Hr.				Assessment Criteria			
				Lec.	Lab	Tut	Sum	ST	MT	PE/OE	Final
MEC 251	Mechanical Engineering	MEC 012	2	2	0	1	3	30	30	--	40
Course Content	Fluid Mechanics: Fluid properties and basic concepts - Fluid static (pressure at a point, basic equation for pressure field, measurement of pressure) - fluid flow rate and mass conservation. Thermodynamics: Definitions and basic concepts - Properties of pure substances (pure substance, phase change process, properties diagram and tables, ideal gas) - First law of thermodynamics (closed system, open systems, applications) thermodynamics (Heat engines, heat pump air conditioning and refrigerators). Heat Transfer: Introduction to Heat Transfer- Modes of heat transfer (conduction, convection, radiation) - One dimensional steady heat conduction – Extended surfaces - Introduction to convection heat transfer (Free and forced)- Heat exchangers.										
References	• Frank M white, Fluid Mechanics, 8th edition 2015 • Yunus A.Cengel Michael A.Boles, 2014, “Thermodynamics An Engineering Approach”, McGraw Hill Education; 8th edition										
Used in Program	Biomedical Engineering Program						Semester	6			

Code	Course Title	Pre-req	CH	Ct. Hr.				Assessment Criteria			
				Lec.	Lab	Tut	Sum	ST	MT	PE/OE	Final
MEC 301	Technical Reports	-	2	1	2	0	3	50	-	50	-
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.										
Used in Program	All Mechanical Department Programs						Semester	7			

Code	Course Title	Pre-req	CH	Ct. Hr.				Assessment Criteria			
				Lec.	Lab	Tut	Sum	ST	MT	PE/OE	Final
MEC 311	Advanced Machining Processes	MEC 214	3	2	2	0	4	10	30	20	40
Course Content	Introduction – processes classification – thermal nontraditional techniques (EDM, EBM & PAC) – mechanical processes (USM, WJM & AJM) – electrochemical machining (ECM, ECG & ECD) – chemical machining – laser industrial applications (cutting, welding & heat treatment) – combinations of various processes – process selection – competitive aspects and economics of manufacturing – modeling and optimization of non-traditional machining processes.										
References	Vijay Kumar Jain, "Advanced Machining Processes", Allied Publishers; 1st edition, 2009.										
Laboratory	The Laboratory has the following section: • Computer Numerical Controlled (CNC) Milling Machine. • Computer Numerical Controlled (CNC) lathe machine • Weld-deposition based Additive Manufacturing Facility										
Used in Program	Mechanical Design & Production Program						Semester	7			

Code	Course Title	Pre-req	CH	Ct. Hr.				Assessment Criteria			
				Lec.	Lab	Tut	Sum	ST	MT	PE/OE	Final
MEC 313	Computer-Aided Manufacturing	MEC 212	3	2	2	0	4	10	30	20	40
Course Content	Fundamentals of CAM – Introduction to NC Machine Tools – Specifications – Automated manufacturing Systems (NC, CNC, DNC, AC) – Classification of NC Machine Systems – Manual part Programming – Computer-Aided Part Programming & post-processors – trajectory interpolators – fundamentals of rapid prototyping and automated fabrication – CAPP – DFA & DFM – Applications programs will be written and interfaced to the CAD/CAM database.										
References	• Radhakrishnan.P, Subramanyan.S and Raju.V, "CAD/CAM/CIM", New Age International Publishers, 2nd edition 2008.										
Laboratory	• Students participate in a manufacturing project which utilizes CAD/CAM software to design and manufacture a component using CNC machining equipment.										
Used in Program	Mechanical Design & Production Program						Semester	8			

Code	Course Title	Pre-req.	CH	Ct. Hr.				Assessment			
				Lec.	Lab.	Tut.	Sum	SA	MT	PE/OE	Final
MEC 312	Engineering Economics	-	2	2	-	1	3	30	30	--	40
Course Contents	Principles of Economics, Economical Analysis, Cost estimation, Comparison between alternatives, Present worth method, Future worth, Depreciation, Taxes, Inflation, Risk and uncertainty, Introduction to Engineering cost analysis and budgeting.										
References	N. Gregory Mankiw, Euston Quah and Peter Wilson, "Principles of Economics", Delmar, Cengage Learning, - 2020, An Asian Edition, ISBN-13: 978-981-4227-87-2										

Code	Course Title	Pre-req	CH	Ct. Hr.				Assessment Criteria			
				Lec.	Lab	Tut	Sum	ST	MT	PE/OE	Final
MEC 314	Robotics and Robot Control	MEC 214	3	2	2	0	4	10	30	20	40
Course Content	Introduction to control methods of robotics applications. Kinematics analysis of planar robotic arms. Spatial robots, rotation representations, Euler angles, homogeneous transformation, Denavit Hartenberg notations, forward and inverse kinematics, Jacobian matrix, singularities. Trajectory planning. Dynamics analysis of industrial robots: joint space dynamics, Newton-Euler algorithm, inertia tensor, Lagrange equations, inverse, and forward dynamics. Control: computed torque techniques, joint space control, PD control stability, trajectory tracking.										
References	• Jadran Lenarcic and Federico Thomas, Advances in Robot Kinematics: Theory and Applications, Kluwer Academic Publishers, 2002. • Craig, J.,2005, "Introduction to Robotics: Mechanics and Control", 3rd edition, by Addison-Wesley Publishing Company, Inc.										
Laboratory	• Determine the working space of planar robot using simulation tools • Kinematic modeling of various models of industrial robots. • Solve and implement the IKPM of educational robot in LAB. • Solve and implement the IKVM of educational robot. • Solve and implement the IDM of educational robot.										
Used in Program	Mechanical Design & Production Program						Semester	8			

Code	Course Title	Pre-req	CH	Ct. Hr.				Assessment Criteria			
				Lec.	Lab	Tut	Sum	ST	MT	PE/OE	Final
MEC 316	Operations Research	MEC 211	3	2	0	2	4	30	30	--	40
Course Content	An introduction to the philosophy of operations research – Formulation of linear programming models and their solution (graphical and simplex methods) – Duality theory – Transportation model – assignment – network models – critical path methods, projects evaluation review technique (PERT) – Sensitivity analysis – Integer programming, branch-and-bound – Use of LP and IP computer software programs.										
References	• Hamdy A. Taha, "Operations Research: An Introduction", 10th Edition, Pearson Inc.										
Used in Program	Mechanical Design & Production Program						Semester	8			

Code	Course Title	Pre-req	CH	Ct. Hr.				Assessment Criteria			
				Lec.	Lab	Tut	Sum	ST	MT	PE/OE	Final
MEC 322	Internal Combustion Engines	MEC 222	3	2	2	0	4	10	30	20	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, • Identification and recognition of different parts gasoline engine (SI) • Investigate the function of glow plug on a live diesel engine testbed • 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										
Used in Program	Mechanical Power Engineering Program			Semester	8						

Code	Course Title	Pre-req	CH	Ct. Hr.				Assessment Criteria			
				Lec.	Lab	Tut	Sum	ST	MT	PE/OE	Final
MEC 323	Combustion	MEC 222	3	2	2	0	4	10	30	20	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, flashand 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										
Used in Program	Mechanical Power Engineering program						Semester	7			

Code	Course Title	Pre-req	CH	Ct. Hr.				Assessment Criteria			
				Lec.	Lab	Tut	Sum	ST	MT	PE/OE	Final
MEC 324	Power System Components	MEC 222	3	2	2	0	4	10	30	20	40
Course Content	Introduction and overview, Energy system components and configuration, Thermal performance evaluation, Physical modeling of transport qualities and governing equations, Modeling methods and algorithms, Thermal design of: Steam generators, Heat exchangers, Compressors, Steam Turbines, Pumps, Facilities phase change, Computer-aided design software with application of energy facilities. References.										
References	• Pradip Majumdar, 2021, "Design of Thermal Energy Systems", Wiley. • Steven G Penoncello, 2018, "Thermal Energy Systems: Design and Analysis", CRC Press • Stultz S. C. and Kitto J. B., Steam: Its Generation and Use, 41 ST Edition										
Laboratory	• Design and simulation of Steam generation using EES Program • Design and simulation of Chilled Water-Cooling Coil using EES Program • Optimization Analysis Models • Parametric Representation of Thermal Parameters and Properties • Optimization process for Heat Exchanger Design										
Used in Program	Mechanical Power Engineering Program			Semester	8						

Code	Course Title	Pre-req	CH	Ct. Hr.				Assessment Criteria			
				Lec.	Lab	Tut	Sum	ST	MT	PE/OE	Final
MEC 325	Air Conditioning	MEC 222	3	2	2	0	4	10	30	20	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 textbook of refrigeration and air conditioning"										
Laboratory	Heating, cooling, humidification, dehumidification processes using practical software. Simulation of Controlling devices in air conditioning system.										
Used in Program	Mechanical Power Engineering program			Semester	**7**						

Code	Course Title	Pre-req	CH	Ct. Hr.				Assessment Criteria			
				Lec.	Lab	Tut	Sum	ST	MT	PE/OE	Final
MEC 331	Design of Mechatronic Systems	MEC 232	3	2	2	0	4	10	30	20	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.										
Used in Program	Mechatronics Engineering Program						Semester	7			

Code	Course Title	Pre-req	CH	Ct. Hr.				Assessment Criteria			
				Lec.	Lab	Tut	Sum	ST	MT	PE/OE	Final
MEC 332	CAD/CAM	MEC 215	3	2	2	0	4	10	30	20	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.										
Used in Program	Mechatronics Engineering Program						Semester	8			

Code	Course Title	Pre-req	CH	Ct. Hr.				Assessment Criteria			
MEC 411	Materials Handling	MEC 313	3	Lec.	Lab	Tut	Sum	ST	MT	PE/OE	Final
				2	3	0	5	10	30	20	40
Course Content	Introduction to tool and die design – Basic types and functions of jigs and fixtures (modular, assembly, welding, inspection, and machining fixtures) – Proper supporting, locating principles, and clamping features of jigs and fixtures – Conceptual design of jigs and fixtures (for drilling, reaming, milling, turning, boring etc.) – Different types of dies and their purpose – The steps to design a die – Different types of presses and press accessories – Considerations of design economics.										
References	• N. Rudenko, A. Troitsky,1970," Materials Handling Equipment", Central Books Ltd; 2Rev Ed edition.										
Laboratory	• Course project and training on design methodologies for the various components under study during the course in computer-aided design laboratories. • Developing and conducting a preventive maintenance program for materials handling equipment.										
Used in Program	Mechanical Design & Production Program						Semester	9			

Code	Course Title	Pre-req	CH	Ct. Hr.				Assessment Criteria			
MEC 413	Production Aids Design	MEC 216	3	Lec.	Lab	Tut	Sum	ST	MT	PE/OE	Final
				2	2	0	4	10	30	20	40
Course Content	Introduction to tool and die design – Basic types and functions of jigs and fixtures (modular, assembly, welding, inspection, and machining fixtures) – Proper supporting, locating principles, and clamping features of jigs and fixtures – Conceptual design of jigs and fixtures (for drilling, reaming, milling, turning, boring etc.) – Different types of dies and their purpose – The steps to design a die – Different types of presses and press accessories – Considerations of design economics.										
References	• Joshi, Prakash Hiralal. 2010. Jigs and Fixtures. 3rd ed. New York: McGraw Hill Education Limited.										
Laboratory	Training on design methodologies for the various components under study during the course in computer-aided design laboratories.										
Used in Program	Mechanical Design & Production Program						Semester	9			

Code	Course Title	Pre-req	CH	Ct. Hr.				Assessment Criteria			
MEC 415	Machine Tool Design	MEC 311	2	Lec.	Lab	Tut	Sum	ST	MT	PE/OE	Final
				1	2	1	4	10	30	20	40
Course Content	General requirements of machine tools and performance nomograms – Standardization of spindle speeds and feet rates – Layout of speed change gears (application for design of machine tools gear boxes) – Design of constructional elements (Frames, Sideways, Spindles and bearings, Cutting, Feed and Control drives) - Hydraulic drives – Vibrations in machine tools.										
References	• N. Acherkan, 2000,"Machine Tool Design", University Press of the Pacific.										
Laboratory	Training on design methodologies for the various components under study during the course, in computer-aided design laboratories										
Used in Program	Mechanical Design & Production Program						Semester	9			

Code	Course Title	Pre-req	CH	Ct. Hr.				Assessment Criteria			
				Lec.	Lab	Tut	Sum	ST	MT	PE/OE	Final
MEC 421	Control Application for Energy Systems	MEC 214	3	2	2	1	5	10	30	20	40
Course Content	Process control principles and applications, sensors, and actuators. signal conditioning circuits: filters, instrumentation amplifiers and power circuits. Dynamics and control of real processes: heat exchangers, boilers, internal combustion engines, turbines, HVAC systems. Experimental and Industrial control system design, P, PI, PID control design of mechanical power systems. Experimental frequency response. Steam temperature control, Supervisory predictive control of a combined cycle thermal power plant. Multivariable power plant control.										
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										
Used in Program	Mechanical Power Engineering Program						Semester	9			

Code	Course Title	Pre-req	CH	Ct. Hr.				Assessment Criteria			
				Lec.	Lab	Tut	Sum	ST	MT	PE/OE	Final
MEC 423	Turbomachinery	MEC 221	3	2	2	0	4	10	30	20	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: General selection criteria and charts - Machines in series, Machines in parallel –Thermal and hydraulic design and analysis of pumps, fans, turbines and compressors – Selection & Installation requirements as per Manufacturer's Catalogues (air compressors, domestic water pumps, chilled water pumps, centrifugal fans, axial fans, etc.) - Vibration and Noise problems and solutions – control of turbomachinery in various application - best practices in operation - Maintenance – Troubleshooting.										
References	• Fundamentals of Turbo machinery William W. Peng Wiley • Hydraulic and compressible flow turbomachiners. A Sayers 1990. • Basic Fluid Mechanics and Fluid Machines Husain el al, 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)										
Used in Program	Mechanical Power Engineering program						Semester	9			

Code	Course Title	Pre-req	CH	Ct. Hr.				Assessment Criteria			
				Lec.	Lab	Tut	Sum	ST	MT	PE/OE	Final
MEC 425	Power Stations	MEC 322	2	1	2	0	3	10	30	20	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										
Laboratory	• Simulation work and virtual laboratories of plants and cycles.										
Used in Program	Mechanical Power Engineering program			Semester	**9**						

Code	Course Title	Pre-req	CH	Ct. Hr.				Assessment Criteria			
				Lec.	Lab	Tut	Sum	ST	MT	PE/OE	Final
MEC 431	Embedded System Design	MEC 214	2	1	2	1	4	10	30	20	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										
Used in Program	Mechatronics Department			Semester	9						

Code	Course Title	Pre-req	CH	Ct. Hr.				Assessment Criteria			
				Lec.	Lab	Tut	Sum	ST	MT	PE/OE	Final
MEC 433	Programmable Logic Controllers	ELE 204	3	2	2	0	4	10	30	20	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										
Used in Program	Mechatronics Department						Semester	9			

Code	Course Title	Pre-req	CH	Ct. Hr.				Assessment Criteria			
				Lec.	Lab	Tut	Sum	ST	MT	PE/OE	Final
MEC 435	Artificial Intelligence	ELE 404	3	2	2	0	4	10	30	20	40
Course Content	Introduction to intelligent control methods. 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 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										
Used in Program	Mechatronics Department						Semester	9			

Code	Course Title	Pre-req	CH	Ct. Hr.				Assessment Criteria			
				Lec.	Lab	Tut	Sum	ST	MT	PE/OE	Final
MEC 31x1	Finite Element Analysis	MEC 216	3	2	0	2	4	30	30	0	40
Course Content	Basic principles of continuum mechanics and finite element methods, modern application to solution of practical problems in solid, structural, and fluid mechanics, heat and mass transfer, other field problems. Kinematics of deformation, strain and stress measures, constitutive relations, conservation laws, virtual work, and variation al principles. Discretization of governing equations using finite element methods. Solution of central problems using an existing general-purpose finite element analysis program, Course project.										
References	• Chandraputla T.R., and Belegundu A.D., "Introduction of Finite Element in Engineering", Prentice Hall of India, Fourth Edition, 2012.										
Used in Program	Production Department (Product Design)						Semester	7:9			

Code	Course Title	Pre-req	CH	Ct. Hr.				Assessment Criteria			
				Lec.	Lab	Tut	Sum	ST	MT	PE/OE	Final
MEC 31x2	Product Design and Development	MEC 215	3	2	0	2	4	30	30	0	40
Course Content	Product development and design processes and methods, including product specifications, concept development, engineering drawings, design for prototyping, and manufacturing.										
References	• Karl T Ulrich and Stephen D Eppinger, "Product Design and Development", Tata McGraw Hill, Fifth Edition, 2011										
Used in Program	Production Department (Product Design)						Semester	7:9			

Code	Course Title	Pre-req	CH	Ct. Hr.				Assessment Criteria			
				Lec.	Lab	Tut	Sum	ST	MT	PE/OE	Final
MEC 31x3	Failure Analysis	MEC 31x1 MEC 32x2	3	2	0	2	4	30	30	0	40
Course Content	Functional and structural failures. Tribological surface failure, abrasive, adhesive, fatigue wear, fretting and corrosive wear. Design against wear. Modes of bulk failures, excessive deformation, buckling, yielding, plastic instability, creep, and creep rupture. Incremental collapse, fracture mechanics and crack propagation. Damage-tolerant design. Identification and detection of failures. Applications to some mechanical components. Case studies. Course project.										
References	• W.F. Hosford, Mechanical Behavior of Materials, Cambridge University Press, 2009. • W.D. Callister, Jr., D.G. Rethwisch, Materials Science and Engineering: An Introduction, John Wiley & Sons, 2009.										
Used in Program	Production Department (Product Design)						Semester	7:9			

Code	Course Title	Pre-req	CH	Ct. Hr.				Assessment Criteria			
				Lec.	Lab	Tut	Sum	ST	MT	PE/OE	Final
MEC 31x4	Design of Experiments	MEC 31x1 MEC 32x2	3	2	0	2	4	30	30	0	40
Course Content	Principles of experimental design. Randomized complete block designs. Latin square and Greco-Latin square designs. General factorial designs. 2k Factorial designs. Response surface methodology and robust design. Planning, performing, and analyzing industrial experiments										
References	Montgomery, Douglas C. *"Design and analysis of experiments"*, 8th Edition, John Wiley & Sons, 2017. George E. P. Box, J. Stuart Hunter and William G. Hunter. "Statistics for Experimenters: Design, Innovation and Discovery".										
Used in Program	Production Department (Product Design)						Semester	7:9			

Code	Course Title	Pre-req	CH	Ct. Hr.				Assessment Criteria			
				Lec.	Lab	Tut	Sum	ST	MT	PE/OE	Final
MEC 31x5	Tribology	MEC 31x1 MEC 32x2	3	2	0	2	4	30	30	0	40
Course Content	Surface topography, Nature of surface and contacts, Viscosity and Rheology, Methods of fluid-film formation, Friction mechanism, Mechanisms of wear, Plain bearing materials, Bearing surface coatings and treatments, Wear resistant materials, Rolling bearing materials, Gear materials, Friction materials, Properties of friction materials, Mineral oils, Synthetic oils, Greases, Solid lubricants and coatings, Selection of lubricant types, Plain bearing lubrication, Rolling bearing lubrication, Gear and chain lubrication, Selection of bearing type and form, Selection of journal bearing, Selection of thrust bearing, Pressure-fed fluid film bearings, Grease, wick, and drip-fed lubricated journal bearings, Dry rubbing bearings, Plain-thrust bearings, Profiled-pad thrust bearings, Tilting-pad thrust bearing, Plain bearings form and installation, Mechanical seals, Selection of seals, Wear-resistant parts, (material selection), course project and computer applications										
References	Jamal, Takadoum, “Materials and Surface Engineering in Tribology”, Wiley Publications, 2008.										
Used in Program	Production Department (Product Design)						Semester	7:9			

Code	Course Title	Pre-req	CH	Ct. Hr.				Assessment Criteria			
				Lec.	Lab	Tut	Sum	ST	MT	PE/OE	Final
MEC 41x6	Special Topics in Mechanical Design	MEC 31x1 MEC 32x2	3	2	0	2	4	30	30	0	40
Course Content	Students study one or more topics in Mechanical Design Engineering that are not covered by other program courses and/or that present recent or advanced development of interest to mechanical engineers. Course project.										
References	Karl T. Ulrich and Steven D. Eppinger,"Product Design and Development”, (the third edition),, the McGraw-Hill Companies, Inc										
Used in Program	Production Department (Product Design)						Semester	7:9			

Code	Course Title	Pre-req	CH	Ct. Hr.				Assessment Criteria			
				Lec.	Lab	Tut	Sum	ST	MT	PE/OE	Final
MEC 41x7	Pressure Vessels and Piping	MEC 31x1 MEC 32x2	3	2	0	2	4	30	30	0	40
Course Content	Introduction to ASME Boiler, Pressure Vessels, and Piping Codes. Section VIII Divs. 1 and 2. B31 code series. Material selection. Basic principles in design. Types of loads. Failure theories. Design for internal and external pressure. Design of end closures with various geometries. Design of openings and nozzles. Fabrication requirements. Non-destructive examination and testing. Piping stress and flexibility analyses, design and selection of piping supports. Computer implementation of general-purpose software packages. Course project.										
References	Wingate, James A - Applying the ASME codes _ plant piping and pressure vessels (2007, ASME Press)										
Used in Program	Production Department (Product Design)						Semester	7:9			

Code	Course Title	Pre-req	CH	Ct. Hr.				Assessment Criteria			
				Lec.	Lab	Tut	Sum	ST	MT	PE/OE	Final
MEC 41x8	Ergonomics and Human Factor	MEC 313	3	2	0	2	4	30	30	0	40
Course Content	Introduction to Occupational Biomechanics. Review of kinematics and kinetics. Anthropometry. Mechanical work-capacity evaluation. Bioinstrumentation for Occupational Biomechanics. Biomechanical models. Methods of classifying and evaluating manual work. Manual material handling limits. Biomechanical considerations in machine control and workplace design. Hand tool design guidelines. Guidelines for seated work. **I**ntroduction to human factors engineering. Muscular work. Nervous control. Work efficiency. Body size and anthropometrics. Workstation design. Heavy work. Handling loads. Man-machine systems. Mental activity. Fatigue. Stress and boredom. Vision and lighting. Noise and vibration.										
References	Henry H Bednar, "Pressure vessel Design Hand book", CBS publishers and distributors J. Phillip Ellenberger, "Pressure Vessels: ASME Code Simplified", ASME. Smith P, "Fundamentals of Piping Design", Elsevier										
Used in Program	Production Department (Product Design)						Semester	7:9			

Code	Course Title	Pre-req	CH	Ct. Hr.				Assessment Criteria			
				Lec.	Lab	Tut	Sum	ST	MT	PE/OE	Final
MEC 41x9	Computer Integrated Manufacturing	MEC 31x1 MEC 32x2	3	2	0	2	4	30	30	0	40
Course Content	CIM introduces the basic concepts and procedures of CIM production as well as the main components and devices in a CIM cell. Students learn about all the aspects of a CIM production cycle, from customer order and inventory control, through automated manufacturing of materials into finished parts, to quality inspection and final delivery. It covers the integration of: Computer Aided Design (CAD), Computer Aided Process Planning (CAPP), and Computer Aided Manufacturing (CAM); Integrating robotic systems such as Automated Guided Vehicles (AGV) and robotic arms into manufacturing systems and use of Flexible Manufacturing Systems (FMS). Use of CIM software										
References	• Radhakrishnan.P, Subramanyan.S and Raju.V, "CAD/CAM/CIM", New Age International Publishers, 2nd edition 2008. • Alavudeen.A and Venkateshwaran. N, "Computer Integrated Manufacturing", PHI Learning Private Limited, 2010.										
Used in Program	Production Department (Product Design)						Semester	7:9			

Code	Course Title	Pre-req	CH	Ct. Hr.				Assessment Criteria			
				Lec.	Lab	Tut	Sum	ST	MT	PE/OE	Final
MEC 41x10	Process Control	MEC 31x1 MEC 32x2	3	2	0	2	4	30	30	0	40
Course Content	Identification and control methods applicable to processes. Read P&I diagrams, identify control loops, and tune industrial controllers including robot arms. The cascade controllers, feed forward controllers, control design of time-delay processes, internal model control, two-degree of freedom controllers, hybrid controllers, introduction to model predictive control, implementation of industrial controllers, introduction to nonlinear controllers.										
References	Dumitru Popescu, Amira Gharbi, Dan Stefanoiu, Pierre Borne, 2017, "Process Control Design for Industrial Applications", John Wiley & Sons, Inc										
Used in Program	Production Department (Product Design)						Semester	7:9			

Code	Course Title	Pre-req	CH	Ct. Hr.				Assessment Criteria			
				Lec.	Lab	Tut	Sum	ST	MT	PE/OE	Final
MEC 41x11	Sheet Metal processes and design	MEC 31x1 MEC 32x2	3	2	0	2	4	30	30	0	40
Course Content	Review of Sheet metal industry applications, Sheet Metal Properties, Deformation of sheet metals, Simple Stamping Analysis, Deep Drawing Die design, Sheet metal shearing and bending, Non-Conventional Sheet metal processes. Die design: Standard parts, progressive and compound dies, Mechanical and Hydraulic Presses selection-CNC punch presses. Course project										
References	Vukota Boljanovic,2004, "Sheet Metal Forming Processes and Die Design", Industrial Press Inc.										
Used in Program	Production Department (Product Design)						Semester	7:9			

Code	Course Title	Pre-req	CH	Ct. Hr.				Assessment Criteria			
				Lec.	Lab	Tut	Sum	ST	MT	PE/OE	Final
MEC 41x12	Material selection in Design	MEC 31x1 MEC 32x2	3	2	0	2	4	30	30	0	40
Course Content	Classification of all engineering material; Materials properties; Performance indices; Materials selection charts; Performance indices with geometry factors; Case studies.										
References	M.F. Ashby, Materials Selection in Mechanical Design, Butterworth-Heinemann, 5th Ed., 2017 (ISBN-13: 978-0081005996) Engineering Design: A Materials and Processing Approach, George E. Dieter, McGraw-Hill										
Used in Program	Production Department (Product Design)						Semester	7:9			

Code	Course Title	Pre-req	CH	Ct. Hr.				Assessment Criteria			
				Lec.	Lab	Tut	Sum	ST	MT	PE/OE	Final
MEC 41x14	Mechanism Design	MEC 31x1 MEC 32x2	3	2	0	2	4	30	30	0	40
Course Content	Introduction and basic concepts, Mechanisms and structures, Number synthesis, Paradoxes, Isomers, Linkage transformation, Intermittent motion, Inversion, Function path and motion generation Graphical synthesis of planar mechanisms: Two-position synthesis, Three-position synthesis, Quick-return mechanisms, Coupler curves, Analytical synthesis of planar mechanisms, Optimal planar mechanism synthesis, Analytical synthesis of simple toggles, Introduction to spatial mechanism synthesis, simulation using Computer Graphics and Matlab Software and case studies. Course project.										
References	Tilman Börgers, 2015, "An Introduction to the Theory of Mechanism Design", Oxford										
Used in Program	Production Department (Product Design)						Semester	7:9			

Code	Course Title	Pre-req	CH	Ct. Hr.				Assessment Criteria			
				Lec.	Lab	Tut	Sum	ST	MT	PE/OE	Final
MEC 31y1	Advanced Composite Materials	MEC 218	3	2	0	2	4	30	30	0	40
Course Content	Stress and strain analysis of continuous fiber composite materials. Orthotropic elasticity, lamination theory, failure criterion, fiber-matrix interfacial features and interactions. Manufacturing and processing techniques of metal-, polymer-, and ceramic-matrix composites; Design philosophies, as applied to structural polymeric composites. Design considerations related to manufacturing techniques; non-destructive testing of composite structures.										
References	LOUIS A PILATO, Michael J. Michno, 1994, "Advanced Composite Materials", Springer, Berlin, Heidelberg										
Used in Program	Production Department (Manufacturing & Materials)						Semester	7:9			

Code	Course Title	Pre-req	CH	Ct. Hr.				Assessment Criteria			
				Lec.	Lab	Tut	Sum	ST	MT	PE/OE	Final
MEC 31y2	Manufacturing Systems	MEC 214	3	2	0	2	4	30	30	0	40
Course Content	Basic principles, NC machines, Numerical control, and industrial robotics. Group technology and flexible manufacturing systems. Production lines, Machining centers, High speed machining. Manufacturing engineering, Process planning, Problem solving and continuous improvement, Concurrent engineering design for manufacturability, Production planning and control, Introduction to Quality control.										
References	• George Chryssolouris, 2006, "Manufacturing Systems: Theory and Practice", Springer Science Inc.										
Used in Program	Production Department (Manufacturing & Materials)						Semester	7:9			

Code	Course Title	Pre-req	CH	Ct. Hr.				Assessment Criteria			
				Lec.	Lab	Tut	Sum	ST	MT	PE/OE	Final
MEC 31y3	Process Control	MEC 31y1 MEC 31y2	3	2	0	2	4	30	30	0	40
Course Content	Identification and control methods applicable to processes. Read P&I diagrams, identify control loops, and tune industrial controllers including robot arms. The cascade controllers, feed forward controllers, control design of time-delay processes, internal model control, two-degree of freedom controllers, hybrid controllers, introduction to model predictive control, implementation of industrial controllers, introduction to nonlinear controllers.										
References	Dumitru Popescu, Amira Gharbi, Dan Stefanoiu, Pierre Borne, 2017, "Process Control Design for Industrial Applications", John Wiley & Sons, Inc										
Used in Program	Production Department (Manufacturing & Materials)						Semester	7:9			

Code	Course Title	Pre-req	CH	Ct. Hr.				Assessment Criteria			
				Lec.	Lab	Tut	Sum	ST	MT	PE/OE	Final
MEC 31y4	Welding Technology	MEC 31y1 MEC 31y2	3	2	0	2	4	30	30	0	40
Course Content	Metal Welding Definition, Welding Joints, Welding Standards, Welding Symbols, Fusion Welding Processes, Solid State Welding Processes, High Energy Welding Processes, Heat Flow in Metal Welding, Chemical Reactions & Fluid Flow in Arc Welding, Solidification of Fusion Zone, Weldability & Cracking Susceptibility, Welding Defects, and Inspection of Welded Joints. Advanced welding operations: Laser welding, Electron beam welding, Friction stir welding of different alloys and post weld heat treatment and dissimilar materials, Ultrasonic welding (USW).										
References	J. Paulo Davim, 2021, Welding Technology, Springer Nature Switzerland										
Used in Program	Production Department (Manufacturing & Materials)						Semester	7:9			

Code	Course Title	Pre-req	CH	Ct. Hr.				Assessment Criteria			
				Lec.	Lab	Tut	Sum	ST	MT	PE/OE	Final
MEC 31y5	Casting Processes	MEC 31y1 MEC 31y2	3	2	0	2	4	30	30	0	40
Course Content	Metal casting technology: Introduction, Solidification processing, Liquid metals, Principles of solidification, Primary (wrought) and casting, Metals and alloys, Production of primary metals, Production of shaped casting, Patterns, Molding techniques: Molding techniques and dynamics, Melting procedures and equipment, Design considerations, Structure, Properties and defects of casting, Casting process selection, Computer applications in metal casting, Quality control in casting, advanced casting processes.										
References	• Sahoo, Mahi, and Sudhari Sahu, 2014, “Principles of Metal Casting”, 3rd ed. New York: McGraw-Hill Education.										
Used in Program	Production Department (Manufacturing & Materials)						Semester	7:9			

Code	Course Title	Pre-req	CH	Ct. Hr.				Assessment Criteria			
				Lec.	Lab	Tut	Sum	ST	MT	PE/OE	Final
MEC 41y6	Powder Metallurgy	MEC 31y1 MEC 31y2	3	2	0	2	4	30	30	0	40
Course Content	Powder preparation, rapid-solidification processing principles, powder characterization, theory of compaction, sintering, full-density processing, powder metallurgy component design, compact characterization, application of powder metallurgy processing to structural, electrical, magnetic, and biomedical components.										
References	Powder Metallurgy: Science, Technology, and Materials, Anish Upadhyaya, Gopal Shankar Upadhyaya, CRC Press,2011.										
Used in Program	Production Department (Manufacturing & Materials)						Semester	7:9			

Code	Course Title	Pre-req	CH	Ct. Hr.				Assessment Criteria			
				Lec.	Lab	Tut	Sum	ST	MT	PE/OE	Final
MEC 41y7	Polymers Engineering & Manufacturing	MEC 31y1 MEC 31y2	3	2	0	2	4	30	30	0	40
Course Content	Engineering analysis and design techniques for synthetic polymers. Treatment of materials properties selection, mechanical characterization, and processing in design of load bearing and environment-compatible structures are covered.										
References	Fundamentals of Composites manufacturing: Materials, Methods, and Applications by Dr. A. Brent Strong Society of manufacturing Engineers, 2nd Edition, 2007, ISBN 13: 978-087263854-9. Anil Kumar, Rakesh K. Gupta, Fundamentals of Polymer Engineering, Third Edition,20										
Used in Program	Production Department (Manufacturing & Materials)						Semester	7:9			

Code	Course Title	Pre-req	CH	Ct. Hr.				Assessment Criteria			
				Lec.	Lab	Tut	Sum	ST	MT	PE/OE	Final
MEC 41y8	Special Topics in Materials Engineering	MEC 31y1 MEC 31y2	3	2	0	2	4	30	30	0	40
Course Content	Nanomaterials (characteristics, fabrication, and application), Magnetic Materials (types, characteristics, fabrication and application), Coating materials (metallic, organic, ceramics and nanocomposite coating), Advanced and smart materials such as photovoltaic solar cells materials …etc.										
References	Some selected scientific research in the field.										
Used in Program	Production Department (Manufacturing & Materials)						Semester	7:9			

Code	Course Title	Pre-req	CH	Ct. Hr.				Assessment Criteria			
				Lec.	Lab	Tut	Sum	ST	MT	PE/OE	Final
MEC 41y9	Computer Integrated Manufacturing	MEC 31y1 MEC 31y2	3	2	0	2	4	30	30	0	40
Course Content	Product Cycle and CAD/CAM, Automation and CAD/CAM, Programming for lathe, drilling and milling machines. Computer assisted part programming, DNC, CNC. Industrial robotic applications. Computer aided process planning: Retrieval type process planning systems, generative process planning systems, machinability data systems, computer generated time standard. Types of manufacturing systems, types of CIMS, special manufacturing systems, Flexible Manufacturing Systems FMS, Manufacturing Cells, Course project.										
References	• Alavudeen.A and Venkateshwaran.N, "Computer Integrated Manufacturing", PHI Learning Private Limited, 2010.										
Used in Program	Production Department (Manufacturing & Materials)						Semester	7:9			

Code	Course Title	Pre-req	CH	Ct. Hr.				Assessment Criteria			
				Lec.	Lab	Tut	Sum	ST	MT	PE/OE	Final
MEC 41y10	Special Topics in Manufacturing	MEC 31y1 MEC 31y2		2	0	2	4	30	30	0	40
Course Content	The course covers advanced topics in manufacturing of relevance to emerging technologies. The topic may include flexible manufacturing systems, reverse engineering and prototyping, integrated manufacturing, manufacturing intelligence, 3-D printing, Additive manufacturing, The course includes independent research project on advanced manufacturing processes.										
References	M.P. Groover, Fundamentals of Modern Manufacturing, 6th edition. John Wiley & Sons, Inc. ISBN: 978-1119128694.										
Used in Program	Production Department (Manufacturing & Materials)						Semester	7:9			

Code	Course Title	Pre-req	CH	Ct. Hr.				Assessment Criteria			
				Lec.	Lab	Tut	Sum	ST	MT	PE/OE	Final
MEC 41y12	Sheet Metal processes and design	MEC 31y1 MEC 31y2	3	2	0	2	4	30	30	0	40
Course Content	Review of Sheet metal industry applications, Sheet Metal Properties, Deformation of sheet metals, Simple Stamping Analysis, Deep Drawing Die design, Sheet metal shearing and bending, Non-Conventional Sheet metal processes. Die design: Standard parts, progressive and compound dies, Mechanical and Hydraulic Presses selection-CNC punch presses. Course project										
References	• Alan Weatherall, Computer Integrated Manufacturing From fundamentals to implementation, 1988 Elsevier Ltd.										
Used in Program	Production Department (Manufacturing & Materials)						Semester	7:9			

Code	Course Title	Pre-req	CH	Ct. Hr.				Assessment Criteria			
				Lec.	Lab	Tut	Sum	ST	MT	PE/OE	Final
MEC 41y13	Design of Experiments	MEC 31y1 MEC 31y2	3	2	0	2	4	30	30	0	40
Course Content	Principles of experimental design. Randomized complete block designs. Latin square and Greco-Latin square designs. General factorial designs. 2k Factorial designs. Response surface methodology and robust design. Planning, performing, and analyzing industrial experiments.										
References	Montgomery, Douglas C. *"Design and analysis of experiments"*, 8th Edition, John Wiley & Sons, 2017. George E. P. Box, J. Stuart Hunter and William G. Hunter. "Statistics for Experimenters: Design, Innovation and Discovery".										
Used in Program	Production Department (Manufacturing & Materials)						Semester	7:9			

Code	Course Title	Pre-req	CH	Ct. Hr.				Assessment Criteria			
				Lec.	Lab	Tut	Sum	ST	MT	PE/OE	Final
MEC 41y14	Ergonomics and Human Factor	MEC 313	3	2	0	2	4	30	30	0	40
Course Content	Introduction to Occupational Biomechanics. Review of kinematics and kinetics. Anthropometry. Mechanical work-capacity evaluation. Bioinstrumentation for Occupational Biomechanics. Biomechanical models. Methods of classifying and evaluating manual work. Manual material handling limits. Biomechanical considerations in machine control and workplace design. Hand tool design guidelines. Guidelines for seated work. **I**ntroduction to human factors engineering. Muscular work. Nervous control. Work efficiency. Body size and anthropometrics. Workstation design. Heavy work. Handling loads. Man-machine systems. Mental activity. Fatigue. Stress and boredom. Vision and lighting. Noise and vibration.										
References	Sanders and McCormick, Human Factors in Engineering and Design, 7th Edition, McGraw Hill, ISBN # 978-0070549012).										
Used in Program	Production Department (Manufacturing & Materials)						Semester	7:9			

Code	Course Title	Pre-req	CH	Ct. Hr.				Assessment Criteria			
				Lec.	Lab	Tut	Sum	ST	MT	PE/OE	Final
MEC 41y15	Industrial Information systems	MEC 31y1 MEC 31y2	3	2	0	2	4	30	30	0	40
Course Content	General concepts. Values and attributes of information. Different types of information systems. Concepts of managerial information systems. Emphasis on analysis, design, and development of industrial information systems. Developing information systems by using microcomputers.										
References	Thomas Boucher, Ali Yalcin - Design of Industrial Information Systems (2006, Elsevier)										
Used in Program	Production Department (Manufacturing & Materials)						Semester	7:9			

Code	Course Title	Pre-req	CH	Ct. Hr.				Assessment Criteria			
				Lec.	Lab	Tut	Sum	ST	MT	PE/OE	Final
MEC 41y16	Artificial Intelligence	ELE 434	3	2	0	2	4	30	30	0	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	Russell, Stuart, and Peter Norvig. "Artificial intelligence: a modern approach."4th Edition (2020).										
Used in Program	Production Department (Manufacturing & Materials)						Semester	7:9			

Code	Course Title	Pre-req	CH	Ct. Hr.				Assessment Criteria			
				Lec.	Lab	Tut	Sum	ST	MT	PE/OE	Final
MEC 31z1	Industrial Automation	MEC 214	3	2	0	2	4	30	30	0	40
Course Content	Introduction to industrial automation: mechanization versus automation, advantages of automation, application of automation, types of automation, automation system structure. Sensor types and selection. Actuator types & selection, Programmable Logic Controllers (PLC): introduction, hardwired ladder diagram, PLC programming and hardware fundamentals. Supervisory control and data acquisition: introduction, fundamental principles, hardware and software, modern applications of SCADA systems. Distributed Control Systems (DCS): introduction, fundamental principles, modern applications of DCS.										
References	Chanchal Dey, Sunit Kumar Sen, 2020, "Industrial Automation Technologies", CRC Press.										
Used in Program	Production Department (Industrial & Management)						Semester	7:9			

Code	Course Title	Pre-req	CH	Ct. Hr.				Assessment Criteria			
				Lec.	Lab	Tut	Sum	ST	MT	PE/OE	Final
MEC 31z2	Motion and time study	MEC 214	3	2	0	2	4	30	30	0	40
Course Content	Introduction to Productivity, Factors affecting on productivity, Productivity Measurements, Productivity Improvement Techniques, Work Study, Method Study, Motion Study, Work Measurement, Time Study										
References	• Benjamin w. Niebel, "motion and time study ".										
Used in Program	Production Department (Industrial & Management)						Semester	7:9			

Code	Course Title	Pre-req	CH	Ct. Hr.				Assessment Criteria			
				Lec.	Lab	Tut	Sum	ST	MT	PE/OE	Final
MEC 31z3	Quality Control	MEC 31z1 MEC 31z2	3	2	0	2	4	30	30	0	40
Course Content	History of quality control Quality definitions and concepts, Process capability analysis, Theory of control charts, Statistical control charts for attributes, Statistical control charts for variables, Acceptance sampling: Principles and concepts, Acceptance sampling by attributes, Acceptance sampling by variables.										
References	Montgomery, Douglas C. *"Introduction to statistical quality control"*,8th Edition. John Wiley & Sons, 2020.										
Used in Program	Production Department (Industrial & Management)						Semester	7:9			

Code	Course Title	Pre-req	CH	Ct. Hr.				Assessment Criteria			
				Lec.	Lab	Tut	Sum	ST	MT	PE/OE	Final
MEC 31z4	Lean Manufacturing Systems	MEC 31z1 MEC 31z2	3	2	0	2	4	30	30	0	40
Course Content	Fundamentals of lean manufacturing principles. Toyota house, seven wastes, Push verse Pull systems and JIT, Kanban system, Kanban size and number, CONWIP. Value stream mapping: How to construct the current state map, improvement tools Kaizen, Poka-a-Yoke, 5S. Takt /mealculations and production leveling.										
References	Lonnie Wilson, "How to Implement Lean Manufacturing", McGraw-Hill Professional; 1 edition, 2009										
Used in Program	Production Department (Industrial & Management)						Semester	7:9			

Code	Course Title	Pre-req	CH	Ct. Hr.				Assessment Criteria			
				Lec.	Lab	Tut	Sum	ST	MT	PE/OE	Final
MEC 31z5	Industrial Market analysis	MEC 31z1 MEC 31z2	3	2	0	2	4	30	30	0	40
Course Content	Supply chain metrics, primary tradeoffs in making supply chain decisions, and basic tools for effective and efficient supply chain management, production planning and inventory control, order fulfillment and supply chain coordination. It will also investigate topics such as global supply chain design, logistics, and outsourcing, several other recent supply chain innovations.										
References	Zimmerman, A. & Blythe, J , Business to Business Marketing Management: A Global Perspective, third edition.										
Used in Program	Production Department (Industrial & Management)						Semester	9			

Code	Course Title	Pre-req	CH	Ct. Hr.				Assessment Criteria			
				Lec.	Lab	Tut	Sum	ST	MT	PE/OE	Final
MEC 41z6	Advanced Operations Research	MEC 316	3	2	0	2	4	30	30	0	40
Course Content	Non-linear programming. Dynamic programming. Inventory models. Waiting line models. Markov analysis. Introduction to Game theory. Applications in industrial, service and public systems										
References	Hamdy A. Taha, "Operations Research – An Introduction" 10th Edition, 2017.										
Used in Program	Production Department (Industrial & Management)						Semester	9			

Code	Course Title	Pre-req	CH	Ct. Hr.				Assessment Criteria			
				Lec.	Lab	Tut	Sum	ST	MT	PE/OE	Final
MEC 41z9	Computer Integrated Manufacturing	MEC 31z1 MEC 31z2	3	2	0	2	4	30	30	0	40
Course Content	Product Cycle and CAD/CAM, Automation and CAD/CAM, Programming for lathe, drilling and milling machines. Computer assisted part programming, DNC, CNC. Industrial robotic applications. Computer aided process planning: Retrieval type process planning systems, generative process planning systems, machinability data systems, computer generated time standard. Types of manufacturing systems, types of CIMS, special manufacturing systems, Flexible Manufacturing Systems FMS, Manufacturing Cells, Course project.										
References	Alavudeen.A and Venkateshwaran.N, "Computer Integrated Manufacturing", PHI Learning Private Limited, 2010.										
Used in Program	Production Department (Industrial & Management)						Semester	7:9			

Code	Course Title	Pre-req	CH	Ct. Hr.				Assessment Criteria			
				Lec.	Lab	Tut	Sum	ST	MT	PE/OE	Final
MEC 41z12	Facilities Planning and Design	MEC 31z1 MEC 31z2	3	2	0	2	4	30	30	0	40
Course Content	Fundamentals of facilities planning. Facilities design. Flow, space, and activity relationships. Material handling systems. Layout planning models. Warehouse operations. Quantitative facilities planning models. Preparing, presenting, implementing and maintaining facilities plan.										
References	Tompkins, J. A, Facilities Planning (4th ed.). Hoboken, NJ: John Wiley & Sons, Inc., 2010										
Used in Program	Production Department (Industrial & Management)						Semester	7:9			

Code	Course Title	Pre-req	CH	Ct. Hr.				Assessment Criteria			
				Lec.	Lab	Tut	Sum	ST	MT	PE/OE	Final
MEC 41z13	Ergonomics and Human Factor	MEC 313	3	2	0	2	4	30	30	0	40
Course Content	Introduction to Occupational Biomechanics. Review of kinematics and kinetics. Anthropometry. Mechanical work-capacity evaluation. Bioinstrumentation for Occupational Biomechanics. Biomechanical models. Methods of classifying and evaluating manual work. Manual material handling limits. Biomechanical considerations in machine control and workplace design. Hand tool design guidelines. Guidelines for seated work. **I**ntroduction to human factors engineering. Muscular work. Nervous control. Work efficiency. Body size and anthropometrics. Workstation design. Heavy work. Handling loads. Man-machine systems. Mental activity. Fatigue. Stress and boredom. Vision and lighting. Noise and vibration.										
References	Sanders and McCormick, Human Factors in Engineering and Design, 7th Edition, McGraw Hill, ISBN # 978-0070549012).										
Used in Program	Production Department (Industrial & Management)						Semester	7:9			

Code	Course Title	Pre-req	CH	Ct. Hr.				Assessment Criteria			
				Lec.	Lab	Tut	Sum	ST	MT	PE/OE	Final
MEC 41z14	Design of Experiments	MEC 31z1 MEC 31z2	3	2	0	2	4	30	30	0	40
Course Content	Principles of experimental design. Randomized complete block designs. Latin square and Greco-Latin square designs. General factorial designs. 2k Factorial designs. Response surface methodology and robust design. Planning, performing, and analyzing industrial experiments.										
References	Montgomery, Douglas C. *"Design and analysis of experiments"*, 8th Edition, John Wiley & Sons, 2017. George E. P. Box, J. Stuart Hunter and William G. Hunter. "Statistics for Experimenters: Design, Innovation and Discovery".										
Used in Program	Production Department (Industrial & Management)						Semester	7:9			

Code	Course Title	Pre-req	CH	Ct. Hr.				Assessment Criteria			
				Lec.	Lab	Tut	Sum	ST	MT	PE/OE	Final
MEC 32x1	Introduction to Renewable Energy	MEC 222	3	2	0	2	4	30	30	0	40
Course Content	Introduction. Different Sources of Energy - Solar Energy. Availability of Solar Energy Collection of Solar Energy. Solar Energy Systems. Wind Energy. Characteristics of Wind. Wind Turbine Theory. Wind Energy Conversion Systems. Biomass Energy. Production of Biomass Gases. Systems and Tools for Energy Production from Biomass - Geothermal Energy: types of geothermal energy, vapor dominated system, liquid dominated system, petro-thermal system. Systems Design of Energy Saving systems.										
References	Kaltschmitt M., Streicher W., Wiese A., Renewable Energy, Springer London, Limited, Jun 1, 2007. Tiwari G. N., and Ghosal M. K., Renewable Energy Resources: Basic Principles And Applications - Morgan & Claypool, 2005										
Used in Program	Mechanical Power Engineering - Sustainable & Renewable Energy						Semester	**7**			

Code	Course Title	Pre-req	CH	Ct. Hr.				Assessment Criteria			
				Lec.	Lab	Tut	Sum	ST	MT	PE/OE	Final
MEC 32x2	Hydroelectric Energy Systems	MEC 221	3	2	0	2	4	30	30	0	40
Course Content	Introduction and Status of Hydropower, Physical and Technical Basics of Hydropower, Hydropower Resource, Categories of hydropower Plant, Components of Hydropower Plants, Large Hydropower Plants: Dams and Barrages, Hydraulic Turbines: Types and Operational Aspects. Generators. Small Hydropower. Use of Ocean Energies, Economics of Hydropower Plants, Outlook for Hydropower										
References	• Hermann-Josef Wagner, Jyotirmay Mathur, 2011, "Introduction to Hydro Energy Systems", Springer Nature Switzerland • Paul Breeze, 2018, "Hydropower", Academic Press										
Used in Program	Mechanical Power Engineering - Sustainable & Renewable Energy						Semester	**7**			

Code	Course Title	Pre-req	CH	Ct. Hr.				Assessment Criteria			
				Lec.	Lab	Tut	Sum	ST	MT	PE/OE	Final
MEC 32x3	Wind Energy System Design	MEC 32x1 MEC 32x2	3	2	0	2	4	30	30	0	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, Wind Turbine Acoustics.										
References	• Gary L. Johnson, 1985, "Wind Energy Systems", Prentice-Hall										
Used in Program	Mechanical Power Engineering - Sustainable & Renewable Energy						Semester	8			

Code	Course Title	Pre-req	CH	Ct. Hr.				Assessment Criteria			
				Lec.	Lab	Tut	Sum	ST	MT	PE/OE	Final
MEC 32x4	Fundamentals and Applications of Solar Energy	MEC 32x1 MEC 32x2	3	2	0	2	4	30	30	0	40
Course Content	Solar energy potential in Egypt- resource assessment measurements - solar geometry-solar thermal applications- flat plate collectors(water-air)- efficiency and Sankey diagram-assessment of yield and solar fraction evacuated tube collectors- medium temperature concentration of solar energy- high temperature concentration application-solar cooling- solar desalination- poly-generation applications-certification.										
References	• Garg & Prakash, H. P. Garg, 2000, " Solar Energy: Fundamentals and Applications ", McGraw-Hill Education										
Used in Program	Mechanical Power Engineering - Sustainable & Renewable Energy						Semester	8			

Code	Course Title	Pre-req	CH	Ct. Hr.				Assessment Criteria			
				Lec.	Lab	Tut	Sum	ST	MT	PE/OE	Final
MEC 32x5	Nuclear Power Stations	MEC 222	3	2	0	2	4	30	30	0	40
Course Content	Thermodynamics of Balance-of-Plant Systems, Nuclear Boilers. Different types of nuclear power stations (boiling water, pressurized water, gas-cooled, fast-breeders). Cycle Isolation and the Mass Balance, Heat Rejection Systems, Cooling Towers. Simulation of different types – methods of choosing nuclear power Station type – choosing the materials used in different reactors.										
References	• Charles F. Bowman, Seth N. Bowman, 2020, " Thermal Engineering of Nuclear Power Stations - Balance-of-Plant Systems", CRC Press.										
Used in Program	Mechanical Power Engineering - Sustainable & Renewable Energy						Semester	8			

Code	Course Title	Pre-req	CH	Ct. Hr.				Assessment Criteria			
				Lec.	Lab	Tut	Sum	ST	MT	PE/OE	Final
MEC 42x5	Essentials of Energy Management	MEC 32x1 MEC 32x2	3	2	0	2	4	30	30	0	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.										
Used in Program	Mechanical Power Engineering - Sustainable & Renewable Energy						Semester	9			

Code	Course Title	Pre-req	CH	Ct. Hr.				Assessment Criteria			
				Lec.	Lab	Tut	Sum	ST	MT	PE/OE	Final
MEC 42x6	Biomass and waste Conversion Technology	MEC 221, MEC 323	3	2	0	2	4	30	30	0	40
Course Content	Characterization of Waste, Types of Biomass, Biomass Properties, Pre-Treatment of Biomass, Thermo-Chemical Processes, Fast and Slow Pyrolysis, Gasification, Transesterification, Design of Gasifiers, Drying and Devolatilization, Heat and Mass Transfer across Small and Large Biomass Particles, Combustion, Chemical Kinetics, Types of Reactors, Incinerators, Bio-Chemical Conversion, Anaerobic Digestion and Fermentation, Operation of Biomass Boilers and Stoves, Use of Bio-Fuels in Internal Combustion Engines and Gas Turbines, Emissions, Cost Considerations.										
References	• Pratima Bajpai, 2019, "Biomass to Energy Conversion Technologies - The Road to Commercialization", Elsevier.										
Used in Program	Mechanical Power Engineering - Sustainable & Renewable Energy						Semester	9			

Code	Course Title	Pre-req	CH	Ct. Hr.				Assessment Criteria			
				Lec.	Lab	Tut	Sum	ST	MT	PE/OE	Final
MEC 42x7	Design of Renewable Energy Equipment	MEC 32x1 MEC 32x2	3	2	0	2	4	30	30	0	40
Course Content	Factors Promoting Renewable Energy Applications. Photovoltaic. Engineering principles of electrical storage technologies: electrical vs. chemical energy storage; batteries; double layer capacitors; superconducting magnetic energy storage; flywheels; demand-side issues: electrical load curve; periodicity; electricity tariff structure and time-of-use tariff. Emerging Renewable energy sources, Fundamentals of demand-side management; efficiency improvements; load management; electricity market basic, integration of renewable generation into the grid, regulatory policy aspects.										
References	• Ziyad Salameh, 2011, "Renewable energy system design", Academic Press.										
Used in Program	Mechanical Power Engineering - Sustainable & Renewable Energy						Semester	9			

Code	Course Title	Pre-req	CH	Ct. Hr.				Assessment Criteria			
				Lec.	Lab	Tut	Sum	ST	MT	PE/OE	Final
MEC 42x8	Geothermal Energy Systems	MEC 32x1 MEC 32x2	3	2	0	2	4	30	30	0	40
Course Content	Basic concepts, Earth's structure, thermal structure of earth. Temperature estimates in some simple geological situations. Geothermal systems and resources, Types of Geothermal Systems. Geological and Hydrological Considerations, Exploration techniques: Geochemical techniques, Geophysical techniques, Airborne surveys, Exploratory drilling.										
References	• Harsh Gupta, Sukanta Roy, 2006, "Geothermal Energy - An Alternative Resource for the 21st Century", Elsevier Science.										
Used in Program	Mechanical Power Engineering - Sustainable & Renewable Energy						Semester	9			

Code	Course Title	Pre-req	CH	Ct. Hr.				Assessment Criteria			
				Lec.	Lab	Tut	Sum	ST	MT	PE/OE	Final
MEC 32y1	Industrial Refrigeration	MEC 226	3	2	0	2	4	30	30	0	40
Course Content	Food Storage and Equipment (Thermal properties of foods, cooling and freezing time of foods, commodity storage requirements, Food microbiology and refrigeration, refrigeration load, refrigerated facility design, methods of precooling fruits, vegetables and cut flowers) – Food refrigeration (Industrial food freezing systems, meat products, poultry products, fishery products, others products) – Industrial applications (Ice manufacture ice rinks, refrigeration in the chemical industries) – Low temperature applications (Cryogenics, Ultralow temperature refrigeration, biomedical applications of cryogenic refrigeration)..										
References	P. C. Koelet, T. B. Gray, 1992, "Industrial Refrigeration: Principles, Design and Applications", Macmillan Education. UK.										
Used in Program	Mechanical Power Engineering - Energy management and HVAC Engineering						Semester	7			

Code	Course Title	Pre-req	CH	Ct. Hr.				Assessment Criteria			
				Lec.	Lab	Tut	Sum	ST	MT	PE/OE	Final
MEC 32y2	Fire Fighting & Water Distribution Systems	MEC 222	3	2	0	2	4	30	30	0	40
Course Content	Fire Fighting System: Introduction and Classification of firefighting system. Sprinkler system – Fire Hose Cabinet – clean agents 200 suppression system – Special firefighting systems- NFPA and firefighting codes. Hydronic system: Domestic cold and hot water system (Demand – systems of circulations – sizing of domestic water piping system – heating capacity) – Sanitary Drainage system (single pipe system, two pipes system, fixture units of plumbing fixtures, sizing of drainage water piping system, sump pits and sump pumps) – Rainwater drainage system – Ventilation system.										
References	Dennis P. Nolan, 2011, "Fire Fighting Pumping Systems at Industrial Facilities", Elsevier.										
Used in Program	Mechanical Power Engineering - Energy management and HVAC Engineering						Semester	7			

Code	Course Title	Pre-req	CH	Ct. Hr.				Assessment Criteria			
				Lec.	Lab	Tut	Sum	ST	MT	PE/OE	Final
MEC 32y3	Refrigeration & Air Conditioning Equipment	MEC 32y1	3	2	0	2	4	30	30	0	40
Course Content	Air handling equipment (duct construction, room air distribution equipment, fans, evaporative air cooling equipment, humidifiers, air-cooling and dehumidifying coils, desiccant dehumidification, air heating coils, air cleaners for particulate contaminants) – General equipment (compressors, condensers, evaporators, cooling towers, liquid coolers, liquid-chilling systems, air to air energy recovery system, expansion devices, pipes, valves and fittings) – Unitary equipment (unitary air conditioners and heat pumps, room air conditioner, packaged terminal air conditioner).										
References	Miller, Rex; Miller, Mark R, 2011, "Air Conditioning and Refrigeration", McGraw-Hill Education.										
Used in Program	Mechanical Power Engineering - Energy management and HVAC Engineering						Semester	8			

Code	Course Title	Pre-req	CH	Ct. Hr.				Assessment Criteria			
				Lec.	Lab	Tut	Sum	ST	MT	PE/OE	Final
MEC 32y4	Fire Extinguishing Systems	MEC 32y2	3	2	0	2	4	30	30	0	40
Course Content	Fundamental of Fire Science - Explosions - Fire Models - Fire and Smoke Spread - Fire Safety Equipment-Design of hydrants – Fire Pumps – Sprinkler Systems Design – Inert Gas Systems – Foam Systems – Fire Codes.										
References	• "NFPA 2001 : standard on clean agent fire extinguishing systems 2018", National Fire Protection Association										
Used in Program	Mechanical Power Engineering - Energy management and HVAC Engineering						Semester	8			

Code	Course Title	Pre-req	CH	Ct. Hr.				Assessment Criteria			
				Lec.	Lab	Tut	Sum	ST	MT	PE/OE	Final
MEC 42y5	Air Filtration	MEC 32y1, MEC 32y2	3	2	0	2	4	30	30	0	40
Course Content	Macroscopic Behavior of Filters, Surface filtration and depth filtration, Layer efficiency, Single fibre efficiency. Filter Structure: Paper, Carded, porous and model filters. Flow Patterns and Pressure Drop. Particle Capture by Mechanical Means. Electrically Charged Filter Material. Particle Capture by Electric Forces. Particle Adhesion and Particle Bounce. Filter Testing.										
References	• R.C. Brown, 1993, "Air Filtration: An Integrated Approach to the Theory and Applications of Fibrous Filters", Pergamon Press.										
Used in Program	Mechanical Power Engineering - Energy management and HVAC Engineering						Semester	8			

Code	Course Title	Pre-req	CH	Ct. Hr.				Assessment Criteria			
				Lec.	Lab	Tut	Sum	ST	MT	PE/OE	Final
MEC 32y6	Essentials of Energy Management	MEC 32y1 MEC 32y2	3	2	0	2	4	30	30	0	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.										
Used in Program	Mechanical Power Engineering - Energy management and HVAC Engineering						Semester	9			

Code	Course Title	Pre-req	CH	Ct. Hr.				Assessment Criteria			
				Lec.	Lab	Tut	Sum	ST	MT	PE/OE	Final
MEC 42y7	Special HVAC design applications	MEC 32y1 MEC 32y2	3	2	0	2	4	30	30	0	40
Course Content	Design requirements-design phases-design concept and different alternatives-schematic design stage and its deliverable-design development stage and its deliverables-tender documents stage and its deliverable-bid analysis and awarding-work shop drawings stage and submittals approval-construction supervision and handover.										
References	R.S. Khurmi, A Textbook of Refrigeration and Air Conditioning,2006										
Used in Program	Mechanical Power Engineering - Energy management and HVAC Engineering						Semester	9			

Code	Course Title	Pre-req	CH	Ct. Hr.				Assessment Criteria			
				Lec.	Lab	Tut	Sum	ST	MT	PE/OE	Final
MEC 42y8	Energy Storage	MEC 222	3	2	0	2	4	30	30	0	40
Course Content	Introduction to the need for storage- storage efficiency- storage density thermal energy storage technology- sensible heat storage- latent heat storage- phase change materials-thermal mass storage-chilled water/ice storage-thermochemical storage- compressed air storage-hydroelectric storage-batteries- super conducting magnetic storage- super capacitors hydrogen as a storage medium-comparison of storage technologies.										
References	• Robert A. Huggins, 2010, "Energy Storage", Springer US.										
Used in Program	Mechanical Power Engineering - Energy management and HVAC Engineering						Semester	9			

Code	Course Title	Pre-req	CH	Ct. Hr.				Assessment Criteria			
				Lec.	Lab	Tut	Sum	ST	MT	PE/OE	Final
MEC 42y9	Air-Conditioning Systems	MEC 42y1 MEC 42y2	3	2	0	2	4	30	30	0	40
Course Content	HVAC system classification – HVAC system analysis and selection – Building air distribution – In-room terminal system – Central cooling and heating – Decentralized cooling and heating – District heating and cooling – Hydronic heating and cooling system design – Applied heat pumps and heat recovery systems – Air conditioning system comfort application (Residences, retail facilities, commercial and public system, hotels, motels and dormitories, educational spaces, health care facilities) – Industrial air conditioning system (industrial drying system, ventilation of the industrial environment, kitchen ventilation) – Air conditioning systems for clean spaces.										
References	• Spach, Adam F.; Stanford III, Herbert W, 2019, "Analysis and Design of Heating, Ventilating, and Air-Conditioning Systems", Chapman and Hall/CRC.										
Used in Program	Mechanical Power Engineering - Energy management and HVAC Engineering			Semester	9						

Code	Course Title	Pre-req	CH	Ct. Hr.				Assessment Criteria			
				Lec.	Lab	Tut	Sum	ST	MT	PE/OE	Final
MEC 32z1	Vehicle Dynamics	MEC 213	3	2	0	2	4	30	30	0	40
Course Content	One-Dimensional Vehicle Dynamics, Tire Dynamics, Tire Stiffness, Tireprint Forces. Driveline Dynamics, Engine Dynamics, Driveline and Efficiency, Gearbox and Clutch Dynamics. Vehicle Applied Kinematics. Steering Dynamics: Steering linkages, steering systems design, Vehicle steering properties: neutral, oversteer and understeer, vehicle directional stability. Suspension Mechanisms: Solid Axle Suspension, Independent Suspension. Vehicle Applied Dynamics: Two-wheel Rigid Vehicle Dynamics, Steady-State Turning. Vehicle Vibration: Mechanical Vibration Elements, Lagrange Method, and Dissipation Function.										
References	• G. Nakhaie Jazar, 2008, "Vehicle Dynamics. Theory and Application", Springer. • Georg Rill, Abel Arrieta Castro, 2020, "Road Vehicle Dynamics-Fundamentals and Modeling with MATLAB", CRC Press										
Used in Program	Mechanical Power Engineering - Vehicle Engineering			Semester	7						

Code	Course Title	Pre-req	CH	Ct. Hr.				Assessment Criteria			
				Lec.	Lab	Tut	Sum	ST	MT	PE/OE	Final
MEC 32z2	Automotive Engineering	MEC 214	3	2	0	2	4	30	30	0	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										
Used in Program	Mechanical Power Engineering - Vehicle Engineering			Semester	8						

Code	Course Title	Pre-req	CH	Ct. Hr.				Assessment Criteria			
MEC 32z3	Electric vehicles	MEC 32z1 MEC 32z2	3	Lec.	Lab	Tut	Sum	ST	MT	PE/OE	Final
				2	0	2	4	30	30	0	40
Course Content	Introduction to Electric Vehicles, Electric Vehicles Advantages: Efficiency Comparison, Pollution Comparison, Capital, and Operating Cost Comparison. Vehicle Kinetics, Dynamics of Vehicle Motion, Propulsion Power. Energy Source: Battery, Battery Basics, Lead-Acid Battery, Nickel-Cadmium Battery, Nickel-Metal-Hydride (NiMH) Battery. Battery Parameters: Battery Capacity, Discharge Rate, State of Charge, State of Discharge, Depth of Discharge. Alternative Energy Sources: Fuel Cells, Supercapacitors and Ultracapacitors, Flywheels. Hybrid Electric Vehicles: Types of Hybrids, Internal Combustion Engines, Gas Turbine Engine.										
References	• James H. Harlow, 2005, "Electric and Hybrid Vehicles Design Fundamentals – Design Fundamentals", CRC Press.										
Used in Program	Mechanical Power Engineering - Vehicle Engineering						Semester	8			

Code	Course Title	Pre-req	CH	Ct. Hr.				Assessment Criteria			
MEC 32z4	Vehicle design & Manufacturing	MEC 32z2	3	Lec.	Lab	Tut	Sum	ST	MT	PE/OE	Final
				2	0	2	4	30	30	0	40
Course Content	Introduction to chassis design, Chassis types. Body design: The styling process, Body design: Aerodynamics. Suspension systems and components, classification of springs, design of coil springs. Leaf springs, Spring capacity. Transmissions and driveline. Design of rigid axle beam and king pin independent suspensions, Design of double wishbone and Macpherson suspensions, Bearings. Drum and disc brakes: Mechanical advantage, Assisted brake systems. Modern materials and their incorporation into vehicle design. The manufacturing challenge for automotive designers.										
References	• HAPPIN SMITH, 2001, " An Introduction to Modern Vehicle Design", Elsevier Limited.										
Used in Program	Mechanical Power Engineering - Vehicle Engineering						Semester	7			

Code	Course Title	Pre-req	CH	Ct. Hr.				Assessment Criteria			
MEC 32z5	Vehicle maintenance Technology	MEC 32y1, MEC 32y2	3	Lec.	Lab	Tut	Sum	ST	MT	PE/OE	Final
				2	0	2	4	30	30	0	40
Course Content	Fundamentals of vehicle systems and components, diagnostic principles, latest techniques employed in effective vehicle maintenance and repair. Diagnostics, or fault finding, Mechanical diagnostic techniques, Electrical diagnostic techniques, Data sources. On-board diagnostics, Petrol/Gasoline on-board diagnostic monitors, Misfire detection. Engine systems, Engine operation, Diagnostics of engines, Test equipment, Engine fault diagnosis table. Fuel system, Carburation, Diagnostics of fuel system. Diagnostics of ignition system. Diagnostics of diesel injection systems. Diagnostics of cooling and lubrication.										
References	• Tom Denton, 2016, " Advanced Automotive Fault Diagnosis: Automotive Technology: Vehicle Maintenance and Repair ", Routledge Press.										
Used in Program	Mechanical Power Engineering - Vehicle Engineering						Semester	8			

Code	Course Title	Pre-req	CH	Ct. Hr.				Assessment Criteria			
				Lec.	Lab	Tut	Sum	ST	MT	PE/OE	Final
MEC 42z6	Engine Testing and Pollution Control	MEC 32z1 MEC 32z2	3	2	0	2	4	30	30	0	40
Course Content	Available technologies to overcome the limitations of conventional prime movers. Important terminology associated with engine. Engine performance parameters. Formulation of hydrocarbons. Engine modifications to limit harmful emissions, Development of new combustion concepts. Adoption of alternative fuels in existing engines. Switching over to electrics: advantages and limitations. Specifications of highly marketed automobiles. Emission measurement methods.										
References	• G. Amba Prasad Rao, T. Karthikeya Sharma, 2020, "Engine Emission Control Technologies - Design Modifications and Pollution Mitigation Techniques", Apple Academic Press.										
Used in Program	Mechanical Power Engineering - Vehicle Engineering						Semester	9			

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment Criteria			
				Lec.	Lab	Tut	Sum	ST	MT	PE/OE	Final
MEC 42z7	Fundamental of hybrid vehicles	MEC 32z1 MEC 32z2	3	2	0	2	4	30	30	0	40
Course Content	Hybrid Vehicles (HV): History Overview and Modern Applications; Power Flow and Power Management Strategies in HV; Vehicle Dynamics Fundamentals for HV Modeling and Computer Simulation (MATLAB/Simulink); Mechanical Drivetrain Engineering; Electric Drives; Wheel-Electric Drive, Suspension System Design; Batteries and Energy Storages: Battery characterization, math modeling and designs, Battery sizing for various vehicle applications; Fuel cells: principles of operation, design, modeling; Power Electronics in Hybrid Electric Vehicles; Plug-in Hybrid Electric Vehicles; Electric Unmanned Ground Vehicle: Computer Modeling and Physical Tests.										
References	• Chris Mi, “Hybrid Electric Vehicles: Principles and Applications with Practical Perspectives” 2nd Edition, Automotive Series. • Allen Fuhs, 2009, “Hybrid Vehicles and the Future of Personal Transportation” CRC press.										
Used in Program	Mechanical Power Engineering - Vehicle Engineering						Semester	9			

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment Criteria			
				Lec.	Lab	Tut	Sum	ST	MT	PE/OE	Final
MEC 42z8	Aerodynamics of Road Vehicles	MEC 32z1 MEC 32z2	3	2	0	2	4	30	30	0	40
Course Content	Introduction to Automobile Aerodynamics, Physical Principles of Aerodynamics. Aerodynamic Forces and influence on passenger vehicles, aerodynamic drag of passenger cars. Aerodynamics and driving stability, safety, and comfort. Cooling and Internal Flow. Aeroacoustics. Numerical methods for computation of flow around road vehicles.										
References	• Wolf-Heinrich Hucho, 1987, " Aerodynamics of Road Vehicles. From Fluid Mechanics to Vehicle Engineering", Butterworth-Heinemann Ltd.										
Used in Program	Mechanical Power Engineering - Vehicle Engineering						Semester	9			

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment Criteria			
				Lec.	Lab	Tut	Sum	ST	MT	PE/OE	Final
MEC 42z9	Mechatronics for Automotive (Autotronics)	MEC 32z1 MEC 32z2	3	2	0	2	4	30	30	0	40
Course Content	Basics of mechatronics, electronic control unit, Automotive networking, Automotive sensors, Electric Actuators, Electrohydraulic Actuators, Electronic Transmission Control, Modules for Transmission Control, Antilock Braking System (ABS). Traction Control System (TCS). Electronic Stability Program. Automatic brake functions. Electronic Diesel Control. Active steering, Drive, and adjustment systems. Heating, ventilation, and air conditioning. Vehicle security systems.										
References	• Konrad Reif, 2019, " Automotive Mechatronics: Automotive Networking, Driving Stability Systems, Electronics", Bosch Professional Automotive Information.										
Used in Program	Mechanical Power Engineering - Vehicle Engineering						Semester	9			

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment Criteria			
				Lec.	Lab	Tut	Sum	ST	MT	PE/OE	Final
MEC 33x1	Mobile Robots	MEC 236	3	2	0	2	4	30	30	0	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										
Used in Program	Mechatronics Engineering - Robotics and Control						Semester	7			

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment Criteria			
				Lec.	Lab	Tut	Sum	ST	MT	PE/OE	Final
MEC 33x2	Autonomous systems	MEC 236	3	2	0	2	4	30	30	0	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.										
Used in Program	Mechatronics Engineering - Robotics and Control						Semester	7			

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment Criteria			
				Lec.	Lab	Tut	Sum	ST	MT	PE/OE	Final
MEC 33x3	Robot Operating Systems (ROS)	MEC 33x1 MEC 33x2	3	2	0	2	4	30	30	0	40
Course Content	An introduction to the Robot Operating System (ROS), ROS architecture: master, nodes, topics, messages, services, parameters, and actions. ROS time, ROS bags. Navigating and analyzing ROS system. Debugging strategies. ROS web services. Software Engineering with ROS. ROS Simulation Frameworks. Interfaces for Interaction with robots, Interface with sensors and actuators. Path planning plugins in ROS.										
References	• Robot Operating System (ROS), Anis Koubaa, Springer, 2016.										
Used in Program	Mechatronics Engineering - Robotics and Control						Semester	8			

Code	Course Title	Pre-req	CR. HRS.	Ct. Hr.				Assessment Criteria			
				Lec.	Lab	Tut	Sum	ST	MT	PE/OE	Final
MEC 33x4	Robust and Fault-tolerant Control	MEC 214 ELE 404	3	2	0	2	4	30	30	0	40
Course Content	Robust and Fault-tolerant Control: Robust and optimal control methods for uncertain physical systems. H2/H_inf control of parametric uncertainty. Structural model of a dynamical system. Design a residual generator from structural and analytical results, Detectability and isolability of faults. Formulate models with uncertainty for a dynamical system. Sensitivity and performance for a feedback system. Algorithms for change detection. Design of control system for a faulty control object.										
References	• M. Blanke, M. Kinnaert, J. Lunze and M. Staroswiecki: Diagnosis and fault-tolerant control, 3nd ed., Springer 2015. • S. Skogestad and I. Postlethwaite, Multivariable feedback control - analysis and design, 2nd ed. Wile.										
Used in Program	Mechatronics Engineering - Robotics and Control						Semester	8			

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment Criteria			
				Lec.	Lab	Tut	Sum	ST	MT	PE/OE	Final
MEC 33x5	Computer Interfacing	ELE 404	3	2	0	2	4	30	30	0	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).										
Used in Program	Mechatronics Engineering - Robotics and Control						Semester	8			

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment Criteria			
				Lec.	Lab	Tut	Sum	ST	MT	PE/OE	Final
MEC 43x6	Rehabilitation Robotics	MEC 33x2	3	2	0	2	4	30	30	0	40
Course Content	Framework for neurorehabilitation robotics: implications for recovery. Biomechatronic design criteria of systems for robot-mediated rehabilitation therapy. Actuators and sensors for rehabilitation and prosthetic robots. Assistive controllers and modalities for robot-aided neurorehabilitation. Exoskeletons for upper limb rehabilitation. Exoskeletons for lower limb rehabilitation. Performance measures in robot-assisted assessment of sensorimotor functions.										
References	John J. Craig, Introduction to Robotics: Mechanics and Control (3rd Edition) 3rd Edition.										
Used in Program	Mechatronics Engineering - Robotics and Control						Semester	9			

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment Criteria			
				Lec.	Lab	Tut	Sum	ST	MT	PE/OE	Final
MEC 43x7	Medical Robotics	MEC 33x2	3	2	0	2	4	30	30	0	40
Course Content	Study of the design and control of robots for medical applications. Focus is on robotics in surgery and Interventional radiology, with introduction to other healthcare robots.										
References	• AchimSchweikard, Floris Ernst, “Medical Robotics”, Springer, 2015. • Paula Gomes, "Medical robotics- Minimally Invasive surgery", Woodhead, 2012.										
Used in Program	Mechatronics Engineering - Robotics and Control						Semester	9			

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment Criteria			
				Lec.	Lab	Tut	Sum	ST	MT	PE/OE	Final
MEC 43x8	Machine Learning	MEC 232	3	2	0	2	4	30	30	0	40
Course Content	Logistic regression, Non-parametric methods, Decision trees, classification, mixture models, neural networks, deep learning, ensemble methods and reinforcement learning.										
References	• Gareth, James, et al. An introduction to statistical learning: with applications in R. Spinger, 2013. • Bishop, Christopher M., and Nasser M. Nasrabadi. *Pattern recognition and machine learning*. Vol. 4. No. 4. New York: springer, 2006.										
Used in Program	Mechatronics Engineering - Robotics and Control						Semester	9			

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment Criteria			
				Lec.	Lab	Tut	Sum	ST	MT	PE/OE	Final
MEC 33y1	Autotronics	MEC 232	3	2	0	2	4	30	30	0	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.										
Used in Program	Mechatronics Engineering - Advanced Mechatronics and Autotronics						Semester	7			

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment Criteria			
				Lec.	Lab	Tut	Sum	ST	MT	PE/OE	Final
MEC 33y2	Machine Vision Systems	MEC 232	3	2	0	2	4	30	30	0	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										
Used in Program	Mechatronics Engineering - Advanced Mechatronics and Autotronics						Semester	7			

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment Criteria			
				Lec.	Lab	Tut	Sum	ST	MT	PE/OE	Final
MEC 33y3	Automotive Engineering	MEC 33y1	3	2	0	2	4	30	30	0	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.										
Used in Program	Mechatronics Engineering - Advanced Mechatronics and Autotronics			Semester	9						

*The course listed in electives of Mechanical Power Engineering – MEC42z2

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment Criteria			
				Lec.	Lab	Tut	Sum	ST	MT	PE/OE	Final
MEC 33y4	Micro Electromechanical Systems (MEMS)	MEC 43y2	3	2	0	2	4	30	30	0	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	• Chang Liu, 'Foundations of MEMS', Pearson Education Inc., 2012. • Stephen D Senturia, 'Microsystem Design', Springer Publication, 2000. • Tai Ran Hsu, "MEMS & Micro systems Design and Manufacture" Tata McGraw Hill, New Delhi, 2002.										
Used in Program	Mechatronics Engineering - Advanced Mechatronics and Autotronics			Semester	9						

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment Criteria			
				Lec.	Lab	Tut	Sum	ST	MT	PE/OE	Final
MEC 33y5	Industrial Mechanisms and Robotics	MEC 236 MEC 33y2	3	2	0	2	4	30	30	0	40
Course Content	Two-position synthesis, Three-position synthesis, Quick-return mechanisms, Coupler curves, Analytical synthesis of planar mechanisms, Optimal planar mechanism synthesis, Analytical synthesis of simple toggles, Introduction to spatial mechanism synthesis. Screw Motion: Plücker coordinates, Motion invariants, Pose, Instantaneous Screw axis (Screw Velocity): screw, twist, Acceleration, Dynamics: wrench, wrench axis, mass, center of mass, 1st moment of mass, Inertia, Kinetic energy, Newton Euler equations, Dynamics canonical equation. Simulation using Computer Graphics and MATLAB Software and case studies. Course project.										
References	• Mikell P. Groover, Mitchell Weiss, Roger N Nagel, Nicholas G Odrey, "Industrial Robotics Technology, Programming and Applications", Tata –McGraw Hill Pub. Co., 2008. • Gupta, Ashwani K., and Satish K. Arora. Industrial automation and robotics. Laxmi publications, 2009.										
Used in Program	Mechatronics Engineering - Advanced Mechatronics and Autotronics			Semester	9						

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment Criteria			
				Lec.	Lab	Tut	Sum	ST	MT	PE/OE	Final
MEC 43y6	Vehicle System Dynamics and Control	MEC 32y1 MEC 32y2	3	2	0	2	4	30	30	0	40
Course Content	Introduction – vehicle body motion – Tires – Suspension systems – Equations of motion of passenger cars – vehicle stability - Simulation of motion of passenger cars - Fundamentals of Hybrid Electric Vehicles and Electric Vehicles, Course Project.										
References	• G. Nakhaie Jazar, 2008, "Vehicle Dynamics. Theory and Application", Springer. • Georg Rill, Abel Arrieta Castro, 2020, "Road Vehicle Dynamics-Fundamentals and Modeling with MATLAB", CRC Press										
Used in Program	Mechatronics Engineering - Advanced Mechatronics and Autotronics			Semester	9						

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment Criteria			
				Lec.	Lab	Tut	Sum	ST	MT	PE/OE	Final
MEC 43y7	Hydraulic Servo Control	MEC 32y1 MEC 32y2	3	2	0	2	4	30	30	0	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.										
Used in Program	Mechatronics Engineering - Advanced Mechatronics and Autotronics			Semester	9						

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment Criteria			
				Lec.	Lab	Tut	Sum	ST	MT	PE/OE	Final
MEC 43y8	Playware Technology	MEC 331	3	2	0	2	4	30	30	0	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.										
Used in Program	Mechatronics Engineering - Advanced Mechatronics and Autotronics			Semester	9						

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

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

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

Code	Course Title	Pre-req	Cr. Hrs.	Ct Hrs				Assessment			
				Lec	Lab	Tut	Tot	SA	MT	PE/OE	Final
BES 211	Engineering Statistics and Probability	BES 012	3	2	2	0	4	10	30	20	40
Course Content	Probability: Obtaining Data - Probability models: mathematical, deterministic model. Probability theory concepts. - Discrete Distributions: Binomial and Poisson distribution. Continuous Distributions: Normal and Exponential Distribution. - Joint distributions. Statistics and Estimation: central point theorem, Single and multiple confidence interval, Prediction interval, tolerance interval - Hypothesis testing, - Inferences on the mean and variance of Normal distribution, Inference of two samples. – Simple and multiple Linear Regression and Correlation. - Applications involving uniform, Gaussian. Markov chains - Queueing Theory - Course examples are drawn from signal processing, system reliability, data science, wireless communications, civil engineering, and mechanical engineering - Lab simulations of engineering applications.										
References	• R. E Walpole, R. H. Myers, "Probability and Statistics for Engineers and Scientists", Macmillan Publishing, Last Edition. • David Levine, Patricia Ramsey , Robert Smidt, "Applied Statistics for Engineers and Scientists: Using Microsoft Excel & Minitab", First Edition, 2000.										
Laboratory	Lab simulations by software's as (Excel, Matlab, Python,…)- Exploratory data analysis and data transformation (Tabulated data summaries and statistics, Histograms, Box and Correlation plots, Computation of means, variances, etc, Missing data imputation)- Simple random sampling with and without replacement- Stratified random sampling- Simulating Bernoulli process and Poisson distribution - Simulating Markov chains applications-Binary and sequential hypothesis testing and gambler's ruin -Gaussian Mixture Models, clustering and anomaly detection- Regression models and inference- Time series forecasting and ARIMA models.										

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

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab	Tut	Sum	ST	MT	PE/OE	Final
ELE 104	Electronic Devices and Circuits	ELE 103	2	1	0	2	3	30%	30%	0%	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	• Sedra / Smith, Microelectronic Circuits, 8th Edition, Oxford University Press, 2019.										

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

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

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

Code	Course Title	Pre-req	Cr. Hrs.	Ct. Hr.				Assessment			
				Lec.	Lab	Tut	Sum	ST	MT	PE/OE	Final
ELE 404	Digital Control	MEC 314	3	2	0	2	4	30%	30%	-	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.										
Used in Program	Mechatronics Engineering Program						Semester	8			