ACADEMIC REGULATIONS, RULES, STUDY PLANS & COURSE DESCRIPTION FOR UNDERGRADUATE STUDIES
(FACULTY OF ENGINEERING)

اللوائح والقواعد الأكاديمية والخطط الدراسية والمحتوي العلمي لمقررات مرحلة البكالوريوس
(كلية الهندسة)

جامعة بنها الأهلية
Benha National University
BNU

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مقدمة

تسعى كلية الهندسة بجامعة بنها الاهلية بمدينة العبور إلى أن تكون أحد أهم القلاع الهندسية داخل جمهورية مصر العربية، وأيضا خارجها على المستويين الإقليمي والدولي. ولقد تم تصميم لائحة كلية الهندسة بجامعة بنها الاهلية لتواكب التطور الحالي في مجال الهندسة والتكنولوجيا على مستوى العالم، حيث صممت اللائحة لإكساب طلاب الكلية العديد من المهارات المتعددة مثل الابتكار، حل المشكلات الهندسية المعقدة، صنع القرار، إدارة وتنظيم المشاريع، مهارات التواصل والعمل بروح الفريق الواحد.

وقد روعي عند تصميم اللائحة على احتواء معظم المقررات الدراسية في كل برنامج هندسي على جانب تطبيقي وعملي وأيضا الاهتمام بالتدريب الصيفي في أحد المؤسسات او الشركات او المكاتب الاستشارية ذات الصلة بالتخصص مما يعطى الطالب مجال لتطبيق ما يدرسه حتى يكون على استعداد للانخراط في سوق العمل وذلك بعد تخرجهم مباشرة.

تم تصميم هذه اللائحة طبقا للإطار المرجعي لإعداد برامج مرحلة البكالوريوس بكليات الهندسة بنظام الساعات المعتمدة والصادر من لجنة قطاع الدراسات الهندسية والتكنولوجية والصناعية بالمجلس الأعلى للجامعات في عام 2020 مع تبنى المعايير القومية الاكاديمية القياسية (NARS) والصادرة في عام 2018 والخاصة بالتخصصات الهندسية المختلفة.

ACADEMIC REGULATIONS AND RULES FOR UNDERGRADUATE STUDIES (FACULTY OF ENGINEERING)

اللوائح والقواعد الاكاديمية لمرحلة البكالوريوس

كلية الهندسة

ARTICLE 1: VISION

The faculty of Engineering - BNU, looking forward to being a leading faculty at the national, regional, and international levels in engineering education fields, scientific research, innovation, and entrepreneurship to achieve the sustainable development of humankind.

مادة (1): رؤية الكلية

تتطلع كلية الهندسة بجامعة بنها الأهلية أن تكون كلية رائدة على المستوى القومي والإقليمي والدولي في مجالات التعليم الهندسي والبحث العلمي والابتكار وريادة الأعمال لتحقيق التنمية المستدامة للبشرية.

ARTICLE 2: MISSION

The faculty of Engineering at BNU is committed to prepare graduates with the skills and attitudes to attain competence as professional engineers and researchers, and to interact with industry and community within the framework of human values and social responsibility.

مادة (2): رسالة الكلية

تلتزم كلية الهندسة بجامعة بنها الأهلية بإعداد خريجين مزودين بالكفاءات والجدارات اللازمة لبلوغ الكفاءة كمهندسين وباحثين محترفين، وللتفاعل مع الصناعة والمجتمع في إطار القيم الإنسانية والمسؤولية المجتمعية.

ARTICLE 3: DEPARTMENTS AND ACADEMIC PROGRAMS

1- Department of Basic Sciences.
2- Mechanical Engineering Department.
   The department offers the following academic engineering programs:
   - Materials and Manufacturing Engineering Program.
   - Mechatronics and Automation Engineering Program.
3- Electrical Engineering Department.
   The department offers the following academic engineering programs:
   - Communication Systems Engineering.
   - Medical Engineering.
4- Department of Civil Engineering.

The department offers the following academic engineering program:
   - Building Engineering

5- Architectural Engineering Department
   The department offers the following academic engineering program:
   - Housing & Design for Communities.

The university can add additional departments or/and academic programs after fulfilling the requirements demanded by the Supreme Council of Egyptian Universities.

مادة (3): الأقسام والبرامج الاكاديمية بالكلية: -

1. قسم العلوم الاساسية.
2. قسم الهندسة الميكانيكية.

ويحتوي على البرامج الاكاديمية التالية: -

- برنامج هندسة الميكاترونكس والاتمتة.
- برنامج هندسة التصنيع والمواد.

3. قسم الهندسة الكهربية.

ويحتوي على البرامج الاكاديمية التالية: -

- برنامج هندسة نظم الاتصالات.
- برنامج الهندسة الطبية.

4. قسم الهندسة المدنية.

ويحتوي على برنامج أكاديمي وهو: -

- برنامج هندسة البناء.

5. قسم الهندسة المعمارية

ويحتوي على برنامج أكاديمي وهو: -

- برنامج الإسكان والتصميم للمجتمعات.

يمكن للجامعة إضـــافة اقســـام علمية و/أو برامج أكاديمية جديدة ومنح درجات بكالوريوس جديدة في العلوم الهندســـية بعد استيفاء المتطلبات التي يطلبها المجلس الأعلى للجامعات المصرية.

ARTICLE 4: BACHELOR'S DEGREES

Benha National University (BNU) awards, upon the request of the faculty Council, the Bachelor of Engineering Science (B.Sc.) degree in one of the following engineering science disciplines: -

- Materials and Manufacturing Engineering
- Mechatronics and Automation
- Communication Systems Engineering
- Medical Engineering
- Building Engineering
- Housing & Design for Communities

The BNU can add new academic programs and awards new bachelor's degrees in engineering science after fulfilling the requirements demanded by the Supreme Council of Egyptian Universities.

مادة (4): درجات البكالوريوس

تمنح جامعة بنها الأهلية بناءً على طلب مجلس الكلية درجة بكالوريوس العلوم الهندسـية في أحد تخصـصـات العلوم الهندسـية التالية: -

- هندسة التصنيع والمواد

- هندسة الميكاترونكس والأتمتة
- هندسة نظم الاتصالات
- الهندسة الطبية
- هندسة البناء
- الإسكان والتصميم للمجتمعات

يمكن للجامعة إضافة برامج أكاديمية جديدة ومنح درجات بكالوريوس جديدة في العلوم الهندسية بعد استيفاء المتطلبات التي يطلبها المجلس الأعلى للجامعات المصرية.

ARTICLE 5: IMPORTANT DEFINITIONS

5.1 **Academic Year:** two regular semesters and a summer semester, if any.

5.2 **Academic Semester:** a period of no less than fifteen (15) weeks of instruction, excluding the registration and final examination periods.

5.3 **Summer Session:** a period not exceeding eight (8) weeks of instruction, excluding the registration and final examination periods. The weekly duration of each course in a summer session is twice its duration during the regular academic semester.

5.4 **Academic Level:** indicates the level of study. The levels required for graduation are at least nine (8), in accordance with the specifications of the approved degree program.

5.5 **Study plan:** Is a set of obligatory, elective and free courses, which constitute the total credits required for graduation that must a student pass successfully to obtain the degree in the selected specialization.

5.6 **Course:** a subject of study within a certain academic level of the approved degree study plan in each major. Each course has a distinguished number, code, title, and a detailed description of its contents. A portfolio on each course is kept in its corresponding department for follow-up, evaluation, and updates. Some courses may have prerequisite or corequisite requirement(s).

5.7 **Credit Hour:** each weekly lecture, with duration not less than fifty (50) minutes or a tutorial session with duration not less than one hundred (100) minutes or a laboratory session or field study not less than (150) minutes of duration.

5.8 **Academic Probation:** a notification given to a student with a cumulative GPA below the minimum acceptable limit as explained in these regulations.

5.9 **Classwork Score:** The score which reflects the student's standing during a semester according to his/her performance in examinations, research, and other activities related to the course.

5.10 **Final Examination:** An examination in course materials, given once at the end of each semester.

5.11 **Final Examination Score:** The score attained by a student in the final examination for each course.

5.12 **Final Score:** The total sum of the classwork score plus the final examination score for each course out of a total grade of 100.

5.13 **Course Grade:** A percentage, or alphabetical letter assigned to a student which indicates the final grade received in a course.

5.14 **Incomplete Grade (IC):** the letter grade (IC) in the academic record indicates a provisional grade in which a student fails to complete the course requirements by the end of a specific date.

5.15 **In-progress Grade (IP):** The letter grade (IP) indicates a provisional grade assigned to each course which requires more than one semester to be completed.

5.16 **Semester GPA:** The total quality points a student has earned, divided by the credit hours assigned for all courses taken in a given semester. Total quality points are calculated by multiplying the credit hours by the grade point in each course.

5.17 **Cumulative GPA (CGPA):** The total quality points a student has earned in all courses taken since enrolling at the university divided by the total number of credit hours assigned for these courses.

5.18 **Graduation Ranking:** The assessment of a student's scholastic achievement during his study at the college.

5.19 **Study load:** Total number of credit hours a student can register determined by his/her academic status, and in accordance with the faculty council decisions.

5.20 **Transcript:** It is a record showing a student's academic path at the program and the courses he/she has studied in each semester, along with their codes, numbers, credit hours and grades. It also includes other transferred courses finished by the student in another university or another program at the university, together with the semester average and GPA.

5.21 **Pre-requisite:** This is a course which must be completed before registering other courses according to the educational program.

5.22 **Probation:** The student is placed under probation if he/she scores a GPA below 2.0 in any regular semester, and this requires the reduction of his/her educational load.

5.23 **Academic Advisor:** The academic advisor is a staff member or a teaching assistant who is assigned the supervision of a group of students in addition to guiding and helping them in choosing what is appropriate to their abilities and interests. In addition, the academic advisor clarifies the plans, courses and tracks in the program for students so that they can take decisions to plan for

their studies and achieve their aspired academic goals. A student should refer to the academic advisor to consult him/her as regards any educational issues.

5.24 **Academic Level of the Student:** If the student completed 25% of the graduation requirements, this considered as a transfer from the current level to the higher level (levels are from 1 to 4). This does not require determining the quality or the level of courses completed by the student.

مادة (5): تعريفات مهمة

5.1 **السنة الدراسية:** فصلان رئيسيان وفصل صيفي واحد إن وجد.

5.2 **الفصل الدراسي الرئيسي:** مدة زمنية لا تقل عن خمسة عشر أسبوعاً تدرس خلالها المقررات الدراسية، ولا تدخل من ضمنها فترتا التسجيل والاختبارات النهائية.

5.3 **الفصل الصيفي:** مدة زمنية لا تزيد على ثمانية أسابيع ولا تدخل من ضمنها فترتا التسجيل والاختبارات النهائية، وتضاعف خلالها الساعات الأسبوعية المخصصة لكل مقرر.

5.4 **المستوى الدراسي:** هو الدال على المرحلة الدراسية وفقا للخطط الدراسية المعتمدة.

5.5 **الخطة الدراسية:** هي مجموعة المقررات الدراسية الإجبارية والاختيارية، والتي تشكل من مجموع وحداتها متطلبات التخرج التي يجب على الطالب اجتيازها بنجاح للحصول على الدرجة العلمية في التخصص المحدد.

5.6 **المقرر الدراسي:** مادة دراسية ضمن الخطة الدراسية المعتمدة في كل تخصص. ويكون لكل مقرر رقم ورمز واسم ووصف مفصل لمفرداته يميزه من حيث المحتوى، والمستوى عما سواه من مقررات، وملف خاص يحتفظ به البرنامج لغرض المتابعة والتقييم والتطوير، ويجوز أن يكون لبعض المقررات متطلب أو متطلبات سابقة.

5.7 **الساعة المعتمدة:** كل محاضرة اسبوعيا لا تتجاوز 50 دقيقة، أو فترة تمارين لا تتجاوز 100 دقيقة أو معمل لا يتجاوز 150 دقيقة.

5.8 **الإنذار الأكاديمي:** الإشعار الذي يوجه للطالب بسبب انخفاض المعدل التراكمي عن الحد الأدنى الموضح في هذه اللائحة.

5.9 **درجة الأعمال الفصلية (اعمال السنة):** الدرجة الممنوحة للأعمال التي تبين تحصيل الطالب خلال فصل دراسي من اختبارات وبحوث وأنشطة تعليمية تتصل بالمقرر الدراسي.

5.10 **الاختبار النهائي:** اختبار في المقرر يعقد مرة واحدة في نهاية الفصل الدراسي.

5.11 **درجة الاختبار النهائي:** الدرجة التي يحصل عليها الطالب في كل مقرر في الاختبار النهائي للفصل الدراسي.

5.12 **الدرجة النهائية:** مجموع درجات الأعمال الفصلية مضافاً إليها درجة الاختبار النهائي لكل مقرر، وتحسب الدرجة من مائة.

5.13 **التقدير:** وصف للنسبة المئوية أو الرمز الأبجدي للدرجة النهائية التي حصل عليها الطالب في أي مقرر.

5.14 **المعدل الفصلي:** حاصل قسمة مجموع النقاط التي حصل عليها الطالب على مجموع الساعات الدراسية المعتمدة المقررة لجميع المقررات التي درسها في أي فصل دراسي، وتحسب النقاط بضرب الساعات الدراسية المعتمدة في وزن التقدير الذي حصل عليه في كل مقرر درسه الطالب.

5.15 **المعدل التراكمي:** أصل قسمة مجموع النقاط التي حصل عليها الطالب في جميع المقررات التي درسها منذ التحاقه بنظام الساعات المعتمدة بالجامعة على مجموع الساعات الدراسية المعتمدة لتلك المقررات.

5.16 **العبء الدراسي:** مجموع الساعات الدراسية المعتمدة التي يسمح للطالب التسجيل فيها في فصل دراسي ويتحدد الحد الأعلى والأدنى للعبء الدراسي حسب القواعد المذكورة لاحقا.

5.17 **درجة غير مكتملة (IC):** تشير الدرجة بالحرف (غم) في السجل الأكاديمي إلى درجة مؤقتة يفشل فيها الطالب في إكمال متطلبات المقرر بنهاية تاريخ محدد.

5.18 **درجة مكملة (IP):** تشير الدرجة بالحرف (مك) في السجل الأكاديمي إلى درجة مؤقتة تُخصص لكل مقرر يتطلب إكماله أكثر من فصل دراسي.

5.19 **ترتيب التخرج:** تقييم التحصيل الدراسي للطالب أثناء دراسته في الكلية.

5.20 **السجل الأكاديمي:** هو سجل يوضح المسار الأكاديمي للطالب في البرنامج والمقررات التي درسها في كل فصل دراسي، إلى جانب الأكواد، والساعات المعتمدة والدرجات. ويشمل أيضًا المقررات التي تم معادلتها للطالب التي أنهها في جامعة أخرى أو في برنامج آخر في الجامعة، مع المعدل الفصلي والمعدل التراكمي.

5.21 **متطلب سابق:** هو مقرر يجب إكماله قبل تسجيل مقرر أخر طبقا للبرنامج التعليمي.

5.22 **المراقبة:** يوضع الطالب تحت المراقبة إذا حصل على معدل تراكمي أقل من 2.0 في أي فصل دراسي منتظم، وهذا يتطلب تقليل العبء التعليمي.

5.23 **المرشد الأكاديمي:** هو عضو هيئة تدريس أو هيئة معاونة مكلف بالإشراف على مجموعة من الطلاب بالإضافة إلى توجيههم ومساعدتهم في اختيار ما يناسب قدراتهم واهتماماتهم. كما يوضح المرشد الأكاديمي الخطط والمقررات والمسارات في البرنامج للطلاب حتى يتمكنوا من اتخاذ قرارات التخطيط لدراساتهم وتحقيق أهدافهم الأكاديمية المنشودة. على الطالب مراجعة المرشد الأكاديمي لاستشارته في أي موضوع تعليمي.

5.24 **المستوى الأكاديمي للطالب:** إذا أكمل الطالب 25٪ من متطلبات التخرج، فيعتبر ذلك بمثابة انتقال من المستوى الحالي إلى المستوى الأعلى (المستويات من 1 إلى 4). هذا لا يتطلب تحديد جودة أو مستوى المقررات التي أكملها الطالب.

ARTICLE 6: ADMISSION OF PROSPECTIVE STUDENTS

6.1. The admission is permitted for the students that meet the following requirements:
- Completion of secondary education certificate or equivalent certificates according to the requirements of the college.
- Meeting the minimum score required to join the program, which is announced before the beginning of the academic year, considering the annually announced terms, regulations and qualifying courses per certificate as specified by the Supreme Council of the Egyptian Universities.

6.2. Students are enrolled at the start of the two main semesters only.

6.3. The applicant must satisfy any other requirements specified by the Supreme Council of the Egyptian Universities at the time of application.

6.4. Selection from among applicants, who satisfy all the admission requirements, is based on their grades in secondary school examinations, as well as the results of the interviews and the admission examinations, if any.

مادة (6): شروط القيد والالتحاق

6.1. يسمح بقيد الطلاب الذين يستوفون الشروط التالية:

- الطلاب المصريين الحاصلون على شهادة الثانوية العامة، او ما يعادلها، شريطة استيفاء الحد الأدنى من الدرجات المطلوبة للالتحاق بالكلية أو ببرنامج ما، والذي يتم الإعلان عنه قبل بداية العام الدراسي، مع مراعاة جميع شروط القبول واجتياز اختبارات القبول المعلنة سنويًا (إن وجدت) على النحو الذي يحدده المجلس الأعلى للجامعات.

- الطلاب المصريين الحاصلين على درجات بكالوريوس أو ليسانس سابقة من الجامعات او المعاهد العليا المصرية المعترف بها، شريطة استيفاء جميع شروط القبول واجتياز اختبارات القبول المعلنة سنويًا (إن وجدت) على النحو الذي يحدده المجلس الأعلى للجامعات.
- الطلاب الوافدين الحاصلين على شهادات معادلة لشهادة الثانوية العامة المصرية، وبشريطة استيفاء جميع الشروط الذي يحددها المجلس الأعلى للجامعات، بالإضافة الى استيفاء شروط الالتحاق بالبرنامج المراد الالتحاق به.

6.2. يتم قيد الطلاب في بداية الفصول الرئيسية فقط (الربيع والخريف).
6.3. يجب أن يستوفي المتقدم أي متطلبات أخرى يحددها المجلس الأعلى للجامعات المصرية وقت تقديم الطلب.
6.4. يتم الاختيار من بين المتقدمين، الذين يستوفون جميع شروط القبول، بناءً على درجاتهم في امتحانات الثانوية العامة، وكذلك نتائج المقابلات وامتحانات القبول، إن وجدت.

ARTICLE 7: SYSTEM OF STUDY

7.1. The study system at the university is the credit hours system and the study within the programs is in Arabic and English according to the Academic program requirement.
7.2. The program makes (if required) an English language examination for the new participated students to determine their level in English. The student who did not pass the examination must join an intensive English language course at the beginning of the 1st semester of the 1st level and allowed to reenter the examination at the beginning of the next semester until he/she passes.

مادة (7): نظام الدراسة

7.1. نظام الدراسة في الجامعة هو نظام الساعات المعتمدة والدراسة بالبرامج باللغة العربية والإنجليزية طبقا الى متطلبات البرنامج الأكاديمي.
7.2. يقوم البرنامج (إذا لزم الأمر) بإجراء امتحان في اللغة الإنجليزية للطلاب المشاركين الجدد لتحديد مستواهم في اللغة الإنجليزية. الطالب الذي لم ينجح في الامتحان يجب أن يلتحق بدورة لغة إنجليزية مكثفة في بداية الفصل الأول من المستوى الأول ويسمح له بإعادة الاختبار في بداية الفصل التالي حتى ينجح.

ARTICLE 8: ACADEMIC YEAR AND DURATION OF STUDY

8.1. The academic year of the University starts at the third week of September and concludes by the end of August of the following calendar year (or according to the decisions of the Supreme Council of Universities). For all undergraduate programs, the academic year normally includes two semesters, each of which consists of 16 weeks of academic work, beside summer semester consist of 8 weeks. An Academic Calendar with dates of important University activities during the academic year is issued for ready reference.
8.2. The duration of the study in the programs is eight (8) main semesters.
8.3. The maximum study duration for the enrolled student, at the program, is eight (8) academic years.

مادة (8): السنة الدراسية ومدة الدراسة

8.1. تبدأ السنة الدراسية للجامعة في الأسبوع الثالث من شهر سبتمبر وتنتهي بنهاية شهر أغسطس من العام الميلادي التالي (أو طبقا لما يحدده المجلس الأعلى للجامعات).

8.2. بالنسبة لجميع برامج البكالوريوس، تشتمل السنة الأكاديمية عادةً على فصلين دراسيين، يتكون كل منهما من 16 أسبوعًا من العمل الأكاديمي بالإضافة لفصل صيفي يتكون من 8 أسابيع.

8.3. يتم إصدار التقويم الأكاديمي مع تواريخ الأنشطة الجامعية الهامة خلال العام الدراسي للرجوع إليها بسهولة.

8.4. الحد الأدنى لمدة الدراسة في البرامج ثمانية (8) فصول دراسية رئيسية.

8.5. الحد الأقصى لمدة الدراسة للطالب المسجل في البرنامج ثماني (8) سنوات أكاديمية.

ARTICLE 9: ATTENDANCE AND WITHDRAWAL

9.1. A regular student is required to attend lectures and laboratory sessions. If his/her attendance is less than the 75% the lectures and laboratory sessions assigned for each course, the student will be barred from continuing the course and will be denied entrance to the respective final examination. A student who is denied entrance to the examination due to absences is considered to have failed that course and is given the grade (F) in the course.

9.2. The faculty council may exempt a denied student from the provisions of attendance and allow him/her to take the examination, provided that the student presents an acceptable excuse to the council. However, the denied student must achieve at least 50% of attendance of the lectures and laboratory sessions specified for the course.

9.3. A student who is absent for a final examination, will be given a zero grade for that examination.

9.4. If a student fails to attend a final examination in any course but offers a compelling excuse, the faculty council may choose to accept his/her excuse and allow him/her to take a make-up examination. The make-up examination must be taken prior to the end of the following semester. In such cases, the course grade will be given to the student after the make-up examination.

9.5. Student may withdraw from the study of a course or more, without his/her being considered as having failed the courses, if he/she presents an acceptable excuse to the authorized body specified by the faculty council at least five weeks prior to the beginning of the final examinations. Under exceptional circumstances, the faculty Council may extend the permitted deadline for withdrawal and assign a (W) grade to the student. This semester will be included in the period required for completion of the program degree.

مادة (9): المواظبة والانسحاب

9.1. يجب على الطالب المنتظم حضور المحاضرات والمعامل والتمارين. ويُمنع الطالب من استكمال المقرر ومن دخول الامتحان النهائي للمقرر، إذا قلت نسبة حضوره عن 75٪ من المحاضرات والتمارين والمعامل المخصصة لكل مقرر، ويُعتبر الطالب الذي يُحرم من دخول الامتحان بسبب الغياب راسبًا في ذلك المقرر ويُمنح تقدير (F) في المقرر.

9.2. لمجلس الكلية إعفاء الطالب المحروم بسبب عدم الحضور والسماح له بإجراء الاختبار، شريطة أن يقدم الطالب عذرًا مقبولاً للمجلس. وفي جميع الاحوال، يجب أن يحقق الطالب نسبة 50٪ على الأقل من حضور المحاضرات والتمارين والمعامل المحددة للمقرر.

9.3. الطالب الذي يتغيب عن امتحان نهائي، يعطى علامة صفرية لهذا الاختبار.

9.4. إذا عجز الطالب عن حضور الامتحان النهائي في أي مقرر، ولكنه قدم عذرًا مقنعًا، يجوز لمجلس الكلية قبول عذره والسماح له بإجراء اختبار تعويضي. يجب إجراء الامتحان التعويضي قبل نهاية الفصل الدراسي التالي وفي مثل هذه الحالات، سيتم منح تقدير المقرر كاملا للطالب بعد الامتحان التعويضي.

9.5. يجوز للطالب الانسحاب من دراسة مقرر أو أكثر دون اعتبار رسوبه في المقررات، إذا قدم عذرًا مقبولاً للجهة المنوطة التي يحددها مجلس الكلية قبل خمسة أسابيع على الأقل من بداية الامتحانات النهائية. في ظل ظروف استثنائية، يجوز لمجلس الكلية تمديد الموعد النهائي المسموح به للانسحاب وتخصيص درجة (W) للطالب. ويتم ادراج هذا الفصل الدراسي ضمن الفترة المطلوبة لاستكمال التخرج من البرنامج.

ARTICLE 10: POSTPONEMENT AND INTERRUPTION OF STUDIES

10.1. A student may postpone study for reasons determined acceptable by the faculty Council. The postponement duration cannot be more than two consecutive regular semesters or three nonconsecutive regular semesters as maximum during his/her study at the University; otherwise, he/she will be dismissed from the University. The University Council may make exceptions when it deems necessary. The postponed period is not included in the period required for completion of the program degree.

10.2. If a regular student interrupts his/her studies for more than one semester without submitting a postponement application, he/she will be dismissed from the University.

10.3. A student is not considered to have interrupted his/her studies during those semesters when he/she is a visiting student at another university.

مادة (10): التأجيل والانقطاع عن الدراسة

10.1. يجوز للطالب تأجيل الدراسة لأسباب يقررها مجلس الكلية، بحيث لا تزيد مدة التأجيل عن فصلين دراسيين متتاليين أو ثلاثة فصول دراسية غير متتالية كحد أقصى خلال دراسته في الجامعة؛ وخلاف ذلك، يتم فصله من الجامعة. ويجوز لمجلس الجامعة الاستثناء من الشروط السابقة عندما يرى ضرورة لذلك. ولا يتم تضمين الفترة المؤجلة في الفترة المطلوبة لإكمال التخرج من البرنامج.

10.2. إذا انقطع الطالب المنتظم عن دراسته لأكثر من فصل دراسي دون تقديم طلب تأجيل، فيتم فصله من الجامعة.

10.3. لا يعتبر الطالب قد انقطع عن دراسته خلال تلك الفصول الدراسية عندما يكون طالباً زائراً في جامعة أخرى.

ARTICLE 11: RE-ENROLLMENT

11.1. A student whose enrollment is cancelled may apply for re-enrollment using the same university ID number and academic record he/she had before cancellation of his/her enrollment, according to the following regulations:

- He/She must apply for re-enrollment within four regular semesters from the date of dismissal.

- The faculty council and the University Council must approve the re-enrollment.
- Four or more semesters have lapsed since he/she interrupts his/her studies from the University; the student can apply to the University for admission as a new student without consideration of his/her old academic record if he/she fulfills all the admission requirements announced at the time of application.
- A student can be granted re-enrollment only once. The University Council may make exceptions when it deems necessary.
- A student cannot be re-enrolled if he/she has been on probation prior to his/her cancellation of enrollment.

11.2. A student who has been dismissed from the University for academic or disciplinary reasons, or who has been dismissed from another university for disciplinary reasons, will not be granted readmission. If it becomes evident after admission that he/she was dismissed for such reasons, his/her readmission is considered canceled from the date of readmission.

مادة (11): إعادة القيد

11.1. يجوز للطالب الذي تم إلغاء قيده التقدم بطلب لإعادة القيد باستخدام نفس الرقم الجامعي والسجل الأكاديمي الذي كان لديه قبل إلغاء تسجيله، وفقًا للشروط التالية:

- يجب عليه التقدم بطلب لإعادة القيد خلال أربعة فصول دراسية رئيسية من تاريخ الفصل.
- يجب أن يوافق مجلس الكلية ومجلس الجامعة على إعادة القيد.
- وفي حالة انقضاء أكثر من أربعة فصول دراسية منذ قطع دراسته من الجامعة؛ يمكن للطالب التقدم للجامعة للقبول كطالب جديد دون النظر إلى سجله الأكاديمي القديم إذا استوفى جميع شروط القبول المعلنة وقت تقديم الطلب.
- يمكن إعادة قيد الطالب مرة واحدة فقط، ولمجلس الجامعة الاستثناء عندما يرى ضرورة لذلك.
- لا يمكن إعادة قيد الطالب إذا كان في فترة المراقبة قبل إلغاء قيده.

11.2. لا يسمح بإعادة قيد الطالب الذي تم فصله من الجامعة لأسباب أكاديمية أو تأديبية، أو تم فصله من جامعة أخرى لأسباب تأديبية. وإذا اتضح بعد إعادة قيد الطالب بأنه تم فصله لهذه الأسباب، فإن إعادة القيد تعتبر ملغية من تاريخ إعادة القيد.

ARTICLE 12: GRADUATION

12.1. Student graduates after successfully completing all graduation requirements according to the study program, provided that his/her cumulative GPA is not less than two (2) out of four (4).

12.2. If the student has passed the required courses but his/her cumulative GPA is less than two (2), the faculty Council, based on the recommendations of the board of the department concerned, is entitled to specify the appropriate courses that the student must complete to improve his/her GPA.

مادة (12): التخرج

12.1. يتخـرج الطالـب بعـد إتمـام جميـع متطلبـات التخـرج بنجـاح، حسـب البرنـامج الـدراسي، بشرـط ألا يقـل معدله التراكمي عن اثنين (2) من أصل أربعة (4).

12.2. إذا اجتاز الطالب المقررات المطلوبة، ولكن معدله التراكمي أقل من اثنين (2)، يحق لمجلس الكلية بناءً على توصيات مجلس القسم المعني تحديد المقررات المناسبة التي يجب على الطالب إكمالها لتحسين معدله التراكمي.

ARTICLE 13: DISMISSAL FROM THE UNIVERSITY

13.1. A student will be dismissed from the University in either of the following situations: -

- The student receives a maximum of six consecutive or eight discontinuous academic probations for having a cumulative GPA lower than 2.00 out of 4.00. Based on the recommendations of the faculty Council, the University Council may grant another chance to a student who can improve his/her cumulative GPA by studying the courses available.
- A student fails to complete the graduation requirements within a maximum of eight (8) academic years.
- The University Council may make an exception and give students falls under the two previous situations the opportunity to complete their studies within an additional period of two semesters.

مادة (13): الفصل من الجامعة

13.1. يفصل الطالب من الجامعة في أي من الحالات التالية: -

- حصـول الطالـب عـلى سـت إنـذارات أكاديميـة متتاليـة أو ثمانيـة متقطعـة كحـد أقصى- إذا قـل معدلـه الـتراكمي عـن 2.00 مـن 4.00. بنـاءً عـلى توصـيات مجلـس الكليـة، يجـوز لمجلـس الجامعـة مـنح فرصـة أخرى للطالب الذي يمكنه تحسين معدله التراكمي من خلال دراسة المقررات المتاحة.
- فشل الطالب في استكمال متطلبات التخرج في مدة أقصاها ثماني (8) سنوات أكاديمية.
- يجـوز لمجلـس الجامعـة إجـراء اسـتثناء وإعطـاء الطـلاب السـابق ذكرهمـا في الحـالتين السـابقتين فرصـة لإكمال دراستهم خلال فترة إضافية بحد أقصى فصلين دراسيين.

ARTICLE 14: EXAMINATIONS AND SCORES

14.1. The score for each course is distributed according to the following table: -

Examination	Timing	Grade %
Midterm Exam. #1	7th week	15%
Midterm Exam. #2	12th week	15%
Semester's Work	--	30%
Final Exam.	16th week	40%

14.2. The semester's work score is evaluated by oral and practical examinations, research, quizzes and other class activities.

14.3. Based upon the recommendation of the board of the department offering the course, the faculty Council may include practical or oral tests in final examination of any course and allocates percentage to these tests as part of the final examination score.

14.4. For project courses and the courses of a field work nature, the Semester's work represents 60% of the total score, while the Final Presentation & Discussion represents 40% of the total score. The faculty Council specifies the ways to evaluate student achievement in such courses.

14.5. Based upon the recommendation of the board of the department offering the course, the faculty Council may allow a student to complete the requirements of any course in the following semester. In such a case, an 'IC' grade is recorded in the student's academic record. The student's grade in the course will not be included in the calculation of the semester or cumulative GPA until he/she completes the course requirements and earns a grade. If the IC grade is not changed in the academic record after the lapse of one semester because the student does not complete the course, the IC status will be automatically changed to an 'F' grade and will be included in the calculation of the semester and cumulative GPAs.

14.6. Appendix (A) shows examples of the calculation of semester and cumulative GPA.

مادة (14): الاختبارات والدرجات

14.1. توزع الدرجات الخاصة بكل مقرر تبعا للجدول التالي:

الاختبار	التوقيت	% الدرجة
امتحان منتصف الفصل (1)	الأسبوع السابع	15
امتحان منتصف الفصل (2)	الأسبوع الثاني عشر	15
أعمال فصلية	--	30
امتحان نهائي	الأسبوع السادس عشر	40

14.2. يتم تقييم درجات الأعمال الفصلية عن طريق الامتحانات الشفوية والعملية، والبحوث، والاختبارات القصيرة وأنشطة الفصل الأخرى.

14.3. بناءً على توصية مجلس القسم التابع له المقرر، يجوز لمجلس الكلية دمج الاختبارات العملية أو الشفوية في الاختبار النهائي لأي مقرر ويخصص نسبة لهذه الاختبارات كجزء من درجة الاختبار النهائي.

14.4. بالنسبة لمقررات المشروع والمقررات ذات طبيعة التدريب الميداني، تمثل الاعمال الفصلية 60٪ من إجمالي درجات المقرر، بينما يمثل العرض النهائي والمناقشة 40٪ من إجمالي الدرجات. ويحدد مجلس الكلية طرق تقييم الطلاب في مثل هذه المقررات.

14.5. بناءً على توصية مجلس القسم التابع له المقرر، يجوز لمجلس الكلية السماح للطالب باستكمال متطلبات أي مقرر مسجله الطالب في الفصل الدراسي التالي. في مثل هذه الحالة، يتم تسجيل درجة

"غير مكتمل" "IC" في السجل الأكاديمي للطالب. لن يتم تضمين تقدير الطالب في المقرر الدراسي في حساب المعدل الفصلي أو المعدل التراكمي حتى يكمل متطلبات المقرر ويحصل على تقدير به. إذا لم يتم تغيير درجة "IC" في السجل الأكاديمي بعد مرور فصل دراسي واحد لأن الطالب لم يستكمل المقرر، فسيتم تغيير حالة "IC" تلقائيًا إلى درجة "راسب" "F" ويتم تضمينها في حساب المعدل الفصلي والمعدل التراكمي.

14.6. يوضح ملحق (أ) أمثلة لحساب المعدل الفصلي والمعدل التراكمي.

ARTICLE 15: GRADES

15.1. The grades earned by students in each course are calculated as follows: -

Points	Grade Code	Percentage
4.00	A+	From 97% and more
4.00	A	From 93% less than 97%
3.70	A-	From 89% less than 93%
3.30	B+	From 84% less than 89%
3.00	B	From 80% less than 84%
2.70	B-	From 76% less than 80%
2.30	C+	From 73% less than 76%
2.00	C	From 70% less than 73%
1.70	C-	From 67% less than 70%
1.30	D+	From 64% less than 67%
1.00	D	From 60% less than 64%
0.00	F	Less than 60%

15.2. The other non-credit grades and its description are listed in Appendix (B).

15.3. Descriptive Grade (Semester average/ Cumulative average) for Engineering Science Programs:

GPA	Descriptive Grade	Percentage
3.7 up to 4.0	Excellent	89% up to 100%
From 3.3 to less than 3.7	Very Good	From 84% less than 89%
From 2.7 to less than 3.3	Good	From 76% less than 84%
From 2.0 to less than 2.7	Pass	From 70% less than 76%

مادة (15): تقديرات المقررات

15.1. تقدر نقاط كل ساعة معتمدة للمقرر للطالب طبقا للجدول التالي:

عدد النقاط	التقدير	النسبة المئوية
4.00	A+	97% فأعلى
4.00	A	من 93% وحتى اقل من 97%
3.70	A-	من 89% وحتى اقل من 93%
3.30	B+	من 84% وحتى اقل من 89%
3.00	B	من 80% وحتى اقل من 84%
2.70	B-	من 76% وحتى اقل من 80%
2.30	C+	من 73% وحتى اقل من 76%
2.00	C	من 70% وحتى اقل من 73%
1.70	C-	من 67% وحتى اقل من 70%
1.30	D+	من 64% وحتى اقل من 67%
1.00	D	من 60% وحتى اقل من 64%
0.00	F	اقل من 60%

15.2. يتم ذكر الدرجات الأخرى التي ليس لها نقاط أو ساعات معتمدة ووصفها في الملحق (ب).

15.3. تمنح التقديرات التي يحصل عليها الطالب عند تخرجه طبقا للجدول التالي:

المعدل التراكمي	التقدير المناظر	النسبة المئوية
3.7 فأكثر	امتياز	89% فأكثر
من 3.3 إلى أقل من 3.7	جيد جدا	84% حتى اقل من 89%
من 2.7 إلى أقل من 3.3	جيد	76% حتى اقل من 84%
من 2.0 إلى أقل من 2.7	مقبول	70% حتى اقل من 76%

ARTICLE 16: COURSES REGISTRATION

16.1. The student must register the courses in each semester and must meet the registration requirements in each course. After consultation with the academic advisor, the registration dates and rules issued by the program will be published annually and published in the student's guide.

16.2. The student who did not registered a course or courses within the registration period, is not allowed to register the courses, unless there is a place, and the faculty council may decide the delay registration fees in addition to the fees of the educational service prescribed.

16.3. Students may not register in any course unless they have completed its prerequisites. Graduating students are an exception and are only granted that after the concerned program coordinator and academic supervisor studies their cases.

16.4. The maximum academic load that can be registered is as follows: -

CGPA	Maximum academic Load (Credit Hours)
from 3.00 to less than 4.00	18
from 2.00 to less than 3.00	16
from 1.00 to less than 2.00	14

16.5. The minimum academic load that can be registered is 12 credit hours, except for graduating students.

16.6. Final year students (last two semesters) may register for one additional course beyond the above limits if this leads to their graduation. The board of the program must examine each of those cases individually.

16.7. Students can register courses from higher semesters to complete their academic load, if they complete the course prerequisites (if any). If students are unable to register their allotted academic load, available courses suffice even if the minimum number of hours is not reached.

16.8. The student can register up to six (6) credit hours in the summer semester and can be promoted to a maximum of nine (9) credit hours at the recommendation of the academic advisor.

مادة (16): تسجيل المقررات

16.1. يجب على الطالب تسجيل المقررات في كل فصل دراسي ويجب أن يستوفي شروط التسجيل في كل مقرر بعد التشاور مع المرشد الأكاديمي. ويتم نشر مواعيد التسجيل والقواعد الصادرة عن البرنامج سنويًا ونشرها في دليل الطالب.

16.2. لا يجوز للطالب الذي لم يسجل مقررًا أو مقررًا خلال فترة التسجيل تسجيل المقررات إلا إذا كان هناك سعة طلابية في المقرر، وللمجلس الكلية أن يقرر رسوم تأخير التسجيل بالإضافة إلى رسوم الخدمة التعليمية المقررة.

16.3. لا يجوز للطلاب التسجيل في أي مقرر ما لم يكملوا متطلباتها السابقة. يتم استثناء الطلاب المتوقع تخرجهم في أخر فصل دراسي لهم بعد أن يدرس منسق البرنامج المختص والمشرف الأكاديمي حالاتهم ويوافق عليها.

16.4. الحد الأقصى للعبء الأكاديمي المسموح بتسجيله طبقا للجدول التالي:

المعدل التراكمي	الحد الأقصى لساعات التسجيل المعتمدة
3.0 فأكثر	18
من 2.0 إلى أقل من 3.0	16
من 1.0 إلى أقل من 2.0	14

16.5. الحد الأدنى من العبء الأكاديمي الذي يمكن تسجيله هو 12 ساعة معتمدة، باستثناء الطلاب الخريجين.

16.6. يمكن لطلاب السنة النهائية (آخر فصلين دراسيين) تسجيل مقرر دراسي واحد إضافي عن الحدود المذكورة أعلاه إذا كان هذا سيؤدي الي تخرجه. ويجب فحص كل حالة على حدة بواسطة منسق البرنامج.

16.7. يمكن للطلاب تسجيل المقررات من المستويات الاعلى من أجل استكمال العبء الأكاديمي، إذا أكملوا متطلبات المقرر (إن وجدت). إذا كان الطلاب غير قادرين على تسجيل العبء الأكاديمي المخصص لهم، يستكفي بالمقررات المتاحة حتى إذا لم يتم الوصول إلى الحد الأدنى لعدد الساعات.

16.8. يمكن للطالب تسجيل ما يصل إلى ست (6) ساعات معتمدة في الفصل الصيفي ويمكن زيادتها إلى تسع (9) ساعات معتمدة كحد أقصى بناءً على توصية المرشد الأكاديمي.

ARTICLE 17: COURSE REPEAT

17.1. A student is considered to have failed a course if he/she obtains (F) according to the grading scheme.

- Failure result (F) for any course shall be registered in the student's transcript and is counted in the calculation of the semester average and cumulative GPA, whether the course is core or elective.
- A student must re-register for core courses which he/she fails. When he/she passes the course, the highest grade a student can receive is B+ (Very Good).

17.2. If the student fails for the second time in the exam of a repeated course, the failure grade is only counted in the semester average.

17.3. A student may repeat any course he/she has already passed if he/she wishes to improve his/her GPA with a maximum of five courses during his period of study. The number of retaken courses can increase more than five in case of removing the under probation.

17.4. A student may not repeat a course for improvement after more than one complete academic year (two regular semesters + summer semester) has passed, unless he/she is under probation and if recommended by the academic advisor.

مادة (17): إعادة المقررات

17.1. يعتبر الطالب راسبًا في مادة ما إذا حصل على (F) وفقًا لنظام الدرجات التالي:

- تسجل نتيجة الرسوب (F) لأي مقرر في كشف درجات الطالب وتحسب في حساب المعدل الفصلي والمعدل التراكمي سواء كان المقرر أساسيًا أو اختياريًا.
- يجب على الطالب إعادة التسجيل في المقررات التي يرسب فيها. وعندما يجتاز المقرر، فإن أعلى درجة يمكن أن يحصل عليها الطالب هي (+B) (جيد جدًا).

17.2. إذا رسب الطالب للمرة الثانية في امتحان مقرر معاد، تحسب علامة الرسوب فقط في المعدل الفصلي.

17.3. يجـوز للطالـب إعـادة أي مقـرر اجتـازه بالفعـل إذا كـان يرغـب في تحسـين معدلـه الـتراكمي بحـد أقصى خمـس مقـررات خـلال فـترة دراسـته. ويمكـن أن يزيـد عـدد مقـررات التحسـين عـن خمسـة في حالـة إزالـة المراقبة.

17.4. لا يجـوز للطالـب إعـادة مقـرر للتحسـين بعـد مـرور أكـثر مـن عـام دراسي كامـل (فصـلين دراسـيين عـاديين + فصل صيفي)، ما لم يكن تحت المراقبة، وإذا أوصى بذلك المرشد الأكاديمي.

ARTICLE 18: TRANSFER

18.1. The transfer of a student from outside the University may be accepted under the following conditions:
- The student should have studied at a recognized college or university.
- The student must not have been dismissed from that university for disciplinary reasons.
- The student must satisfy the transfer conditions, as determined by the University Council and the Supreme Council of Egyptian Universities.

18.2. The faculty Council evaluates the courses that were taken by the student outside the University, based on the recommendations of the board of the program that offer equivalent courses. The courses evaluated as equivalent are recorded in the student's academic transcript but are not included in the calculation of his/her cumulative GPA.

18.3. If it becomes evident, after a student's transfer, that the student was dismissed for disciplinary reasons, his/her enrollment is considered cancelled from the date of acceptance of his/her transfer to the University.

18.4. The transfer of a student from one university to another during any semester takes place in accordance with the procedures and the dates announced by the university to which the student is transferring, according to the general rules governing transfer.

18.5. A student may transfer from one program to another within the University in accordance with the rules endorsed by the University Council.

18.6. All courses that have been studied by a student transferred from one program to another are recorded in his/her academic record, including the grades and the semester and cumulative GPAs obtained throughout his/her study at the respective University.

18.7. A student may transfer from one major to another within the university, in accordance with the rules established by the University Council.

مادة (18): التحويل

18.1. تحويل الطالب من خارج الجامعة لابد أن يخضع للاشتراطات التالية:
- أن يكون الطالب محول من كلية او جامعة معترف بها.
- ألا يكون الطالب مفصول من الجامعة المحول منها لأسباب تأديبية.

- أن يحقق الطالب شروط التحويل الموضوعة من قبل المجلس الأعلى للجامعات.

18.2. يتم معادلة المقررات التي تم دراستها خارج الكلية من قبل مجلس الكلية بعد توصية مجلس إدارة البرنامج. تضاف المقررات التي تم معادلتها الي السجل الأكاديمي لكن لا تضاف لحساب المعدل التراكمي.

18.3. إذا تم اكتشاف أن الطالب المحول تم فصله لأسباب تأديبية، يتم إلغاء التحاقه بالجامعة من تاريخ قبول تحويله للجامعة.

18.4. يتم نقل الطالب من جامعة إلى أخرى خلال أي فصل دراسي وفق الإجراءات والمواعيد التي تعلنها الجامعة المحول إليها، وفق القواعد العامة التي تحكم التحويل.

18.5. يجوز للطالب الانتقال من برنامج إلى آخر داخل الجامعة وفق الضوابط التي يقرها مجلس الجامعة.

18.6. يتم تسجيل جميع المقررات التي درسها الطالب المنقول من برنامج إلى آخر داخل الجامعة في سجله الأكاديمي، بما في ذلك الدرجات والفصل الدراسي والمعدلات التراكمية التي حصل عليها خلال دراسته في الجامعة.

18.7. يجوز للطالب الانتقال من تخصص إلى آخر داخل الجامعة وفق الضوابط التي يضعها مجلس الجامعة.

ARTICLE 19: VISITING STUDENTS

19.1. A “visiting student” is a student who studies courses at another university or in any Branch of the University to which he/she belongs without transferring. These courses are considered equivalent to those offered at the University, according to the following rules:

- The student must obtain the approval of his/her program before he/she begins his/her studies.
- His/Her studies should be at a recognized college or university.
- The course the student takes outside his/her university should be equivalent, in terms of content, to a course required for graduation.
- The University Council determines the maximum credit hours to be allocated to a visiting student from outside the University.
- The course grades credited to the visiting student will be recorded in his/her academic record, but not included in the calculation of his/her cumulative GPA.

19.2. Any other conditions required by the University Council should be satisfied.

مادة (19): الطلاب الزائرين

19.1. الطالب الزائر هو الطالب الذي يدرس مقررات في جامعة أخرى أو في أي فرع من فروع الجامعة التي ينتمي إليها دون أن ينتقل. تعتبر هذه المقررات معادلة للمقررات المطروحة في الجامعة وفق القواعد التالية:

- يجب على الطالب الحصول على الموافقة من برنامجه قبل أن يبدأ دراسته.
- أن تكون دراسته في كلية أو جامعة معترف بها.

- يجب أن يكون المقرر الذي يأخذه الطالب خارج جامعته معادل من حيث المحتوى لمقرر ملزم لتخرجه.
- يحدد مجلس الجامعة الحد الأقصى للساعات المعتمدة للطالب الزائر من خارج الجامعة.
- يتم تسجيل درجات المقرر الدراسي للطالب الزائر في سجله الأكاديمي، ولكن لا يتم تضمينها في حساب المعدل التراكمي الخاص به.

19.2. يجب استيفاء أي شروط أخرى يضعها مجلس الجامعة.

ARTICLE 20: GUEST STUDENTS

20.1. Students who are enrolled at any other university may be registered as guest students. As a rule, this registration should not exceed two semesters except in justified cases.

20.2. Any other conditions required by the University Council should be satisfied.

مادة (20): الطلاب الضيوف

20.1. يمكن للطلاب المسجلين في أي جامعة أخرى أن يتم تسجيلهم كطلاب ضيوف. ويجب ألا يتجاوز هذا التسجيل فصلين دراسيين إلا في حالات مبررة.

20.2. يجب استيفاء أي شروط أخرى يضعها مجلس الجامعة.

ARTICLE 21: EXCHANGE STUDENTS

21.1. Students who are enrolled at any non-Egyptian partner university (exchange partners) may be registered as exchange students for a defined period, usually for up to two semesters. Students who register as exchange students receive full student status.

21.2. All credits and study achievements are transferrable.

21.3. Any other conditions required by the University Council should be satisfied.

مادة (21): طلاب التبادل

21.1. يمكن للطلاب المسجلين في أي جامعة مصرية أو غير مصرية (بناء على برتوكول تعاون بين الجامعتين) أن يتم تسجيلهم كطلاب تبادل لفترة محددة، تصل إلى فصلين دراسيين. ويحصل الطلاب الذين يسجلون كطلاب تبادل على حالة الطالب الكاملة.

21.2. يتم نقل جميع الساعات المعتمدة والاستحقاقات الدراسية.

21.3. يجب استيفاء أي شروط أخرى يضعها مجلس الجامعة.

ARTICLE 22: BACHELOR'S DEGREES

Benha National University (BNU) awards, upon the request of the faculty Council, the Bachelor of Engineering Science (B.Sc.) degree in one of the following engineering science disciplines: -

- Manufacturing and Materials Engineering
- Mechatronics and Automation
- Communication Systems Engineering

- Medical Engineering
- Building Engineering
- Housing & Design for Communities

The BNU can add new academic programs and awards new bachelor's degrees in engineering science after fulfilling the requirements demanded by the Supreme Council of Egyptian Universities.

مادة (22): درجات البكالوريوس

تمنح جامعة بنها الأهلية بناءً على طلب مجلس الكلية درجة بكالوريوس العلوم الهندسية في أحد تخصصات العلوم الهندسية التالية: -

- هندسة التصنيع والمواد
- هندسة الميكاترونكس والأتمتة
- هندسة نظم الاتصالات
- الهندسة الطبية
- هندسة البناء
- الإسكان والتصميم للمجتمعات

يمكن للجامعة إضافة برامج أكاديمية جديدة ومنح درجات بكالوريوس جديدة في العلوم الهندسية بعد استيفاء المتطلبات التي يطلبها المجلس الأعلى للجامعات المصرية.

ARTICLE 23: HONOR DEGREE

23.1. The honor degree is granted to the student who has earned a cumulative GPA between 3.30 and 4.00 at the time of his/her graduation.

23.2. A student who is eligible for honor degree also must meet the following criteria:
   - He/she must not have failed any course completed at the University or any other university.
   - He/she must have completed all graduation requirements within the allowed period.
   - He/she must have completed 60% or more of the graduation requirements at the university from which he/she is graduating.

مادة (23): مرتبة الشرف

23.1. تمنح مرتبة الشرف للطالب الذي حصل على معدل تراكمي بين 3.30 و4.00 وقت تخرجه.

23.2. يجب على الطالب المؤهل للحصول على مرتبة الشرف أيضًا أن يستوفي المعايير التالية:
   - ألا يكون قد رسب في أي مقرر تم دراسته في الجامعة أو أي جامعة أخرى.
   - أن يكون قد أكمل جميع متطلبات التخرج خلال المدة المسموح بها.
   - أن يكون قد درس وأتم 60٪ أو أكثر من متطلبات التخرج في جامعة بنها الاهلية.

ARTICLE 24: OFFENSES AND DISCIPLINARY AND ACADEMIC PENALTIES

In case a student commits an offense, the disciplinary penalties are as follows:

24.1. **First: Violations of exam regulations and academic integrity:**
These range from dismissal from the examination hall to final expulsion from the university. This is decided through presenting the case to the faculty council as follows:

#	Student Offense	Offense Description	Penalty
1	Disobeying examination instructions	Disrupting the discipline or quietness of the exam hall. For example: • Repetition (more than once) of talking to a colleague during the exam. • Repetition (more than once) of showing a switched off mobile phone during the exam. • Repetition (more than once) of the ringing of a mobile phone.	After the invigilator gives oral warning when the offense is committed for the first time only, the student is dismissed from the exam and allocated "zero" for the given exam.
2	Refusing to carry out instructions	Repetition of any of the offenses mentioned in item number (1) in any other subject during the exam period.	The student is dismissed from the examination hall and the grade allocated to the subject is "F".
3	Cheating	Using any cheating methods. For example: • A switched-on mobile phone is not switched off and contains course information. • An unauthorized paper slip, table, notes or any other means or tools with course information. • Exchanging answer or questions sheet with a colleague during the exam. • Exchanging tools with information about the subject with a colleague during the exam. • Failing to observe the required regulations for university integrity.	The student fails the subject in question. In addition, the grades allocated to the two subsequent subjects (or the two previous ones in case the subject is the last one in the student's exam schedule) should be "W".
4	Offending the invigilator or the exam supervision authority verbally or physically	Offending the invigilator or the exams supervision authority whether verbally or physically.	The student fails all courses registered for the semester during which the offense occurs (grades allocated to all subjects should be "F"). In

			addition, the student's registration for the following semester is suspended. The case is then forwarded to the university council to determine whether the student is to continue his/her studies at the university or not.
5	Impersonation of another student to sit for the exam instead of him/her	Impersonation of another student to sit for the exam instead of him/her.	Final expulsion from the University.

- It is permissible to apply the strictest penalty which can be expulsion from the university in case another contravention accompanied the process of documenting the one the student is penalized for. This is decided by the university council after referring to the faculty council.
- In all the above-mentioned cases, an official report of the case (the offense) should be written.
- The student's questions and answer sheets (after filling in all necessary information), as well as any other evidence related to the incident, should be attached, and sent with related documents to the program's coordinator.
- The penalty is added to the student's unofficial transcript.

24.2. **Second: General Behavior Offenses:**

The penalties for general behavior offenses range from warning to final expulsion. This is decided by presenting the case to the faculty council (such as smoking in classes or corridors, damaging the university properties, disrupting the discipline of lectures and tutorials).

مادة (24): المخالفات والعقوبات التأديبية والأكاديمية

في حال ارتكب الطالب مخالفة تكون العقوبات التأديبية كما يلي:

24.1. أولا: مخالفات لوائح الامتحان والنزاهة الأكاديمية:

تتراوح هذه المخالفات من الطرد من قاعة الامتحان إلى الفصل النهائي من الجامعة. ويتقرر ذلك من خلال عرض الحالة على مجلس الكلية على النحو التالي:

#	المخالفة	وصف المخالفة	العقوبة
1	مخالفة تعليمات الامتحان	تعطيل الانضباط أو هدوء قاعة الامتحان. على سبيل المثال: • تكرار (أكثر من مرة) التحدث إلى زميل أثناء الامتحان.	بعد أن يعطي المراقب إنذارًا شفهيًا عند ارتكاب المخالفة لأول مرة فقط، يطرد الطالب من الاختبار ويحصل على درجة "صفر" في الاختبار المحدد.

		• تكرار (أكثر من مرة) إظهار هاتف نقال مغلق أثناء الامتحان. • تكرار رنين الهاتف المحمول (أكثر من مرة).	
2	رفض تنفيذ التعليمات	تكرار أي من المخالفات الواردة في البند رقم (1) في أي مادة أخرى خلال فترة الامتحان.	يُطرد الطالب من قاعة الامتحان ويعطي تقدير "F"للمقرر.
3	الغش	استخدام أي طرق الغش. علي سبيل المثال: • الهاتف المحمول غير المغلق ويحتوي على معلومات المقرر. • أوراق، أو ملاحظات، أو أي وسيلة، أو أدوات أخرى غير مصرح بدخولها الامتحان. • تبادل الإجابات أو ورقة الأسئلة مع زميل أثناء الامتحان. • تبادل أدوات بها معلومات حول موضوع الامتحان مع زميل أثناء الامتحان. • عدم مراعاة اللوائح المطلوبة للنزاهة الجامعية.	رسوب الطالب في المقرر بالإضافة إلى حرمان الطالب من مقررين تاليين (أو المادتين السابقتين في حال كان المقرر هو الأخير في جدول امتحان الطالب).
4	إهانة المراقب أو المشرف علي العملية الامتحانية لفظيا أو جسديا	إهانة المراقب أو المشرف علي العملية الامتحانية لفظيا أو جسديا.	رسوب الطالب في جميع المقررات المسجل للفصل الذي وقعت فيه المخالفة (الدرجات المخصصة لجميع المواد يجب أن تكون "F"). بالإضافة إلى تعليق تسجيل الطالب للفصل الدراسي التالي ثم يتم إحالة الحالة إلى مجلس الجامعة لتحديد ما إذا كان الطالب سيواصل دراسته في الجامعة أم لا.
5	انتحال شخصية طالب آخر لحضور للامتحان بدلاً منه	انتحال شخصية طالب آخر لحضور للامتحان بدلاً منه.	الفصل النهائي من الجامعة.

- يجوز توقيع العقوبة الأشد التي يمكن أن تصل الى الفصل من الجامعة في حالة وجود مخالفة أخرى عند تحرير محضر المخالفة التي يعاقب عليها الطالب. ويقرر ذلك مجلس الجامعة بعد الرجوع لمجلس الكلية.
- في جميع الحالات المذكورة أعلاه يجب تحرير محضر رسمي عن الحالة (المخالفة).
- يجب إرفاق أسئلة الطالب وأوراق الإجابة (بعد ملء جميع المعلومات اللازمة)، وكذلك أي دليل آخر يتعلق بواقعة المخالفة، وإرسالها مع المستندات ذات الصلة إلى منسق البرنامج.
- يتم وضع العقوبة في ملف الطالب.

24.2. **ثانيا: مخالفات السلوك العام**

تتراوح عقوبات مخالفات السلوك العام من الإنذار إلى الفصل النهائي. يتم تحديد ذلك من خلال عرض الحالة على مجلس الكلية (مثل التدخين في الفصول، أو الممرات، أو الإضرار بممتلكات الجامعة، أو تعطيل نظام المحاضرات والدروس).

ARTICLE 25: ADDITIONAL RULES

25.1. The faculty Council shall be presented with all the subjects for which no provision has been made in the articles of this regulation. It may be necessary to apply to the University to approve the decision of the faculty Council.

25.2. The Law of the Egyptian National Universities shall be applied in the absence of any regulations not listed.

مادة (25): قواعد إضافية

25.1. يعرض على مجلس الكلية كافة الموضوعات التي لم يرد في شأنها نص في مواد هذه اللائحة، وقد يتطلب الامر الرفع الى الجامعة للتصديق على قرار مجلس الكلية.

25.2. يطبق فيما لم يرد به نص في هذه اللائحة وتعديلاتها الأحكام الواردة بقانون تنظيم الجامعات وتعديلاته.

APPENDIX (A)
EXAMPLES OF THE CALCULATION OF SEMESTER AND CUMULATIVE GPA

First Semester:

Course	Credit Hours	%	code	GPA	Quality Points
BAS001	3	75	C+	2.30	6.9
GEN001	2	82	B	3.00	6
ISE003	3	66	D+	1.30	3.9
MEC101	4	90	A-	3.70	14.8
Total	**12**	-	-	-	**31.6**

$$\text{First Semester GPA} = \frac{\text{Total Quality Points}}{\text{Total Credits}} = \frac{31.6}{12} = 2.63$$

Second Semester:

Course	Credit Hours	%	code	GPA	Quality Points
BAS006	3	50	F	0.00	0
GEN002	2	73	C+	2.30	4.6
ISE004	3	88	B+	3.30	9.9
MEC201	3	68	C-	1.70	5.1
MEC202	3	76	B-	2.70	8.1
Total	**14**	-	-	-	**27.7**

$$\text{Second Semester GPA} = \frac{\text{Total Quality Points}}{\text{Total Credits}} = \frac{27.7}{14} = 1.98$$

$$\text{Cumulative GPA} = \frac{31.6+27.7}{12+14} = 2.28$$

ملحق (أ)
أمثلة لحساب المعدل الفصلي والتراكمي

الفصل الأول:

المقرر	الساعات المعتمدة	%	التقدير	المعدل	عدد النقاط
عهس001	3	75	C+	2.30	6.9
عام001	2	82	B	3.00	6
صنع003	3	66	D+	1.30	3.9
ميك101	4	90	A-	3.70	14.8
الإجمالي	**12**	-	-	-	**31.6**

المعدل الفصلي للفصل الأول= $\frac{\text{اجمالي عدد النقاط}}{\text{الساعات المعتمدة}}$ = 31.6 / 12 = 2.63

الفصل الثاني:

المقرر	الساعات المعتمدة	%	التقدير	المعدل	عدد النقاط
عهس006	3	50	F	0.00	0
عام002	2	73	C+	2.30	4.6
صنع004	3	88	B+	3.30	9.9
ميك201	3	68	C-	1.70	5.1
ميك202	3	76	B-	2.70	8.1
الإجمالي	**14**	-	-	-	**27.7**

المعدل الفصلي للفصل الثاني = $\frac{\text{اجمالي عدد النقاط}}{\text{الساعات المعتمدة}}$ = 27.7/ 14 = 1.98

المعدل التراكمي = $\frac{31.6+27.7}{12+14}$ = 2.28

APPENDIX (B)

TABLE OF OTHER NON-CREDIT GRADES

Grade	Significance	Description
I	Incomplete	It is the grade of a postponed final exam due to an urgent excuse accepted by college. An incomplete result (I) is given to enable the student to sit for the final exam in the assigned date. Otherwise, the student is considered to have failed the course.
W	Withdrawn	It is the grade of a course that has been withdrawn. It is not counted in the GPA.
DN	Denial	Any undergraduate who fails in a course because of exceeding the permissible limit of absences or a disciplinary verdict. Consider as F on GPA calculate. If the student repeat the course, the grade will not be changed to the letter "R" on the transcript, it will be as a letter "DN" and the new grade will be added to the next semester GPA.
RT	Retake	Any undergraduate student may retake a course for which he/she passed and received a grade below a B-. (A student may exercise this option for no more than five courses, totaling no more than 15 credit hours). Student to benefit from the retake policy his/her new grade must not be F or DN.
RP	Repeat	If the student fails in a course, he/she must repeat it. When he/she passes the course, the highest grade a student can receive is B+ (Very Good).
NC	Non-Credit	Units for courses which are graded with a "P" (Pass) or "NP" (No Pass) will not be included in the student's GPA calculation. Units for courses which are graded with a "P" will be counted toward the student's degree requirements; those with grades "NP" will not.

Grade	Significance	Description
IP	In-Progress	A student who does not complete a course by the end of the semester and his/her project/work will require an extension to the next semester. The final grade will be reported to the student after he/she finishes all requirements of the course.
AU	Audit	The student was given permission to audit this course. After the last day of late registration (last day of drop/add), students may not transfer from audit to credit status. Students may change from credit to audit up to the official withdrawal date.

ملحق (ب)

جدول التقديرات بدون ساعات معتمدة

التقدير	المعني	التوصيف
IC	غير مكتمل	هو تقدير اختبار نهائي مؤجل نتيجة لعذر طارئ مقبول من الكلية. تعطي تلك النتيجة لتسمح للطالب حضور الامتحان النهائي في الموعد المحدد والا الطالب يعتبر راسب في المقرر.
W	منسحب	هو تقدير مقرر تم الانسحاب منه ولا تضاف للمعدل التراكمي
DN	محروم	هو تقدير مقرر تم حرمان الطالب منه نتيجة لتجاوزه حد الغياب المسموح به أو نتيجة لعقوبة ما. ويتم اعتبار الطالب راسب بالمقرر عند حساب المعدل. عند إعادة المقرر، ستظل التقدير كما هو في السجل الأكاديمي والتقدير الجديد يتم اضافته للمعدل الفصلي التالي.
RT	تحسين	هو تقدير مقرر سبق دراسته والنجاح فيه بتقدير اقل من (+B)، ويحق للطالب التحسين في خمس مقررات بحد أقصي 15 ساعة معتمدة. للاستفادة من سياسة التحسين يجب علي الطالب عدم الحصول على التقدير راسب أو محروم في التقدير الجديد.
RP	اعادة	هو تقدير مقرر رسب فيه الطالب ويجب عليه اعادته ولا يحق له الحصول على تقدير أعلي من (+B) (جيد جدا) عند النجاح فيه.
NC	بدون ساعات معتمدة	هو تقدير مقرر ليس له ساعات معتمدة ويتطلب نجاح أو رسوب فقط دون الإضافة للمعدل التراكمي.
IP	مكمل	هو تقدير مقرر في نهاية فصل دراسي يتم استكماله في فصل دراسي تالي. التقدير النهائي يتم اضافته للطالب عند الانتهاء من كل متطلبات المقرر.
AU	مستمع	هو تقدير مقرر يتم السماح فيه للطالب بالحضور كمستمع. وعند انتهاء فترة التسجيل والحذف والإضافة لا يحق للطالب التحويل من مستمع الي منتظم. يحق للطالب التحويل من منتظم الي مستمع حتى نهاية فترة الانسحاب.

جامعة بنها الاهلية (برامج كلية الهندسة)

الخطط الدراسية والمحتوى العلمي

Benha National University (BNU)

Faculty of Engineering Programs

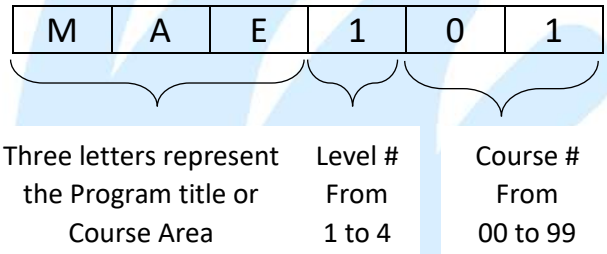
Study Plans and Courses Description

List of Faculty of Engineering Programs

#	Program Title	Code	Total Credits	Pages #
1	Manufacturing and Materials Engineering	MME	144	19-39
2	Mechatronics and Automation	MAE	144	40-61
3	Communication Systems Engineering	CSE	144	62-78
4	Medical Engineering	MDE	144	79-100
5	Building Engineering	BLE	144	101-120
6	Housing & Design for Communities	HDC	144	121-147

Coding System of Courses

#	Program Title/Course Area	Code
1	General Courses (University Requirements)	GEN
2	General Engineering Courses	ENG
3	Basic Science and Mathematics Courses	BAS
4	Manufacturing and Materials Engineering	MME
5	Mechatronics and Automation	MAE
6	Communication Systems Engineering	CSE
7	Medical Engineering	MDE
8	Building Engineering	BLE
9	Housing & Design for Communities	HDC



Example: The course with **MAE101** code is the course number 01 at the 1st level of Mechatronics and Automation Program

Benha National University (BNU)

University Requirements

متطلبات الجامعة

A. List of University Requirements

LIST OF COURSES

Code	Course	CR	Lec	Tut	Lab	Pre-requisites
(A) Mandatory Courses						
GEN201	Information Technology	1	1	0	0	---
GEN301	Current Social Issues in Egypt	1	1	0	0	---
GEN401	Professional Ethics	2	2	0	0	---
GEN202	Communication & Presentation Skills	2	1	2	0	---
GEN407	Entrepreneurship	2	1	2	0	---
(B) Elective Courses						
(I) Languages Courses						
GEN000	English Language (A remedy course)	0	0	0	0	---
GEN101	English Language	2	1	2	0	---
GEN102	German Language	2	1	2	0	---
(II) History & Arts Courses						
GEN104	History of Science, Engineering & Technology	2	2	0	0	---
GEN105	History of Arts & Architecture	2	2	0	0	---

Benha National University (BNU)

University Requirements

Courses Description

المحتوى العلمي لمقررات متطلبات الجامعة

UNIVERSITY REQUIREMENTS
COURSES DESCRIPTION

GEN000	English Language (A remedy course)	0 (0,0,0)
This course is dedicated for (below Intermediate level) students improve their English language knowledge and skills.		

Prerequisites: ---.

GEN101	English Language	2 (1,2,0)
Characteristics of the English technical language, grammar review, effective sentences and their characteristics, identify some common mistakes in the writing of English technical sentence, paragraph construction, types of paragraphs, development of communication skills by reading and analysis of excerpts from technical writing in various engineering disciplines.		

Prerequisites: ---.

GEN102	German Language	2 (1,2,0)
This is German language beginner's course. The course provides the students with a good idea about the German language, and include typical themes, grammar and vocabulary fields.		

Prerequisites: ---.

GEN104	History of Science, Engineering & Technology	2 (2,0,0)
The definition of science, technology and engineering. The development of civilizations and their relationship to human sciences (ancient Egyptian civilization, Roman and Greek civilization, Mesopotamia, dark ages, industrial revolution). Different engineering disciplines and their role in society. The historical relationship between science and technology. The relationship between the development of engineering, the social and economic development of the environment, the challenges of globalization and the new economy. The contribution of engineers in the new millennium, the issues of economic and industrial development in Egypt.		

Prerequisites: ---.

GEN105	History of Arts & Architecture	2 (2,0,0)
The course describes the changes and development that occurred in architecture during Middle Ages in both Europe and Islamic world, by teaching the characteristics and features of different architectural styles that appeared at that time, and the factors that led to them. The course includes the study of Romanesque and Gothic architecture in Medieval Europe, as well as the origins and development of Islamic architecture, with special focus on Islamic architecture of Egypt during its different periods (Caliphate, Umayyad, Abbasid, Tulunid, Fatimid, Ayyubid, Mamluk and Ottoman periods).		

Prerequisites: ---.

GEN201	Information Technology	1 (1,0,0)
IT concepts and terminology, Computer hardware, operating systems, Computer networks, Internet, Computer graphics, Multimedia systems, Databases, Virtual and Augmented Realty, Quantum Computers, Internet of things (IoT), Artificial Intelligence (AI), Big-Data, Cloud Computing, Digital Currency …etc.		

Prerequisites: ---.

GEN202	Communication & Presentation Skills	2 (1,2,0)
General introduction to communication, the importance of communication, types of communication, communication barriers, listening skills, attributes and methods of reading, verbal communication: speaking and writing skills, non-verbal communication, dialogue skills and strategies of persuasion, communication in the work environment, writing CVs, reports and official letters.		

Prerequisites: ---.

GEN301	Current Social Issues in Egypt	1 (1,0,0)
The course provides the students with an overview of the current social issues in Egypt such as the Population explosion, water problems, climatic changes, desertification, pollution …etc.		

Prerequisites: ---.

GEN401	Professional Ethics	2 (2,0,0)
The course provides the background needed to discuss the core topics of professional ethics, with a focus on the ethical issues facing profession in the areas of their work in companies. The course includes the definition of the general elements of the ethics of the profession and the observance of the public interest and regulations, obligations to the community, the responsibilities, disclosure of violations.		

Prerequisites: ---.

GEN407	Entrepreneurship	2 (1,2,0)
Concepts in Entrepreneurship, Entrepreneurship and Small Enterprises, Generating Ideas for Entrepreneurial Projects, University and Entrepreneurship Opportunities and Challenges, Marketing Plan, Operational Plan, Financial Plan, Business Plan Writing, Technological Environment of Entrepreneurship, External Business Environment of Entrepreneurial Projects, Support Programs for Leading Projects Egyptian Economy, Entrepreneurial Project Presentation Skills.		

Prerequisites: ---.

Benha National University (BNU)

Faculty Requirements

مقررات متطلبات الكلية

A. List of Basic Science & Mathematics Courses

Code	Course	CR	Lec	Tut	Lab	Pre Req.
BAS101	Differential Calculus and Algebra	3	2	2	0	-
BAS102	Integral Calculus & Analytical Geometry	3	2	2	0	BAS101
BAS103	Physics of Materials	3	2	0	3	-
BAS104	General Chemistry	3	2	0	2	-
BAS105	Statics & Dynamics (1)	3	2	2	0	-
BAS106	Physics of Electricity & Magnetism	3	2	0	3	BAS103
BAS107	Statics & Dynamics (2)	3	2	2	0	BAS105
BAS201	Probability and Statistical Methods	3	2	2	0	-
BAS202	Physics of Light & Heat	3	2	0	3	BAS106
BAS203	Differential Equations	3	2	2	0	BAS102
BAS210	Special Functions and Transformations	3	2	2	0	BAS120
BAS301	Partial Differential Equations & Numerical Analysis	3	2	2	0	BAS203
BAS310	Operations Research	3	2	2	0	BAS201

B. List of General Engineering Courses

Code	Course	CR	Lec	Tut	Lab	Pre Req.
ENG101	Production Engineering	3	2	0	3	-
ENG102	Engineering Graphics	3	1	0	4	-
ENG202	Technical Report Writing	3	2	2	0	-
ENG201	Engineering Economy & Accounting	3	2	2	0	-
ENG104	Computer Programming with MATLAB	3	2	0	3	-

C. List of Projects & Training Courses

Code	Course	CR	Lec	Tut	Lab	Pre Req.
xxx430	Graduation Project (1)	3	1	2	2	100 Credits
xxx440	Graduation Project (2)	4	2	2	2	xxx430
xxx230	Field Training (I)	1	0	0	3	60 Credits
xxx340	Field Training (II)	1	0	0	3	90 Credits

BASIC SCIENCE & MATHEMATICS
COURSES DESCRIPTION

BAS101	Differential Calculus and Algebra	3 (2,2,0)
Differentiation: Elementary functions, Polynomials, Exponential, Logarithmic and trigonometric functions, Limits and continuity, Derivative, Implicit differentiation, Maximum and minimum values, Mean value theorem, Taylor's expansion, Integration of Polynomials, Exponential and trigonometric functions, Definite integral. Algebra: Matrices, Algebra of matrices, Eigenvalues and eigenvectors, Positive and negative matrices, Linear systems, Finite series, Complex numbers, Mathematical induction.		

Prerequisites: ---.

References:

- Basic Technical Mathematics with Calculus Kindle Edition, Pearson; 11thEdition, 2017.
- Textbook of Basic Mathematics: A Beginner's Guide to Geometry, Trigonometry and Calculus Kindle Edition, 2017.

BAS102	Integral Calculus & Analytical Geometry	3 (2,2,0)
Integration: Hyperbolic functions and inverse functions and their derivatives, derivatives of parametric relations, Methods of integrations, integration by partial fractions, parts, reduction and substitution, Applications of definite integrals for obtaining plane area, volumes, arc length and surface area. Analytical geometry: Cartesian and polar coordinates, Equation of pair of lines, Equation of circle, Conic sections and their properties, Equation of plane, Equations of sphere, cone and cylinder.		

Prerequisites: BAS101.

References:

- Basic Technical Mathematics with Calculus Kindle Edition, Pearson; 11th Edition, 2017.
- Textbook of Basic Mathematics: A Beginner's Guide to Geometry, Trigonometry and Calculus Kindle Edition, 2017.

BAS103	Physics of Materials	3 (2,0,3)
Physical quantities, standard units and dimensions, atomic structure (electronic distribution, classification of elements and energy levels), crystalline structure (crystalline grid, symmetry, vacuum groups, some simple examples of crystalline structure), stress and strain, mechanical properties of materials (tensile strength and yield stress, etc.,) Physical properties of liquids, viscosity, surface tension, Archimedes principles, Pascal's law, Bernoull's equation and their applications. Laboratory experiments.		

Prerequisites: BAS101.

References:

- Modern Classical Physics: Optics, Fluids, Plasmas, Elasticity, Relativity, and Statistical Physics by Kip S. Thorne , Princeton University Press, 2017.
- Basic Physics: A Self-Teaching Guide by K Kuhn, Noah Books, 2018

BAS104	General Chemistry	3 (2,0,2)
Gaseous state (gases law), chemical equilibrium and Le Chatellier, principle –solutions- phase diagram- basics of water treatment and desalination technology- Introduction on thermo-chemistry and its rules, basics of fuel combustion, calorimetric and determination of heat of combustion – Electrochemistry and conduction in electrolytic solutions Electrochemical cells and Nernst equation Corrosion of metals (types, methods of prevention of corrosion – ionic equilibrium and pH calculation- building materials and some petrochemicals industry.		

Prerequisites: ---.

References:

- Chemistry: Concepts and Problems, A Self-Teaching Guide, By Richard Post, Chad Snyder, Clifford C. Houk, 3rd edn, 2020.
- Atkins, P; De Poula, J; Keeler, J, physical chemistry 11th edn, 2018.

BAS105	Statics & Dynamics (1)	3 (2,2,0)
Statics: Application on space vectors, resultant of a set of forces, moments, equivalent couple moment, equations of equilibrium for rigid body, types of supports, statically determinate beams and trusses. Dynamics: Kinematics of Particle (rectilinear and curvilinear motion, Cartesian coordinates, projectile motion, natural coordinates, polar coordinates, relative motion), kinetics of Particle (acceleration force method).		

Prerequisites: ---.

References:

- Engineering Mechanics: Statics & Dynamics by Russell Hibbeler, Pearson; 15thEdition, 2021.

BAS106	Physics of Electricity & Magnetism	3 (2,0,3)
Electrical: charge and matter, Coulomb's law, electric field, Gauss's law, electric potential, capacitors and dielectric materials, electrical resistance and electromotive force, Ohm's law, simple electrical circuit, laboratory experiments. Magnetism: magnetic field, Faraday magnetic law, magnetic induction, Boit-savart's law, Ampere's law, laboratory experiments.		

Prerequisites: BAS103.

References:

- Modern Classical Physics: Optics, Fluids, Plasmas, Elasticity, Relativity, and Statistical Physics by Kip S. Thorne , Princeton University Press, 2017.
- Basic Physics: A Self-Teaching Guideby K Kuhn, Noah Books, 2018.

BAS107	Statics & Dynamics (2)	3 (2,2,0)
Statics: Equilibrium under influence of spatial forces and couples, center of mass (for particles and planer surface), moment of inertia (parallel axes, major axes, planer surface). Dynamics: plane kinematics of rigid bodies (translational and rotational motion, general motion: relative velocities, instantaneous center of zero velocity, planer kinetics of rigid body, acceleration forces, work and energy, impact and momentum.		

Prerequisites: BAS105.

References:

- Engineering Mechanics: Statics & Dynamics by Russell Hibbeler, Pearson; 15thEdition, 2021.

BAS201	Probability and Statistical Methods	3 (2,2,0)
Descriptive statistics, Statistical classification of data, Measures of central tendency, Measures of dispersion, Probability theory, Independent and dependent events, Conditional probability, Bayes theorem, Random variable, Probability density function, Discrete probability distributions, Continuous probability distributions, Central limit theorem , Test of hypothesis.		

Prerequisites: ---.

References:

- Probability and Statistics for Computer Science, D. Forsyth, Springer International Publishing AG, 2018.

BAS202	Physics of Light & Heat	3 (2,0,3)
Principles of heat and thermodynamics: Zero law, first and second Law of thermodynamics, heat transfer, gas theory, temperature measurement methods. Light and laser physics: general concepts of light, straight diffusion of light, Velocity of light diffusion, light beam, optical beams, geometric light, reflection and refraction, wave radiation modeling, wave dissipation, diffraction of light, introduction to lasers, Einstein's equations and magnification Light, Explanation of some lasers (gas, solid and liquid lasers), laser applications.		

Prerequisites: BAS106.

References:

- Modern Classical Physics: Optics, Fluids, Plasmas, Elasticity, Relativity, and Statistical Physics by Kip S. Thorne , Princeton University Press, 2017.
- Basic Physics: A Self-Teaching Guide by K Kuhn, Noah Books, 2018

BAS203	Differential Equations	3 (2,2,0)
Functions of several variables, Partial differentiation, Maximum and minimum values, Conditional extrema, Curvature, Double and triple integrals, Line integral, Ordinary differential equations, first order and higher order, Linear Systems of ordinary differential equations, Vectors analysis, Gradient, Laplace transformations, Inverse Laplace transformations.		

Prerequisites: BAS102.

References:

Elementary Differential Equations and Boundary Value Problems, William E. Boyce, Richard C. DiPrima, Douglas B. Meade, ISBN-13: 978-1119443766.

Schaum's Outline of Differential Equations, 4th Edition (Schaum's Outlines) 4th Edition, by Richard Bronson, Gabriel Costa, ISBN-13: 978-0071824859.

BAS210	Special Functions and Transformations	3 (2,2,0)
Periodic functions, Fourier series, Fourier integrals, Special functions, Gamma, Beta, Green function, Bessel functions, Z-transform, Inverse Z-transform, Integral equations.		

Prerequisites: BAS120.

References: Linear Algebra, J. Liesen and V. Mehmann, Springer International Publishing Switzerland, 2015.

BAS301	Partial Differential Equations & Numerical Analysis	3 (2,2,0)
Partial Differentiation and Derivatives of vector functions. Gradient/ Divergence/curl/Laplacian. Line integrals, line integrals independent of the path, exactness. Conservative vector fields. Double integrals in Cartesian and polar coordinates, Mathematical expectation, Numerical methods: Finding roots using bisection method, Newton's method, Solution of linear system of equations using Gauess method and matrix decomposition, Solution of partial D.E. (Heat and Wave equations), Lagrange and Newton Interpolation methods.		

Prerequisites: BAS203.

References:

- Elementary Differential Equations and Boundary Value Problems, William E. Boyce, Richard C. DiPrima, Douglas B. Meade, ISBN-13: 978-1119443766.
- Schaum's Outline of Differential Equations, 4th Edition (Schaum's Outlines) 4th Edition, by Richard Bronson, Gabriel Costa, ISBN-13: 978-0071824859.

ENG310	Operations Research	3 (2,2,0)
Operations research helps in solving problems in different environments that needs decisions. The module cover topics that include linear programming, Transportation, Assignment, and CPM/MSPT techniques. Analytic techniques and computer packages will be used to solve problems facing business managers in decision environments.		

Prerequisites: BAS201.

References:

- Taha, Hamdy, Operations Research, 8th Edition, Pearson Education, 2007.
- P. Rama Murthy, "Operations Research", 2nd Edition, 2007, New Age Limited Publisher.

GENERAL ENGINEERING
COURSES DESCRIPTION

ENG101	Production Engineering	3 (2,0,3)
The course introduces the basic concepts of production and productivity. The topics include classification of production processes, industrial safety, engineering materials, ferrous and nonferrous alloys, steel and its types, cast iron and its types, steel and cast iron production, metal casting processes (sand casting, mold casting, centrifugal casting, wax casting, hot and cold metal forming processes (extrusion, forging, rolling, deep drawing, wire drawing, etc.), metal cutting processes (turning, milling, shaping, drilling, grinding, etc.), metal joining techniques (welding processes,. rivets, bolts … etc). Simple workshop measuring tools (Vernier caliper, micrometers, etc.), practical skills in workshops.		

Prerequisites: ---.

References:

- Carolina Witchmichen Penteado Schmidt, Manufacturing Engineering, Springer Nature, 2021.
- K. Hitomi, Manufacturing Systems Engineering, Taylor & Francis, 2017.

ENG102	Engineering Graphics	3 (1,0,4)
Introduction to graphical representation using free hand drawing and computer-aided drafting (CAD). Engineering graphics covers basic engineering drawing techniques such as Lines & Lettering, Geometrical Constructions, Principles of Tangency, Orthographic Projections, Sectional views, and Dimensioning. The use of CAD software is an integral part of the course.		

Prerequisites: ---.

References:

- Er Alok Kumar Jha, Fundamentals of Engineering Drawing: A to Z of Principles of Orthographic Projection, Projections of Points & Projections of Lines, independently published, 2021.
- GLIOULA Mohamed, ENGINEERING DRAWING: Problems and Solutions Paperback, independently published, 2021.
- A. Fuller, A. Ramirez, D. Smith, Technical Drawing 101 with AutoCAD 2021, SDC Publications, 2021.

ENG201	Engineering Economy & Accounting	3 (2,2,0)
The basic concepts of engineering economy, Time-money relationships, cash flow, and effects of inflation, Present worth (PW) method, annual worth (AW) method, rate of return (ROR) method, benefit/cost ratio (B/C) method, and incremental rate of return analysis, Depreciation schedules, replacement analysis, and after-tax analysis, cost estimation and indirect cost allocation, break-even analysis and payback period, selection among competing alternatives, Sensitivity analysis and expected value decisions.		

Prerequisites: ---.

References:

- Leland Blank, Anthony Tarquin, “Engineering Economy”, 7th edition, McGraw-Hill, 2005.
- Chan S. Park, “Contemporary Engineering Economics”, Pearson Prentice Hall, 4th Edition, 2007

ENG202	Technical Report Writing	3 (2,2,0)
Introduction, Audience Analysis, Report Purposes, Data Gathering - Report Organization, Textual Report Elements, Graphical Report Elements, Writing Style, Grammar, Punctuation & Spelling.		

Prerequisites: ---.

References:

- How to Write Technical Reports Understandable Structure, Good Design, Convincing Presentation, by Hering, Heike., Berlin, Heidelberg: Springer Berlin Heidelberg, 2nd ed. 2019.

BCS104	Computer Programming with MATLAB	3 (2,0,3)
The aims of this course are to introduce the elements and practicalities of computer programming through the MATLAB mathematical computing environment. The students will develop the skills to implement software solutions to a wide range of engineering problems. Topics include MATLAB interface and basic commands, pseudocode, Variable creation, operators, user input and output, Flow control: if statements, switch statements, while loops, For loops, Vectors (arrays), matrices, strings, Algorithms implementation, plotting, Image manipulation, Scripts and functions.		

Prerequisites: non.

References:

- MATLAB Programming for Beginners and Professionals, by Irfan Turk, CreateSpace Independent Publishing Platform, 2018.

PROJECTS & TRAINING
COURSES DESCRIPTION

xxx430	Graduation Project (1)	x (x,x,x)
This course requires the students, working in teams, to take an actual project from the initial proposal stage through the preliminary design phase. Students will conduct the necessary activities and prepare the various documents needed to complete the preliminary design.		

Prerequisites: 100 Credits

xxx440	Graduation Project (2)	x (x,x,x)
The design process will continue from the preliminary phase to the completion of a conceptual design of the project. The students, working in teams, will prepare requirements, design, implementations of the project. A list and general description of the many details and other miscellaneous activities required to complete the project will also be prepared.		

Prerequisites: xxx430.

xxx230	Field Training (I)	1 (0,0,3)
The student is required to spend at least three weeks (5 days/each) in an industrial facility for training that is relevant to his/her field of study. The program council will assign a staff member to set the training plan with the industrial partner and to follow up on the student's progress. At the end of the training period, the student is required to submit a report and give a presentation before an examination panel from the department and/or industrial partners. In the report and presentation, the student would highlight the achievements and/or challenges she/he has gone through during the training period. 60% of the student's score is provided by the industrial training supervisor and the remaining 40% is determined based on: the student's report, final presentation, and how well the student responds to the examination board questions.		

Prerequisites: 60 Credits.

xxx340	Field Training (II)	1 (0,0,3)
The student is required to spend at least three weeks (5 days/each) in an industrial facility for training that is relevant to his/her field of study. The program council will assign a staff member to set the training plan with the industrial partner and to follow up on the student's progress. At the end of the training period, the student is required to submit a report and give a presentation before an examination panel from the department and/or industrial partners. In the report and presentation, the student would highlight the achievements and/or challenges she/he has gone through during the training period. 60% of the student's score is provided by the industrial training supervisor and the remaining 40% is determined based on: the student's report, final presentation, and how well the student responds to the examination board questions.		

Prerequisites: 90 Credits.

برنامج هندسة التصنيع والمواد

MANUFACTURING & MATERIALS ENGINEERING PROGRAM

(MME)

MANUFACTURING & MATERIALS ENGINEERING (MME) PROGRAM

1. FACULTY VISION

The faculty of Engineering at BNU, looking forward to being a leading faculty at the national, regional, and international levels in engineering education fields, scientific research, innovation, and entrepreneurship to achieve the sustainable development of humankind.

2. FACULTY MISSION

The faculty of Engineering at BNU is committed to prepare graduates with the skills and attitudes to attain competence as professional engineers and researchers, and to interact with industry and community within the framework of human values and social responsibility.

3. PROGRAM VISION

Materials and Manufacturing Engineering (MME) program at BNU, aspires to be a leading program in education and scientific research in the fields of materials and manufacturing engineering at the regional and international levels and to provide an outstanding community service.

4. PROGRAM MISSION

Provide high quality education that will prepare graduates for successful careers in material and manufacturing engineering and their related fields to support the local, regional, and international needs.

5. PROGRAM OBJECTIVES

1. Providing students with the ability to apply knowledge in mathematics and basic sciences to model problems related to manufacturing systems.
2. Providing students with basic knowledge in various fields of materials and manufacturing engineering such as: nanomaterials, materials testing, materials processing, materials selection, non-conventional manufacturing, metal forming, rapid prototyping, composite materials, 3D printing, reverse engineering, …etc.
3. Providing students with the communication skills and responsible teamwork, establish professional attitudes and ethics, so that graduates are prepared for a complex modern work environment and lifelong learning.
4. Providing students with the ability to identify, formulate, and find optimal solutions to complex system problems, considering the physical, economic and safety constrains... etc.
5. Provide an environment that enables students to achieve their goals in a program that supports innovation.

6. GRADUATE ATTRIBUTES

1. Master a wide spectrum of engineering knowledge and specialized skills and can apply acquired knowledge using theories and abstract thinking in real life situations.
2. Apply analytic critical and systemic thinking to identify, diagnose and solve engineering problems with a wide range of complexity and variation.
3. Behave professionally and adhere to engineering ethics and standards.
4. Work in and lead a heterogeneous team of professionals from different engineering specialties and assume responsibility for own and team performance
5. Recognize his/her role in promoting the engineering field and contribute to the development of the profession and the community.
6. Value the importance of the environment, both physical and natural, and work to promote sustainability principles.
7. Use techniques, skills, and modern engineering tools necessary for engineering practice.
8. Assume full responsibility for own learning and self-development, engage in lifelong learning and demonstrate the capacity to engage in post- graduate and research studies.
9. Communicate effectively using different modes, tools, and languages with various audiences; to deal with academic/professional challenges in a critical and creative manner.
10. Demonstrate leadership, business administration and entrepreneurial skills.
11. Use of mathematics, physical, engineering and systems analysis tools in manufacturing and materials.
12. Use different instruments appropriately and carry-out experimental design, automatic data acquisition, data analysis, data reduction-interpretation & presentation, both orally and in the written form.
13. Use the computer graphics for design, communication, and visualization.
14. Use and/or develop computer software, necessary for the manufacturing systems and materials design and selection.

7. PROGRAM COMPETENCIES

According to the National Academic Reference Standard (NARS) 2018, the program in Materials and Manufacturing Engineering must satisfy the following Competencies:

1- General Engineering NARS Competencies in 2018		
Level A (NARS)	**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, analyze 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, taking into consideration other trades requirements.
	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.

2- Mechanical Engineering NARS		
Level B (NARS)	**B1**	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.
	B2	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.
	B3	Select conventional mechanical equipment according to the required performance.
	B4	Adopt suitable national and international standards and codes, integrate legal, economic, and financial aspects to design, build, operate, inspect and maintain mechanical equipment and systems.

3- Manufacturing & Materials Engineering ARS		
Level C (ARS)	**C1**	Use basic workshop equipment safely and healthy
	C2	Plan, prepare and manage processes for manufacturing.
	C3	Apply quality control and management principles in projects and manufacturing.
	C4	Prepare, supervise the implementation of engineering drawings, computer graphics and write and present technical reports.
	C5	Manage design and manufacturing problems, identification, formulation, and solution.
	C6	Master the ability to carry out development projects independently and in teams.

	C7	Select and design materials and materials-systems by applying advanced sciences, computational techniques and engineering principles underlying the major elements of the field: structure, properties, processing, and performance.
	C8	Identify and classify the recent technological developments and emerging fields relevant to materials engineering and systems; involving the design, implementation, and improvement of relevant processes.
	C9	Adopt suitable national and international standards and codes to design, operate, inspect, and maintain materials' systems.

For determination the compatibility of program objectives with its competencies, the following matrix can be used:

Program Objectives	**Program Competencies**																					
	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	B1	B2	B3	B4	C1	C2	C3	C4	C5	C6	C7	C8	C9
Objective #1	√								√		√				√								
Objective #2				√		√						√		√		√	√		√		√	√	√
Objective #3		√					√	√										√					
Objective #4	√		√											√	√				√				
Objective #5					√				√	√										√	√	√	

MATRIX RELATING THE PROGRAM COURSES WITH COMPETENCIES

Course Code	Course Name	Engineering Competencies NARS (2018)										Mechanical Engineering Competencies (NARS)				"Discipline" Manufacturing and Materials Engineering Competencies (ARS)								
		A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	B1	B2	B3	B4	C1	C2	C3	C4	C5	C6	C7	C8	C9
GEN000	English Language (A remedy course)							√	√															
GEN201	Information Technology	√	√								√													
GEN301	Current Social Issues in Egypt			√				√	√															
GEN401	Professional Ethics			√					√	√														
GEN101	English Language							√	√															
GEN102	German Language							√	√															
GEN104	History of Science, Engineering & Technology			√	√																			
GEN202	Communication & Presentation Skills					√		√	√															
GEN407	Entrepreneurship									√	√													
BAS101	Differential Calculus and Algebra	√		√																				
BAS102	Integral Calculus & Analytical Geometry	√		√																				
BAS103	Physics of Materials	√	√																					
BAS105	Statics & Dynamics (1)	√		√																				
BAS106	Physics of Electricity & Magnetism	√	√			√																		
BAS201	Probability and Statistical Methods	√	√								√													

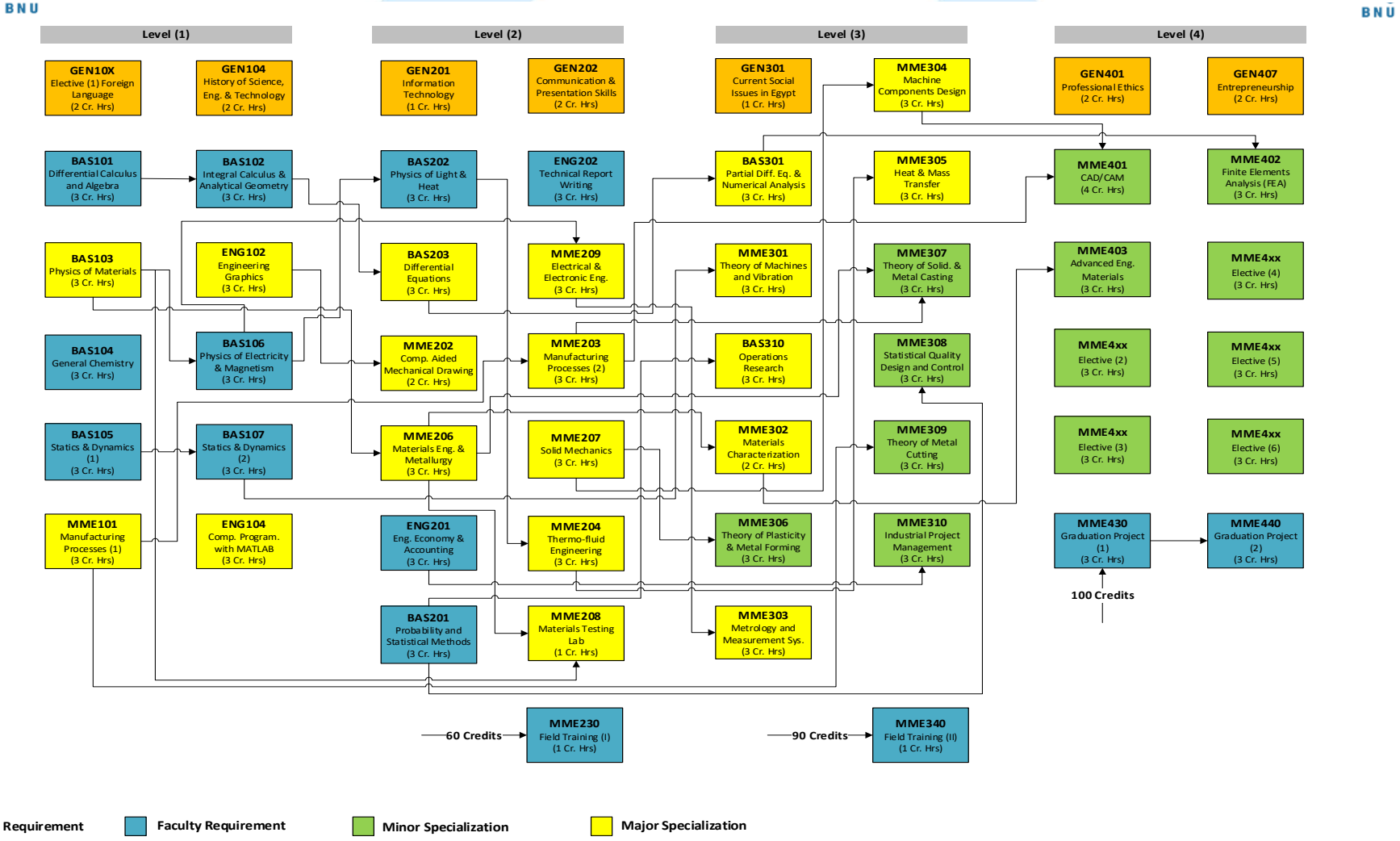
Course Code	Course Name	Engineering Competencies NARS (2018)										Mechanical Engineering Competencies (NARS)				"Discipline" Manufacturing and Materials Engineering Competencies (ARS)								
		A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	B1	B2	B3	B4	C1	C2	C3	C4	C5	C6	C7	C8	C9
ENG201	Engineering Economy & Accounting	√		√					√	√														
BAS202	Physics of Light & Heat	√	√			√																		
ENG202	Technical Report Writing							√	√															
BAS107	Statics & Dynamics (2)	√		√		√																		
MME230	Field Training (I)														√	√			√					√
MME340	Field Training (II)													√							√		√	√
MME430	Graduation Project (1)															√	√	√	√					
MME440	Graduation Project (2)																			√	√	√		√
BAS104	General Chemistry	√	√																					
BAS310	Operations Research		√			√																		
ENG102	Engineering Graphics	√	√		√		√		√															
ENG104	Computer Programming with MATLAB				√								√		√									
BAS203	Differential Equations	√						√																
BAS301	Partial Differential Equations & Numerical Analysis	√	√			√																		
MME101	Manufacturing Processes (1)			√	√								√	√										
MME202	Computer Aided Mechanical Drawing						√		√															

Course Code	Course Name	Engineering Competencies NARS (2018)										Mechanical Engineering Competencies (NARS)				"Discipline" Manufacturing and Materials Engineering Competencies (ARS)								
		A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	B1	B2	B3	B4	C1	C2	C3	C4	C5	C6	C7	C8	C9
MME203	Manufacturing Processes (2)				√								√	√										
MME204	Thermo-fluid Engineering	√						√				√												
MME206	Materials Engineering & Metallurgy			√	√								√											
MME207	Solid Mechanics			√								√		√										
MME208	Materials Testing Lab			√								√		√										
MME209	Electrical & Electronic Engineering	√							√			√												
MME301	Theory of Machines and Vibration	√		√								√		√										
MME302	Materials Characterization											√		√										
MME303	Metrology and Measurement Systems	√	√			√						√												
MME304	Machine Components Design										√	√	√											
MME305	Heat & Mass Transfer	√										√												
MME306	Theory of Plasticity & Metal Forming											√	√											
MME307	Theory of Solidification & Metal Casting											√			√									
MME308	Statistical Quality Design and Control											√						√						
MME309	Theory of Metal Cutting					√						√	√	√										
MME310	Industrial Project Management												√			√					√			

Course Code	Course Name	Engineering Competencies NARS (2018)										Mechanical Engineering Competencies (NARS)				"Discipline" Manufacturing and Materials Engineering Competencies (ARS)								
		A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	B1	B2	B3	B4	C1	C2	C3	C4	C5	C6	C7	C8	C9
MME401	Computer Aided Design & Manuf. (CAD/CAM)												√		√		√					√		
MME402	Finite Elements Analysis (FEA)												√		√							√		√
MME403	Advanced Engineering Materials													√								√	√	
MME411	Nontraditional Machining																			√	√		√	
MME412	Robotics and Flexible Mfg. Systems											√								√	√			
MME413	Systems and Control											√								√	√			
MME414	Data Analytics for Systems Engineering												√					√	√					√
MME415	Special Topics in Manufacturing Engineering															√	√	√			√			
MME416	Micromanufacturing Technology															√	√	√			√			
MME417	Engineering Simulation												√									√		√
MME418	Non-Metallic Materials Processing																√		√					
MME419	Lean Manufacturing Systems															√	√	√						
MME421	Materials Selection & Design												√	√						√		√		
MME422	Corrosion Engineering																	√	√					
MME423	Energy Materials													√								√		
MME424	Electronic Materials													√								√		

Course Code	Course Name	Engineering Competencies NARS (2018)										Mechanical Engineering Competencies (NARS)				"Discipline" Manufacturing and Materials Engineering Competencies (ARS)								
		A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	B1	B2	B3	B4	C1	C2	C3	C4	C5	C6	C7	C8	C9
MME425	Fracture of Materials												√	√						√		√		
MME426	Biomaterials												√	√						√		√		
MME427	Laser Processing and Nanostructures																√		√				√	
MME428	Surface Engineering of Nanomaterials																	√	√				√	
MME429	Construction Materials												√	√						√		√		

FLOWCHART FOR MATERIALS & MANUFACTURING ENGINEERING PROGRAM COURSES



MANUFACTURING & MATERIALS ENGINEERING PROGRAM
COURSES CLASSIFICATION AND PERCENTAGES

#	Subject Area	CR	%	Min. Percentage according to reference framework (%)
1	University Requirements	12	8.33	8
2	Faculty Requirements	39	27.08	20
3	Major Specialization Subjects	53	36.81	35
4	Minor Specialization Subjects	40	27.78	Maximum 30
		144	**100**	**100**

MANUFACTURING & MATERIALS ENGINEERING PROGRAM
LIST OF COURSES

Code	Course	CR	Lec	Tut	Lab	Pre-Req.
(A) University Requirements (12 Credits)						
GEN000	English Language (A remedy course)	0	0	0	0	---
GEN201	Information Technology	1	1	0	0	---
GEN301	Current Social Issues in Egypt	1	1	0	0	---
GEN401	Professional Ethics	2	2	0	0	---
GEN10X	Elective (1) From Language Courses List	2	1	2	0	---
GEN104	History of Science, Engineering & Technology	2	2	0	0	---
GEN202	Communication & Presentation Skills	2	1	2	0	---
GEN407	Entrepreneurship	2	1	2	0	---
(B) Faculty Requirements (39 Credits)						
BAS101	Differential Calculus and Algebra	3	2	2	0	-
BAS102	Integral Calculus & Analytical Geometry	3	2	2	0	BAS101
BAS103	Physics of Materials	3	2	0	3	-
BAS104	General Chemistry	3	2	0	2	-
BAS105	Statics & Dynamics (1)	3	2	2	0	-
BAS106	Physics of Electricity & Magnetism	3	2	0	3	BAS103
BAS107	Statics & Dynamics (2)	3	2	2	0	BAS105
ENG101	Production Engineering	3	2	0	3	-
ENG102	Engineering Graphics	3	1	0	4	-
ENG104	Computer Programming with MATLAB	3	2	0	3	---
MME230	Field Training (I)	1	0	0	3	60 Credits
MME340	Field Training (II)	1	0	0	3	90 Credits
MME430	Graduation Project (1)	3	1	2	2	100 Credits
MME440	Graduation Project (2)	4	2	2	2	MME430
(C) Major Specialization Subjects (53 Credits)						
ENG202	Technical Report Writing	3	2	2	0	-
BAS310	Operations Research	3	2	2	0	BAS201
ENG201	Engineering Economy & Accounting	3	2	2	0	-
BAS202	Physics of Light & Heat	3	2	0	3	BAS103
BAS203	Differential Equations	3	2	2	0	BAS102
BAS301	Partial Differential Equations & Numerical Analysis	3	2	2	0	BAS203
BAS201	Probability and Statistical Methods	3	2	2	0	-
MME202	Computer Aided Mechanical Drawing	2	1	0	2	ENG102
MME203	Manufacturing Processes	3	2	0	2	ENG101
MME204	Thermo-fluid Engineering	3	2	0	2	BAS202
MME206	Materials Engineering & Metallurgy	3	2	0	2	BAS103
MME207	Solid Mechanics	3	2	0	2	BAS103
MME208	Materials Testing Lab	1	0	0	2	BAS103 & MME206

Code	Course	CR	Lec	Tut	Lab	Pre-Req.
MME209	Electrical & Electronic Engineering	3	2	0	2	BAS106
MME301	Theory of Machines and Vibration	3	2	0	2	BAS107
MME302	Materials Characterization	2	1	0	3	MME206
MME303	Metrology and Measurement Systems	3	2	0	2	MME209
MME304	Machine Components Design	3	2	2	0	MME207
MME305	Heat & Mass Transfer	3	2	0	3	MME204
(D) Minor Specialization Subjects (40 Credits)						
MME306	Theory of Plasticity & Metal Forming	3	2	2	0	MME207
MME307	Theory of Solidification & Metal Casting	3	2	0	2	MME206 & MME203
MME308	Statistical Quality Design and Control	3	2	2	0	BAS201
MME309	Theory of Metal Cutting	3	2	0	2	MME101
MME310	Industrial Project Management	3	2	0	2	ENG201
MME401	Computer Aided Design & Manuf. (CAD/CAM)	4	3	0	2	MME304 & MME203
MME402	Finite Elements Analysis (FEA)	3	2	0	2	BAS301
MME403	Advanced Engineering Materials	3	2	0	3	MME302
MME4xx	Elective (2) (Manuf. Or Mat. Elective Courses List)	3	2	0	2	xxx
MME4xx	Elective (3) (Manuf. Or Mat. Elective Courses List)	3	2	0	2	xxx
MME4xx	Elective (4) (Manuf. Or Mat. Elective Courses List)	3	2	0	2	xxx
MME4xx	Elective (5) (Manuf. Or Mat. Elective Courses List)	3	2	0	2	xxx
MME4xx	Elective (6) (Manuf. Or Mat. Elective Courses List)	3	2	0	2	xxx
Elective Courses for Manufacture Engineering Concentration						
MME411	Nontraditional Machining	3	2	0	2	MME101
MME412	Robotics and Flexible Mfg. Systems	3	2	0	2	MME401
MME413	Systems and Control	3	2	0	2	MME301
MME414	Data Analytics for Systems Engineering	3	2	0	2	BAS201 & ENG104
MME415	Special Topics in Manufacturing Engineering	3	2	0	2	MME203
MME416	Micromanufacturing Technology	3	2	0	2	MME203
MME417	Engineering Simulation	3	2	0	2	BAS301 & ENG104
MME418	Non-Metallic Materials Processing	3	2	0	2	MME206
MME419	Lean Manufacturing Systems	3	2	0	2	MME401
Elective Courses for Materials Engineering Concentration						
MME421	Materials Selection & Design	3	2	0	2	MME206
MME422	Corrosion Engineering	3	2	0	2	MME206
MME423	Energy Materials	3	2	0	2	BAS202 & MME302
MME424	Electronic Materials	3	2	0	2	MME209 & MME302
MME425	Fracture of Materials	3	2	0	2	MME206 & MME208
MME426	Biomaterials	3	2	0	2	MME206 & MME302
MME427	Laser Processing and Nanostructures	3	2	0	2	MME403 & MME302
MME428	Surface Engineering of Nanomaterials	3	2	0	2	MME403 & MME302
MME429	Construction Materials	3	2	0	2	MME206 & MME302

Code	Course	CR	Lec	Tut	Lab	Pre-Req.
Basic Science & Mathematics Courses						
BAS101	Differential Calculus and Algebra	3	2	2	0	-
BAS102	Integral Calculus & Analytical Geometry	3	2	2	0	BAS001
BAS103	Physics of Materials	3	2	0	3	-
BAS104	General Chemistry	3	2	0	2	-
BAS105	Statics & Dynamics (1)	3	2	2	0	-
BAS106	Physics of Electricity & Magnetism	3	2	0	3	BAS103
BAS201	Probability and Statistical Methods	3	2	2	0	-
BAS202	Physics of Light & Heat	3	2	0	3	BAS103
BAS107	Statics & Dynamics (2)	3	2	2	0	BAS105
BAS310	Operations Research	3	2	2	0	BAS201
MME207	Solid Mechanics	3	2	0	2	BAS103
BAS203	Differential Equations	3	2	2	0	BAS102
BAS301	Partial Differential Equations & Numerical Analysis	3	2	2	0	BAS203

MANUFACTURING & MATERIALS ENGINEERING PROGRAM
STUDY PLAN

STUDY PLAN FOR MANUFACTURING & MATERIALS ENGINEERING PROGRAM

1st Level

FIRST SEMESTER

Code	Subject	Credits	Contact Hours			Prerequisites
			Lec.	Tut.	Lab.	
GEN10X	Elective (1) From Language Courses List	2	1	2	0	---
BAS101	Differential Calculus and Algebra	3	2	2	0	---
BAS103	Physics of Materials	3	2	0	3	---
BAS104	General Chemistry	3	2	0	2	---
BAS105	Statics & Dynamics (1)	3	2	2	0	---
ENG101	Production Engineering	3	2	0	3	-
		17	**11**	**6**	**8**	

SECOND SEMESTER

Code	Subject	Credits	Contact Hours			Prerequisites
			Lec.	Tut.	Lab.	
GEN104	History of Science, Eng. & Technology	2	2	0	0	---
BAS102	Integral Calculus & Analytical Geometry	3	2	2	0	BAS101
BAS106	Physics of Electricity & Magnetism	3	2	0	3	BAS103
BAS107	Statics & Dynamics (2)	3	2	2	0	BAS105
ENG102	Engineering Graphics	3	1	0	4	---
ENG104	Computer Programming with MATLAB	3	2	0	3	---
		17	**11**	**4**	**10**	

STUDY PLAN FOR MANUFACTURING & MATERIALS ENGINEERING PROGRAM

2nd Level

FIRST SEMESTER

Code	Subject	Credits	Contact Hours			Prerequisites
			Lec.	Tut.	Lab.	
GEN201	Information Technology	1	1	0	0	---
BAS202	Physics of Light & Heat	3	2	0	3	BAS103
BAS203	Differential Equations	3	2	2	0	BAS102
MME202	Computer Aided Mechanical Drawing	2	1	0	2	ENG102
MME206	Materials Engineering & Metallurgy	3	2	0	2	BAS103
ENG201	Engineering Economy & Accounting	3	2	2	0	---
MME204	Thermo-fluid Engineering	3	2	0	2	BAS202
		18	**12**	**4**	**9**	

SECOND SEMESTER

Code	Subject	Credits	Contact Hours			Prerequisites
			Lec.	Tut.	Lab.	
GEN202	Communication & Presentation Skills	2	1	2	0	---
ENG202	Technical Report Writing	3	2	2	0	---
MME209	Electrical & Electronic Engineering	3	2	0	2	BAS106
MME203	Manufacturing Processes	3	2	0	2	ENG101
MME207	Solid Mechanics	3	2	0	2	BAS103
BAS201	Probability and Statistical Methods	3	2	2	0	---
MME208	Materials Testing Lab	1	0	0	2	BAS103 & MME206
		18	**11**	**6**	**8**	

SUMMER SEMESTER

Code	Subject	Credits	Contact Hours			Prerequisites
			Lec.	Tut.	Lab.	
MME230	Field Training (I)	1	0	0	3	60 Credits

STUDY PLAN FOR MANUFACTURING & MATERIALS ENGINEERING PROGRAM

3rd Level

FIRST SEMESTER

Code	Subject	Credits	Contact Hours			Prerequisites
			Lec.	Tut.	Lab.	
GEN301	Current Social Issues in Egypt	1	1	0	0	---
BAS301	Partial Diff. Eq. & Numerical Analysis	3	2	2	0	BAS203
MME301	Theory of Machines and Vibration	3	2	0	2	BAS107
BAS310	Operations Research	3	2	2	0	BAS201
MME302	Materials Characterization	2	1	0	3	MME206
MME306	Theory of Plasticity & Metal Forming	3	2	2	0	MME207
MME303	Metrology and Measurement Systems	3	2	0	2	MME209
		18	**12**	**6**	**7**	

SECOND SEMESTER

Code	Subject	Credits	Contact Hours			Prerequisites
			Lec.	Tut.	Lab.	
MME304	Machine Components Design	3	2	2	0	MME207
MME305	Heat & Mass Transfer	3	2	0	3	MME204
MME307	Theory of Solidification & Metal Casting	3	2	0	2	MME206 & MME203
MME309	Theory of Metal Cutting	3	2	0	2	MME101
MME308	Statistical Quality Design and Control	3	2	2	0	BAS201
MME310	Industrial Project Management	3	2	0	2	ENG201
		18	**12**	**4**	**9**	

SUMMER SEMESTER

Code	Subject	Credits	Contact Hours			Prerequisites
			Lec.	Tut.	Lab.	
MME340	Field Training (II)	1	0	0	3	90 Credits

STUDY PLAN FOR MANUFACTURING & MATERIALS ENGINEERING PROGRAM

4th Level

FIRST SEMESTER

Code	Subject	Credits	Contact Hours			Prerequisites
			Lec.	Tut.	Lab.	
GEN401	Professional Ethics	2	2	0	0	---
MME401	CAD/CAM	4	3	0	2	MME304 & MME203
MME403	Advanced Engineering Materials	3	2	0	3	MME302
MME4xx	Elective (2)	3	2	0	2	xxxxxx
MME4xx	Elective (3)	3	2	0	2	xxxxxx
MME430	Graduation Project (1)	3	1	2	2	100 Credits
		18	**12**	**2**	**11**	

SECOND SEMESTER

Code	Subject	Credits	Contact Hours			Prerequisites
			Lec.	Tut.	Lab.	
GEN407	Entrepreneurship	2	1	2	0	---
MME402	Finite Elements Analysis (FEA)	3	2	0	2	BAS301
MME4xx	Elective (4)	3	2	0	2	xxxxxx
MME4xx	Elective (5)	3	2	0	2	xxxxxx
MME4xx	Elective (6)	3	2	0	2	xxxxxx
MME440	Graduation Project (2)	4	2	2	2	MME430
		18	**11**	**4**	**10**	

MANUFACTURING & MATERIALS ENGINEERING PROGRAM
COURSE DISCERPTIONS

MME202	Computer Aided Mechanical Drawing	3 (1,0,2)
This course aims to provide the students with basic knowledge on assembly drawings and representation of mechanical components. The topics include: Sections in machine members, Assembly and detailed drawings, Fits and tolerances, Geometrical tolerances, Surface texture and roughness symbols, Welding symbols. The students can Identify the different types of machine elements like gears, shafts and keys, journal bearings, anti-friction bearings, springs, valves, pulleys, pipelines, clutches and breaks ...etc. Applications on assembly drawings of jacks, vices, valves, gearboxes …etc are provided. Applications using of 3D modeling software (like SolidWorks or Autodesk Inventor) to draw and assemble machine components to construct a complete complex machine in addition to make detailed drawings.		

Prerequisites: ENG102.

References:

[1]. Narayana K L, Kannaiah P, Reddy K Machine Drawing for Engineers, Third Edition, new age international (p) limited, publishers, 2006
[2]. Reddy, K., Textbook of Engineering Drawing, Second Edition, BS Publications, 2008.
[3]. Davies, B. L., Robotham, A. J. and Yarwood, A. Computer-aided Drawing, First edition, Springer Netherlands, 1991.
[4]. Fulkerson, F., SolidWorks Basics, Industrial Press, Inc, 2015
[5]. Lombard, M., Mastering SolidWorks, Wiley, 2019
[6]. Tremblay T., Autodesk Inventor 2010: No Experience Required, Sybex, 2009.

MME206	Materials Engineering & Metallurgy	3 (2,0,2)
Atomic structure, interatomic bonding and structure of crystalline solids, defects in crystalline solids, dislocations and strengthening mechanisms, phase diagrams, iron-carbon phase diagram, phase transformation and heat treatment of metals, time-temperature-transformation (TTT) diagrams, Steels and its alloys, Cast iron and its alloys, Non-ferrous alloys (aluminum, copper, magnesium, zinc). The structure of polymers, ceramics and composite materials.		

Prerequisites: BAS103.

References:

[1]. Callister, W. D., Rethwisch, D. G., Fundamentals of Materials Science and Engineering: An Integrated Approach (5 ed.), Wiley,2015.
[2]. Seetharaman, S.Fundamentals of Metallurgy, Woodhead Publishing Ltd, 2005.
[3]. Askeland, D. R. Essentials of Materials Science & Engineering, 2nd edition, CL-Engineering, 2009.

MME204	Thermo-fluid Engineering	3 (2,0,2)
This course introduces the fundamentals and techniques of thermodynamics and fluid mechanics. Emphasis is placed on being able to formulate and solve typical problems of engineering importance. The scope of the course covers basic thermal fluid properties, dimensional analysis, incompressible flows, thermal effect on fluid mechanics …etc. Laboratory experiments will demonstrate the principles of fluid mechanics and thermodynamics.		

Prerequisites: BAS202.

References:

[1]. Claus B., Richard E. S. Fundamentals of Thermodynamics, 10th Edition, Willy, 2019

[2]. Hutter, K. and Wang Y., Fluid and Thermodynamics: Volume 1: Basic Fluid Mechanics, Springer, 2016

[3]. Hutter, K. and Wang Y., Fluid and Thermodynamics: Volume 2: Advanced Fluid Mechanics and Thermodynamic Fundamentals, Springer, 2016.

MME209	Electrical & Electronic Engineering	3 (2,0,2)
The student learns the fundamentals involved in electrical and electronic engineering. Topics include analysis of circuits, transient and steady state phenomena, and general analysis techniques, Kerchief's law, theorem circuit, the electronic components and their characteristics, electronic circuits.		

Prerequisites: BAS106.

References:

[1]. Christopher R. R., Fundamental Electrical and Electronic Principles, Third Edition, Routledge, 2008.

[2]. David B., Electrical and Electronic Principles and Technology, Third Edition, Routledge, 2010.

[3]. Earl D. G., Introduction to Basic Electricity and Electronics Technology, 1st Edition, Cengage Learning, 2013.

MME203	Manufacturing Processes	3 (2,0,2)
Introduction to production management and planning, Introduction to cost analysis. Introduction to foundry technology, pattern making and design, technology of moulding and core making, testing of moulding sand, different types of moulding sand and their properties, gating system design and risering, melting technology, casting defects and its remedy, casting methods-Fettling and heat treatment of casting- Welding technology: Basic aspects of welding, solid state welding methods, fusion welding methods, welding defects and remedy, destructive and nondestructive tests.		

Prerequisites: GEN101.

References:

[1]. Gupta, H. N. Gupta, R. C. Mittal, Arun, Manufacturing Processes, 2nd Edition, new age international (p) limited, publishers, 2009.

[2]. Mikell P. G., Introduction to Manufacturing Processes, 1st Edition, Wiley, 2011.

[3]. Kalpakjian, Manufacturing Processes for Engineering Materials, 7th Edition, Pearson Education, 2013

[4]. Creese, R., Introduction to Manufacturing Processes and Materials. CRC Press, 2017.

[5]. Beddoes, J., and Bibby, M., Principles of metal manufacturing processes. Butterworth-Heinemann, 1999.

[6]. Schrader, G. F. and Elshennawy, A. K., Manufacturing processes and materials. Society of Manufacturing Engineers, 2000.

MME207	Solid Mechanics	3 (2,0,2)
The course covers the following topics: stress and strain concepts, axial load, statically indeterminate axially loaded members, thermal stress, torsion, angle of twist, statically indeterminate torque-loaded members, bending, eccentric axial loading of beams, transverse shear, shear flow in build-up members, combined loadings, stress and strain transformation, deflection of beams and shafts, statically indeterminate beams and shafts.		

Prerequisites: BAS103.

References:

[1]. Hibbeler, R., Mechanics of Materials 10th Edition, Pearson, 2016

[2]. Crandall, H. Lardner, T., Introduction to the Mechanics of Solids, Second Edition within SI Units 2nd Edition, McGraw-Hill Publishing Company, 1987.

[3]. Gere, J. M., Timoshenko, S.P., Mechanics of Materials 4th Edition, CL Engineering 1996.

MME208	Materials Testing Lab	1 (0,0,2)
Mechanical tests of the materials (hardness - impact - tension - compression - bending - shear - torsion - wear - creep), non-destructive tests (NDT) of metals (X-ray diffraction - ultrasonic testing - magnetic methods ... etc.), practical experiments in the laboratory to perform the mechanical tests.		

Prerequisites: BAS103 & MME206.

References:

[1]. Crankovic, M.G., ASM Handbook: Volume 10: Materials Characterization (Asm Handbook) (Asm Handbook) 9th Edition, (2019 Edition), ASM International, 1986.

[2]. Sultan, K. Practical Guide to Materials Characterization: Techniques and Applications 1st Edition, Wiley-VCH, 2022.

[3]. Dieter, G., Mechanical Metallurgy, CreateSpace Independent Publishing Platform, 2014.

MME301	Theory of Machines and Vibration	3 (2,0,2)
Types of mechanisms, degree of freedom of mechanisms, Kinematics movement of the rigid objects, introduction to planner mechanisms, kinematics analysis of the planer mechanisms: the characterization of the different types of gears design and analysis of the form of camshafts and attachments, Kinematics of belts and chains. Planar motion dynamics of the rigid bodies, analysis of the static and dynamic forces at mechanisms, the dynamics of reciprocating machines, sketches of rotation torque diagrams, dynamic equilibrium, gyroscope, design of the appropriate flywheels for different engines and various mechanisms. Properties of vibrational motion, derivation of the governing differential equations, free and damping vibration, forced harmonic motion, the imbalanced rotation and reciprocation, the motion of carriages, vibration isolation, transmitted vibration, free vibrations of systems with two-degrees of freedom, instant analysis, vibration of system with many degrees of freedom, continuous systems, numerical and computational methods to determine the natural frequencies.		

Prerequisites: BAS107.

References:

[1]. Dresig, H., Dynamics of Machinery: Theory and Applications 2010th Edition, Springer, 2010.

[2]. Myklestad, O.N., Fundamentals of Vibration Analysis, Reprint Edition, Dover Publications, 2018.
[3]. Cai, L.W., Fundamentals of Mechanical Vibrations, 1st Edition, Wiley-ASME Press Series, 2016.

MME302	Materials Characterization	2 (1,0,3)
This course will introduce the basic principles of materials characterization and the common characterization techniques. It will cover the following topics: Basic principles, interaction of radiation and particle beams with matter. Diffraction methods. Images, optical, scanning, transmission electron, scanning tunneling and field ion microscopy. Microanalysis and Spectroscopy, energy dispersive, wavelength dispersive, Auger Processes, Electron, Ion growth, SIMS, ESCA. Thermal analysis: DTA, DSC. Depending on availability and functionality of equipment, lab visits and demonstrations will be scheduled to the class to discuss some case studies.		

Prerequisites: MME206.

References:

[1]. (Asm Handbook) 9th Edition, (2019 Edition), ASM International, 1986.
[2]. Sultan, K. Practical Guide to Materials Characterization: Techniques and Applications 1st Edition, Wiley-VCH, 2022.
[3]. Dieter, G., Mechanical Metallurgy, CreateSpace Independent Publishing Platform, 2014.
[4]. Theodore, D. Materials Characterization – Book 5: 250+ Questions & Answers, Kindle Edition, 2018.

MME306	Theory of Plasticity & Metal Forming	3 (2,2,0)
Introduction to theory of plasticity, plastic deformation of metals, stress-strain relations, yield criteria, flow stress, slip-line field theory, calculation of the required forces to perform wire drawing, extrusion, forging, shear, deep drawing and rolling processes, sheet metal forming mechanisms, precision shearing, contour forming sheet, metal forming machines.		

Prerequisites: MME207.

References:

[1]. Singh, S., Theory of Plasticity and Metal Forming Processes, Khanna Publishers, 2008
[2]. Sluzalec, A., Theory of Metal Forming Plasticity: Classical and Advanced Topics, 2004th Edition, Springer, 2013.

MME303	Metrology and Measurement Systems	3 (2,0,2)
The aim of the students with the fundamental background as well as practical knowledge to precisely measure and quantify geometric aspects of manufactured parts as well as production system capabilities. Topics include: Linear Measurements, Standards of Measurements, Limits, Fits and Gages, Comparators, Measurement by Light-Wave Interference, Straightness, Flatness, Squareness, Parallelism, Circularity and Rotation, Angular Measurement and Circular Division, Basics of Machine Tool Metrology.		

Prerequisites: MME209.

References:

[1]. Diering, M., Wieczorowski, M. Advances in Manufacturing II: Volume 5 - Metrology and Measurement Systems 1st edition, Springer,2019.

[2]. Krishnamurthy, and Raghavendra, Engineering Metrology and Measurements, Pap/Psc edition, Oxford University Press, 2013
[3]. Dotson, L.C., Fundamentals of Dimensional Metrology, 6th Edition, Cengage Learning, 2015.

MME304	Machine Components Design	3 (2,0,3)
Concepts of mechanical design, primary steps of the mechanical design, engineering materials, engineering manufacturing considerations of the mechanical design, design of mechanical parts under the effect of static and repeated loads, stress concentration, safety factor, bolts and welded joints design, design of power screws, design of springs, chains, gears, belts and pulleys. Design projects using 3D CAD software like (SolidWorks or Autodesk Inventor).		

Prerequisites: MME207.

References:

[1]. Marshek, K.M., Juvinall, R.C.,Fundamentals of Machine Component Design, 7th Edition, Wiley, 2020.
[2]. Ugural, A.C., Mechanical Design of Machine Components 2nd Edition, CRC Press, 2015.
[3]. CADFolks, SolidWorks 2022 Step-By-Step Guide, 978-81-93063033, 2021.

MME305	Heat & Mass Transfer	3 (2,0,3)
Heat transfer in boiling and condensation, Heat exchangers and their types, Design of heat exchanger and effectiveness calculation, Methods of heat transfer enhancement, Thermal radiation, Combined convection and radiation heat transfer, Heat transfer by radiation exchange between surfaces, Heat transfer by radiation transfer between flames and gases, radiation and environment, Heat and mass transfer analogy, Mass transfer in gas, liquid and solid media, Mass transfer applications.		

Prerequisites: MME204.

References:

[1]. Ghajar, A., Heat and Mass Transfer: Fundamentals and Applications, 6th Edition, McGraw Hill, 2019
[2]. Bergman, T., Fundamentals of Heat and Mass Transfer 7th Edition, Wiley, 2011.

MME307	Theory of Solidification & Metal Casting	3 (2,0,2)
Crystallization kinetics of melts and gases, Influence of the boundary structure on the kinetics, Forced dissolution in solid phase during crystallization, Sub cooling of melts, homogeneous and heterogeneous nucleation in melts and gases, Facetted and dendritic growth, transition between these morphologies, Eutectic and peritectic reactions and transitions between these reactions in multi-component systems, Analysis of technically important crystallisation processes, Directional solidification in theory and practice, Production of a favourable texture, Single crystals, composite materials, Thermal analysis, Directional solidification.		

Prerequisites: MME206 & MME203.

References:

[1]. Laughlin, D.E., Physical Metallurgy 5th Edition, Elsevier, 2014.
[2]. Zolotorevsky, V., Belov, N., Casting Aluminum Alloys: Their Physical and Mechanical Metallurgy, 2nd Edition, Butterworth-Heinemann,2018.

MME309	Theory of Metal Cutting	3 (2,0,2)
Cutting tools materials, cutting tools life time and its wear, machinability of metals, cutting operation mechanisms with single and multiple point cutting edges tools, orthogonal and inclined cutting, cutting forces diagrams, speed curves, specific energy and power, metal removal rate, heat effect during cutting operations, cutting forces analysis, heat effect during turning, milling and drilling, dynamometers.		

Prerequisites: MME101.

References:

[1]. Stephenson, D., Agapiou, J., Metal Cutting Theory and Practice 3rd Edition, CRC Press,2016.

[2]. Gorczyca, F.E., Application of Metal Cutting Theory, Illustrated edition, Industrial Press, Inc., 1987.

MME308	Statistical Quality Design and Control	3 (2,2,0)
History of quality control, modern quality control philosophy, Design-Measure-Analyze-Improve Control paradigm, methods for describing variation including histograms, stem-and-leaf plots, box plots, discrete and continuous random variables, probability plots, statistical inference methods, design of control charts for variable and attribute data including X-bar, R, S, CUSUM, MA and EWMA charts, sensitizing rules including Western Electric guidelines, average run length, process characterization and capability analysis, gauge R&R studies, design of experiments with emphasis on factorial design, sampling inspection, attribute and variable acceptance plans, six-sigma and TQM.		

Prerequisites: BAS201.

References:

[1]. Devor, R., Sutherland, j., Statistical Quality Design and Control: Contemporary Concepts and Methods 2nd Edition, Pearson, 2006.

[2]. Allen, T., Introduction to Engineering Statistics and Six Sigma: Statistical Quality Control and Design of Experiments and Systems, Springer, 2006.

MME310	Industrial Project Management	3 (2,0,2)
Introduction engineering project management with applications in industrial projects, projects analysis, network analysis samples, balancing of time and cost, resources planning, monitoring and control of engineering projects, performance evaluation of engineering projects, the concept of a feasibility study, elements of feasibility study, planning and control of the small projects, use of computer for planning and control of the projects using the Microsoft Project software, case studies and applications.		

Prerequisites: ENG201.

References:

[1]. Kerzner, H., Project Management Metrics, KPIs, and Dashboards: A Guide to Measuring and Monitoring Project Performance 3rd Edition, Wiley, 2017.

[2]. Carstens, D.S., Project Management Tools and Techniques 2nd Edition, CRC Press, 2021.

MME401	Computer Aided Design & Manuf. (CAD/CAM)	4 (3,0,2)
Introduction to CAD/CAM, Principles of NC and CNC machines (types and operations), CNC programming, industrial robots, components of CAD systems, computer graphics, modelling		

techniques, introduction of finite element analysis. Design projects using computer software e.g. SolidWorks, Simulation Xpress and Ansys …etc. Laboratory exercises in CNC Lab.

Prerequisites: MME304 & MME203.

References:

[1]. Bi, Z., Wang, X., Computer Aided Design and Manufacturing, 1st Edition, Wiley-ASME Press Series, 2020

[2]. Chang, T., Computer-Aided Manufacturing, 3rd Edition, Pearson, 2005.

[3]. Groover, M., CAD/CAM: Computer-Aided Design and Manufacturing, Pearson Technology Group; Facsimile edition, 2008.

MME403	Advanced Engineering Materials	3 (2,0,3)

Structures, classifications, properties and applications of ceramics, plastics, composite materials, Nanomaterials, smart materials, superalloys, amorphous materials, porous materials. Manufacturing and forming processes of the advanced materials.

Prerequisites: MME302.

References:

[1]. Behera, A., Advanced Materials: An Introduction to Modern Materials Science, Springer, 2021.

[2]. Mittal, V., Advanced Materials (Specialty Materials), Central West Publishing, Australia, 2019.

[3]. Reed, R., The Superalloys: Fundamentals and Applications 1st Edition, Cambridge University Press, 2008.

[4]. Sims, C.T., Superalloys II: High-Temperature Materials for Aerospace and Industrial Power 2nd Edition, Wiley-Interscience, 2008.

MME402	Finite Elements Analysis (FEA)	3 (2,0,2)

The course gives an outline of the finite element method (FEM) as a numerical simulation technique used widely in simulating several materials Engineering problems. The course also presents the use of FEM numerical method to materials engineers using MATLAB and the partial differential equation (PDE) toolbox in the modeling of many materials processes. Topics such as developing weak formulations as prelude to solving the finite element equation, interpolation functions, derivation of elemental equations, assembly and sample solutions are treated in this course. Problems in materials engineering and their solutions using MATLAB on heat transfer, casting, plastic deformation and elasticity are provided.

Prerequisites: BAS301.

References:

[1]. Cook, R., Concepts and Applications of Finite Element Analysis, 4th Edition 4th Edition, Wiley, 2001.

[2]. Khennane, A. Introduction to Finite Element Analysis Using MATLAB® and Abaqus 1st Edition, CRC Press, 2013.

MME411	Nontraditional Machining	3 (2,0,2)

The course covers the non-conventional machining processes. The topics include: Brief overview of Abrasive jet Machining (AJM), Water jet machining (WJM), Ultrasonic machining (USM), Electric

discharge machining (EBM), Electro-chemical machining (ECM), Electron beam machining (EBM), Laser beam machining (LBM), Plasma arc machining (PAM). This defines the selecting operations, machine tool types, materials, workpieces, calculation time and how to choose the best machining procedures.

Prerequisites: MME101.

References:

[1]. Sommer, C., Non-Traditional Machining Handbook Second Edition, Advance Publishing(TX), 2009.

[2]. Jagadeesha, T. Nontraditional Machining Processes, Dreamtech Press, 2021.

MME413	Systems and Control	3 (2,0,2)
This course introduces linear systems, transfer functions, and Laplace transforms. It covers stability and feedback and provides basic design tools for specifications of transient response. It also briefly covers frequency-domain techniques.		

Prerequisites: MME301.

References:

[1]. Williams, I.J., Schaum's Outline of Feedback and Control Systems, 3rd Edition, McGraw Hill, 2013.

[2]. Dorf, R., Modern Control Systems 13th Edition, Pearson, 2016.

MME412	Robotics and Flexible Mfg. Systems	3 (2,0,2)
Introduction of CAD/CAM systems, overview of FMS, system hardware and general functions, material handling system, work holding systems, cutting tools and tool management, physical planning of system, software structure functions and description, cleaning and automated inspection, communications and computer networks for manufacturing, quantification of flexibility, human factors in manufacturing, FMS and CIM in action (case studies), justification of FMS, modelling for design, planning and operation of FMS. overview of industrial robots, systems, concepts, end effectors, computer control, specifications, Modelling, justifications, and programming.		

Prerequisites: MME401.

References:

[1]. Leondes, C., Computer-Aided Design, Engineering, and Manufacturing: Systems Techniques and Applications, Volume VII, Artificial Inte 1st Edition, CRC Press, 2000.

[2]. Makarov, M.I., Modelling Robotic & Flexible Manufacturing Systems 1st Edition, CRC Press, 1990.

MME414	Data Analytics for Systems Engineering	3 (2,0,2)
Emphasizes data-driven system modeling, including basic statistical learning models, and system modeling and decision-making. Covers experimental design for data collection, tree-based control charts for process monitoring, rule-based decision-making, and diagnosis of root causes as learning problems. Students develop connections between emerging statistical learning techniques with system modeling and optimization methods. Applications using MATLAB.		

Prerequisites: BAS201 & ENG104.

References:

[1]. Reis, J., Fundamentals of Data Engineering: Plan and Build Robust Data Systems 1st Edition, O'Reilly Media, 2022.
[2]. Mathews, J., Numerical Methods Using Matlab 4th Edition, Pearson, 2003.
[3]. Perez, C., BIG Data Analytics With Neural Networks Using MATLAB, Lulu.com, 2019.

MME415	Special Topics in Manufacturing Engineering	3 (2,0,2)
Selected topics in the field of the manufacturing, it is designed to deepen the student background in the field of the advanced manufacturing processes. The topics are determined at the start of the academic semester and must be approved by the program council.		

Prerequisites: MME203.

References:

[1]. Kalpakjian, Manufacturing Engineering & Technology (7th Ed), Pearson India, 2018.
[2]. Thompson, R., Manufacturing Processes for Design Professionals, Reprint edition, 2007.

MME416	Micromanufacturing Technology	3 (2,0,2)
The purposes of this course is defined as the creation of high precision 3-dimensional products using a wide variety of engineering materials with feature sizes in the range of tens of micrometers to a few millimeters with extremely tight tolerances. Emphasis will be placed on micro-scale product design and material-related issues and on new top-down and bottom-up manufacturing processes in addition to the accompanying trend toward the miniaturization of manufacturing equipment and systems.		

Prerequisites: MME203.

References:

[1]. Shipley, D., Micro-Manufacturing Technologies and Their Applications: A Theoretical and Practical Guide (Springer Tracts in Mechanical Engineering) 1st ed. 2017 Edition, Springer, 2017.
[2]. Adithan, M., Micromanufacturing: Materials, Processes and Technology, 1st edition, Atlantic Publishers and Distributors Pvt Ltd, 2019.

MME417	Engineering Simulation	3 (2,0,2)
Advanced applications of discrete event, continuous, and combined discrete-continuous simulation modeling, detailed examination of fundamental computer programming concepts underlying the design and development of simulation languages, variance reduction techniques, and output analysis for various engineering and manufacturing applications.		

Prerequisites: BAS301 & ENG104.

References:

[1]. Law, A., Simulation Modeling and Analysis 5th Edition, McGraw Hill, 2014.
[2]. Zeigler, B.P., Modeling & Simulation-Based Data Engineering: Introducing Pragmatics into Ontologies for Net-Centric Information Exchange, Academic Press, 2014.

MME418	Non-Metallic Materials Processing	3 (2,0,2)
This course deals with the technology basics of advanced ceramics, glass-ceramics and plastics. The emphasis is put on technology principles of particular classes of materials. Processing methods		

are discussed with respect to the nature and properties of materials. The course includes an overview of processing of ceramics-ceramics composites, glass-ceramics composites and ceramics-metal composites.

Prerequisites: MME206.

References:

[1]. Somiya, S., Handbook of Advanced Ceramics: Materials, Applications, Processing, and Properties 2nd Edition, Academic Press, 2013.

[2]. Mohamed, A.M.a., Advanced Ceramic Processing, Intechopen, 2015.

MME419	**Lean Manufacturing Systems**	**3 (2,0,2)**
Introduction, Lean manufacturing through waste elimination, Value stream mapping, Concepts, Kaizen in lean manufacturing paradigm, Single minute exchange of die, Pull production through Kanban card systems, One piece flow production system, Visual management, The fundamental structure of Agile manufacturing paradigm, Implementation of Agile paradigm in moderate and smart organizations.		

Prerequisites: MME401.

References:

[1]. Black, J.T., Lean Manufacturing Systems and Cell Design, Society of Manufacturing Engineers, 2003.

[2]. Meyers, F.E., Motion and Time Study for Lean Manufacturing, Subsequent edition, Pearson College Div, 2001.

MME421	**Materials Selection & Design**	**3 (2,0,2)**
Types and properties of engineering materials, materials selection necessity for mechanical design, materials selection charts, basics of materials selection, materials selection for manufacturing, computer aided materials selection, improvement of the available materials for production or production of new materials to cover a wide range of the required properties such as physical and chemical properties, surface heat-treatment, diffusion, microstructure, recrystallization, age hardening, phase transformation, grains growth and composite materials.		

Prerequisites: MME206.

References:

[1]. Ashby, M., Materials Selection in Mechanical Design 5th Edition, Butterworth-Heinemann, 2017.

[2]. Dieter, G., ASM Handbook: Materials Selection and Design, Volume XX 1st Edition, CRC Press, 1997.

[3]. Maleque,M.A., Materials Selection and Design, 2013th Edition, Springer, 2014.

MME422	**Corrosion Engineering**	**3 (2,0,2)**
This course gives the basic and practical understanding of the corrosion process. The topics include: Corrosion principles: electrochemical, environmental and materials aspects, Forms of corrosion: uniform attack, galvanic corrosion, crevice corrosion, pitting, intergranular, Corrosion, selective leaching, erosion corrosion, stress corrosion and fretting, corrosion fatigue, Hydrogen damage, Materials used for corrosion applications: ferrous alloys, steels and cast irons, nonferrous alloys, Ceramics, plastics, thermoplastics and thermoses, Corrosion testing techniques, Corrosion		

control: materials selection, design, environment control, cathodic and anodic protection, coatings, high temperature corrosion, Case studies.

Prerequisites: MME206.

References:

[1]. Roberge, P.R., Handbook of Corrosion Engineering, Third Edition 3rd Edition, McGraw Hill, 2019.

[2]. Ahmad, Z., Principles of Corrosion Engineering and Corrosion Control 1st Edition, Butterworth-Heinemann, 2006.

[3]. Fontana, Corrosion Engineering, 3Ed, MC GRAW HILL INDIA, 2005.

MME423	**Energy Materials**	**3 (2,0,2)**
The relationship between materials and energy. Materials for solar cells: semi-conductors. Battery materials: Li-batteries, metal-hydrid-batteries. Materials for hydrogen technology: production (electrolysis), storage (hydrids), fuel cells. Materials used in connection with gas power (catalysts, microporous materials, membranes).		

Prerequisites: BAS202 & MME302.

References:

[1]. Dittrich, T., Materials Concepts for Solar Cells (Energy Futures), Icp, 2014.

[2]. Zhang, S., Materials for Energy (Advances in Materials Science and Engineering) 1st Edition, CRC Press, 2020.

MME424	**Electronic Materials**	**3 (2,0,2)**
Defects, diffusion, ion implantation, epitaxy, thermal oxidation, plasma processing, thin films, semi-conductor devices, very-large-scale integration (VLSI) processes and nanoelectronic devices.		

Prerequisites: MME209 & MME302.

References:

[1]. Kasap, S., Principles of Electronic Materials and Devices 4th Edition, McGraw Hill, 2017.

[2]. Waser, R., Nanoelectronics and Information Technology: Advanced Electronic Materials and Novel Devices 3rd Edition, Wiley-VCH, 2012.

MME425	**Fracture of Materials**	**3 (2,0,2)**
Various Types of Damage, Fracture Mechanics Principles, Brittle Fracture, Ductile Fracture, Ductile-Brittle Transition, Fatigue, Creep, Fractography, Environment Assisted Cracking, Damage and Fracture of Non-metallic Materials, Creep-Fatigue-Oxidation Interactions, Contact Mechanics; Friction and Wear, Focal Mechanism, Fracture Toughness, Structural Fracture Mechanics.		

Prerequisites: MME206 & MME208.

References:

[1]. Hertzberg, R.W., Deformation and Fracture Mechanics of Engineering Materials 6th Edition, Wiley, 2020.

[2]. Suresh, S., Fatigue of Materials (Cambridge Solid State Science Series) Second Edition 2nd Edition, Cambridge University Press, 1998.

[3]. Askeland, D., Essentials of Materials Science and Engineering 4th Edition, Cengage Learning, 2018.

[4]. Anderson, T., Fracture Mechanics: Fundamentals and Applications, Third Edition 3rd Edition, CRC Press, 2004.

MME426	Biomaterials	3 (2,0,2)
General overview of components in the human body used to construct tissue. Implantable materials: temporary or permanent implants, biodegradable materials, cell substrates, tailored tissue. Bioactive materials and drug delivery systems. Protein surface interactions. Interactions between human tissue and biomaterials: properties at natural tissue and transplantation techniques. Tissue Engineering and regenerative medicine. Biomimetic systems. Sterilisation. Evaluation procedures for medical devices.		

Prerequisites: MME206 & MME302.

References:

[1]. Chen, O., Biomaterials: A Basic Introduction 1st Edition, CRC Press, 2018.

[2]. Agrawal, C., Introduction to Biomaterials: Basic Theory with Engineering Applications (Cambridge Texts in Biomedical Engineering) 1st Edition, Cambridge University Press, 2013.

MME427	Laser Processing and Nanostructures	3 (2,0,2)
Fundamentals of Laser, Continuous and pulsed Laser concept, Laser safety and best practices, Fundamentals of Laser Material Interactions, Introduction to Nanotechnology, Nanomaterials, Semiconducting and metallic nanoparticles, Synthesis/fabrication techniques of Nanomaterials, Laser induced synthesis of nanoparticles, Laser fabrication of Nanostructures for energy and bio applications.		

Prerequisites: MME403 & MME302.

References:

[1]. Pottathara, Y., Nanomaterials Synthesis: Design, Fabrication and Applications (Micro and Nano Technologies), 1st Edition, Elsevier, 2019.

[2]. Veiko, V., Fundamentals of Laser-Assisted Micro- and Nanotechnologies, 2014th Edition, Springer, 2014.

[3]. Schaaf, P., Laser Processing of Materials: Fundamentals, Applications and Developments,2010th Edition, Springer, 2010.

MME428	Surface Engineering of Nanomaterials	3 (2,0,2)
Tribology & its classification: Friction Tribology, wear & corrosion, lubrication, effect of tribology on surface of nanomaterials, Conventional surface engineering: types of surface modifications, physical modification, chemical modifications, applications of surface engineering towards nanomaterials, Deposition and surface modification methods: Physical Vapour deposition (PVD), chemical vapour deposition (CVD), Synthesis, processing and characterization of nanostructured coatings, functional coatings, characterization of nanocoatings, application of nanocoatings, advanced methods for surface and coating testings, Thin films for surface engineering of nanomaterials.		

Prerequisites: MME403 & MME302.

References:

[1]. Takadoum, J., Nanomaterials and Surface Engineering 1st Edition, Wiley-ISTE, 2013.

[2]. Roy, M., Surface Engineering for Enhanced Performance against Wear 2013th Edition, Springer, 2013.
[3]. Kumar, K., Coatings: Materials, Processes, Characterization and Optimization (Materials Forming, Machining and Tribology) 1st ed, Springer, 2021.

MME429	Construction Materials	3 (2,0,2)
Structure of building materials, from binding types through to macro-structure, for example. porosity and density. Composition and properties of concrete, steel, wood-based materials, plastics, insulation materials, bricks, plaster, masonry and coating materials. Basic mechanics and deformations under load and materials volume resistance with respect to moisture, temperature and aging. Resistance of materials, including chemical, physical and biological as well as radiation exposure. Fabrication and properties of building materials. Sustainability aspects related to building materials. Methodology for life cycle and life cost analysis. Sound and environmentally profiled materials. Blending, manufacturing and strength testing of concrete.		

Prerequisites: MME206 & MME302.

References:

[1]. Allen, E., Fundamentals of Building Construction: Materials and Methods 7th Edition, Wiley, 2019.
[2]. Marotta, T., Basic Construction Materials (Pearson Construction Technology) 8th Edition, Pearson, 2010.

برنامج هندسة الميكاترونكس والاتمتة

MECHATRONICS AND AUTOMATION ENGINEERING PROGRAM

(MAE)

MECHATRONICS AND AUTOMATION ENGINEERING (MAE) PROGRAM

1. FACULTY VISION

The faculty of Engineering at BNU, looking forward to being a leading faculty at the national, regional, and international levels in engineering education fields, scientific research, innovation, and entrepreneurship to achieve the sustainable development of humankind.

2. FACULTY MISSION

The faculty of Engineering at BNU is committed to prepare graduates with the skills and attitudes to attain competence as professional engineers and researchers, and to interact with industry and community within the framework of human values and social responsibility.

3. PROGRAM VISION

The MAE program at BNU, aspires to be a leading program in education and scientific research in the fields of mechatronics and automation engineering at the regional and international levels and to provide an outstanding community service.

4. PROGRAM MISSION

The objective of the MAE program is to prepare an engineer with the ability to handle fully automated industrial systems with high level of efficiency through good knowledge of the principles of mechanical, electrical and computer engineering besides the information science and industrial intelligence through a proactive integrative program. The graduate is expected to be able to install, troubleshoot, maintain and repair, automation lines and Mechatronic systems using industry-standard tools, practices, and procedures. The program also aims to enhance the graduate's capabilities in maximizing energy utilization and industrial sustainability. In addition, design and rebuilding projects and fully automated industrial sectors. Besides the ability to interact and work within a multidisciplinary team.

5. PROGRAM OBJECTIVES

1. Use modern engineering techniques, skills and methods in controlling industrial processes.
2. Install, troubleshoot, maintain and repair mechatronic systems using industry-standard tools, practices, and procedures.
3. Assist in design and rebuilding projects .
4. Follow, develop, and troubleshoot manufacturing processes and procedures .
5. Organize, interpret, and use technical information and documentation.
6. Promote energy efficiency and industrial sustainability.
7. Demonstrate the ability to adhere to personal and industry safety standards.

8. Communicate effectively across a variety of audiences: technicians, engineers, management, and customers.
9. Design and demonstrate experiments with analysis and data interpretation.
10. Interact and work within a multidisciplinary team.

6. GRADUATE ATTRIBUTES

1. Master a wide spectrum of engineering knowledge and specialized skills and can apply acquired knowledge using theories and abstract thinking in real life situations.
2. Apply analytic critical and systemic thinking to identify, diagnose and solve engineering problems with a wide range of complexity and variation.
3. Behave professionally and adhere to engineering ethics and standards.
4. Work in and lead a heterogeneous team of professionals from different engineering specialties and assume responsibility for own and team performance
5. Recognize his/her role in promoting the engineering field and contribute in the development of the profession and the community.
6. Value the importance of the environment, both physical and natural, and work to promote sustainability principles.
7. Use techniques, skills, and modern engineering tools necessary for engineering practice.
8. Assume full responsibility for own learning and self-development, engage in lifelong learning and demonstrate the capacity to engage in post- graduate and research studies.
9. Communicate effectively using different modes, tools, and languages with various audiences; to deal with academic/professional challenges in a critical and creative manner.
10. Demonstrate leadership qualities, business administration and entrepreneurial skills.
11. Use of mathematics, physical science and systems analysis tools in components and system design.
12. Students will learn engineering sciences and demonstrate the application of this knowledge to electro-mechanical systems.
13. Solve problems in the areas of integrated mechanics, electronics, computers, and software systems.
14. Analyze and investigate the inter-disciplinary characteristics of mechanical, electrical, and hydraulic systems.
15. Graduates should have wide choices leading to specialization in mechanics, electronics, design, computer software or other areas

7. PROGRAM COMPETENCIES

According to the National Academic Reference Standard (NARS) 2018, the program in Mechatronics and Automation Engineering must satisfy the following Competencies:

1- General Engineering NARS Competencies in 2018		
Level A (NARS)	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, analyze 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, taking into consideration other trades requirements.
	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.

2- Mechanical Engineering NARS		
Level B (NARS)	B1	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.
	B2	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.
	B3	Select conventional mechanical equipment according to the required performance.
	B4	Adopt suitable national and international standards and codes, integrate legal, economic, and financial aspects to design, build, operate, inspect and maintain mechanical equipment and systems.

3- Mechatronics and Automation Engineering ARS		
Level C	C1	Master the ability to apply technological knowledge, electronic theories and software and connect them to find solutions for mechatronics systems,

(ARS)		especially problems of manufacturing, maintenance and interaction in a creative way, taking into account industrial and commercial restrictions and developing new products.
	C2	Design and computation of mechanical and electronic circuit designs and software development for smart products.
	C3	Use the practical systems approach to design mechatronic systems and evaluate their performance.
	C4	Define and apply principles of sustainable design and development.
	C5	Master the ability to carry out development projects independently and in teams.
	C6	Assess the characteristics and performance of mechatronic components, systems, and fabrication processes for Nano scale systems.

For determination the compatibility of program objectives with its competencies, the following matrix can be used:

Program Competencies	**Program Objectives**																		
	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	B1	B2	B3	B4	C1	C2	C3	C4	C5	C6
Objective #1	√								√		√				√					
Objective #2				√		√						√		√			√			√
Objective #3			√			√					√	√				√			√	
Objective #4	√													√	√					
Objective #5		√						√												
Objective #6			√										√			√		√		
Objective #7				√			√													
Objective #8								√												
Objective #9			√		√					√	√									
Objective #10							√												√	

MATRIX RELATING THE PROGRAM COURSES WITH COMPETENCIES

Course Code	Course Name	Engineering Competencies NARS (2018)										Mechanical Engineering Competencies (NARS)				"Discipline" Mechatronics and Automation Engineering Competencies (ARS)					
		A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	B1	B2	B3	B4	C1	C2	C3	C4	C5	C6
GEN000	English Language (A remedy course)							√	√												
GEN201	Information Technology	√	√								√										
GEN301	Current Social Issues in Egypt			√				√	√												
GEN401	Professional Ethics			√					√	√											
GEN101	English Language							√	√												
GEN102	German Language							√	√												
GEN104	History of Science, Engineering & Technology			√	√																
GEN202	Communication & Presentation Skills					√		√	√												
GEN407	Entrepreneurship									√	√										
BAS101	Differential Calculus and Algebra	√		√																	
BAS103	Physics of Materials	√	√																		
BAS105	Statics & Dynamics (1)	√		√																	
BAS102	Integral Calculus & Analytical Geometry	√		√																	
BAS201	Probability and Statistical Methods	√	√								√										
BAS203	Differential Equations	√						√													

Course Code	Course Name	Engineering Competencies NARS (2018)										Mechanical Engineering Competencies (NARS)				"Discipline" Mechatronics and Automation Engineering Competencies (ARS)					
		A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	B1	B2	B3	B4	C1	C2	C3	C4	C5	C6
BAS301	Partial Differential Equations & Numerical Analysis	√	√			√															
BAS106	Physics of Electricity & Magnetism	√	√			√															
BAS107	Statics & Dynamics (2)	√		√		√															
BAS104	General Chemistry	√	√																		
MAE230	Field Training (I)								√					√	√						
MAE340	Field Training (II)								√			√	√			√					
MAE430	Graduation Project (1)							√				√	√			√	√				
MAE440	Graduation Project (2)								√					√	√			√		√	
ENG102	Engineering Graphics	√	√		√		√		√												
ENG101	Production Engineering				√								√	√							
ENG104	Computer Programming with MATLAB				√								√		√						
MAE201	Computer Aided Mechanical Drafting						√		√												
MAE203	Electric Circuits	√					√		√												
MAE205	Kinematics of Mechanisms	√						√				√									
MAE207	Fluid Mechanics	√							√			√									
MAE202	Mechanics of Materials	√		√	√								√								

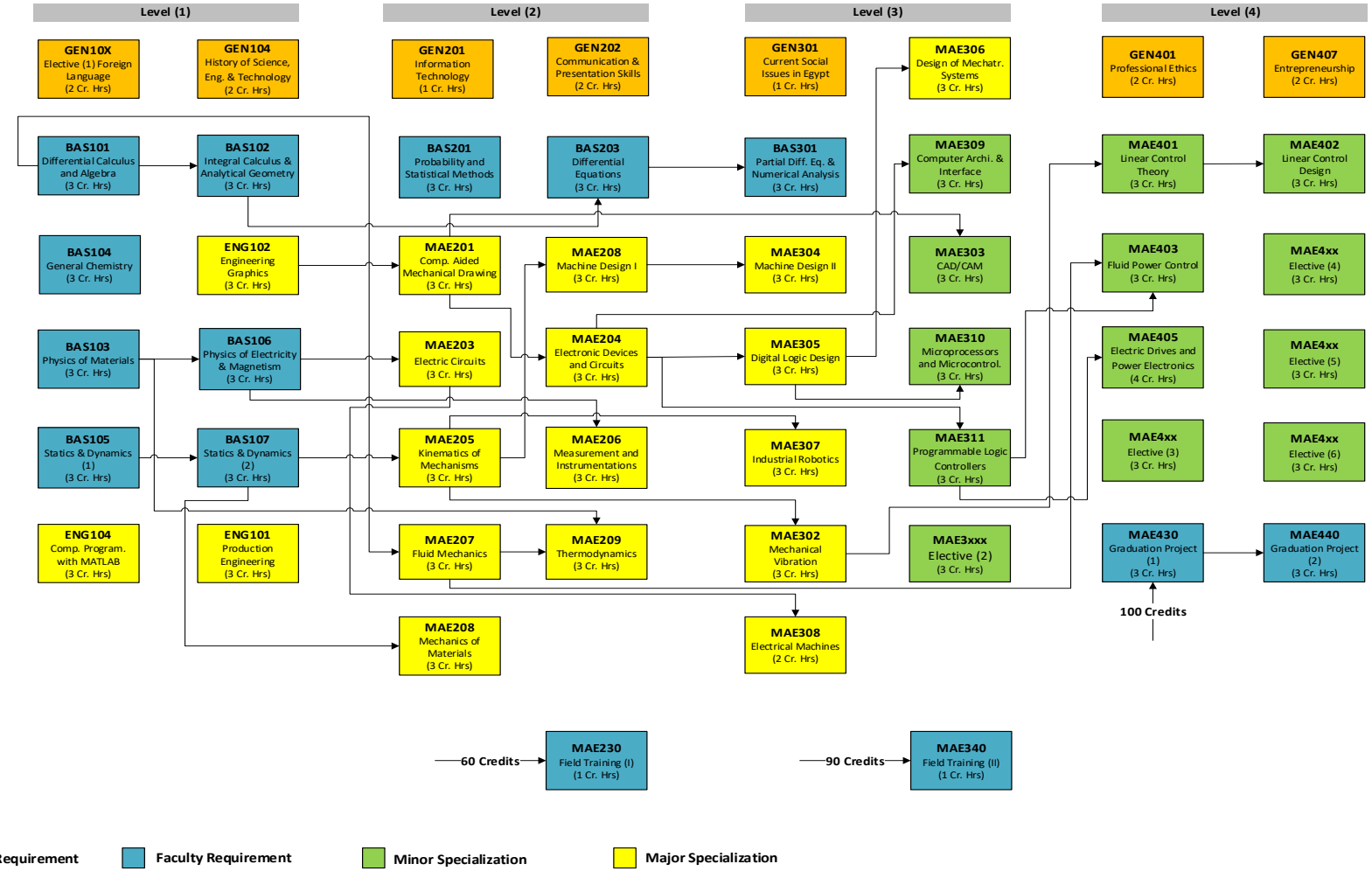
Course Code	Course Name	Engineering Competencies NARS (2018)										Mechanical Engineering Competencies (NARS)				"Discipline" Mechatronics and Automation Engineering Competencies (ARS)					
		A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	B1	B2	B3	B4	C1	C2	C3	C4	C5	C6
MAE208	Machine Design I			√								√	√								
MAE204	Electronic Devices and Circuits				√						√	√									
MAE206	Measurement and Instrumentations	√	√			√						√									
MAE208	Thermodynamics	√							√			√									
MAE304	Machine Design II			√								√	√								
MAE305	Digital Logic Design													√		√	√				
MAE307	Industrial Robotics													√		√	√				
MAE302	Mechanical Vibration	√		√								√		√							
MAE308	Electrical Machines												√		√		√	√			
MAE306	Design of Mechatronic Systems														√		√	√			√
MAE309	Computer Architecture/Interface															√			√		
MAE303	CAD/CAM										√	√	√								
MAE310	Microprocessors and Microcontrollers													√		√				√	√
MAE311	Programmable Logic Controllers (PLC)												√			√	√	√			
MAE401	Linear Control Theory										√	√	√				√				
MAE402	Linear Control Design										√	√	√				√				

Course Code	Course Name	Engineering Competencies NARS (2018)										Mechanical Engineering Competencies (NARS)				"Discipline" Mechatronics and Automation Engineering Competencies (ARS)					
		A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	B1	B2	B3	B4	C1	C2	C3	C4	C5	C6
MAE403	Fluid Power Control											√			√	√		√			
MAE405	Electric Drives and Power Electronics													√		√	√	√			
MAE311	Mobile Robots															√	√			√	
MAE411	Playware Technology															√		√			√
MAE412	Embedded System Design															√	√	√			√
MAE413	Machine Vision Systems													√		√			√		√
MAE414	Intelligent Control										√	√	√				√				
MAE415	Robust and Fault-Tolerant Control										√	√	√				√				
MAE416	Bio-mechatronics										√	√	√				√				
MAE417	Machine Learning										√	√	√				√				
MAE418	Robot Operating Systems												√			√	√	√			
MAE419	Computer Numerical Controllers												√			√	√	√			
MAE418	Autonomous Robotic Systems												√			√	√	√			
MAE321	Industrial Automation												√			√	√	√			
MAE421	Sensors and Actuators											√			√			√			√
MAE422	Industrial Material Flow Management												√			√			√	√	

Course Code	Course Name	Engineering Competencies NARS (2018)										Mechanical Engineering Competencies (NARS)				"Discipline" Mechatronics and Automation Engineering Competencies (ARS)					
		A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	B1	B2	B3	B4	C1	C2	C3	C4	C5	C6
MAE423	Advanced Autonomous Robots																√	√		√	√
MAE424	Advanced Topics in Robotics																√	√		√	√
MAE425	Theory of Automata											√				√		√	√		
MAE426	Internet of things												√			√		√			√
MAE428	Computer Numerical Controllers (CNC)												√			√	√	√			
MAE429	Advanced Programmable Logic Controllers (PLC)												√			√	√	√			
MAE430	Autotronics												√			√	√		√		

جامعة بنها الأهلية
Benha National University
BNU

FLOWHART FOR MECATRONICS & AUTOMATION ENGINEERING (MAE) PROGRAM COURSES



MECATRONICS & AUTOMATION ENGINEERING (MAE) PROGRAM
COURSES CLASSIFICATION AND PERCENTAGES

#	Subject Area	CR	%	Min. Percentage according to reference framework (%)
1	University Requirements	12	8.33	8
2	Faculty Requirements	39	27.08	20
3	Major Specialization Subjects	53	36.81	35
4	Minor Specialization Subjects	40	27.78	Maximum 30
		144	**100**	**100**

MECATRONICS & AUTOMATION ENGINEERING PROGRAM
LIST OF COURSES

Code	Course	CR	Lec	Tut	Lab	Pre Req.
(A) University Requirements (12 Credits)						
GEN000	English Language (A remedy course)	0	0	0	0	---
GEN201	Information Technology	1	1	0	0	---
GEN301	Current Social Issues in Egypt	1	1	0	0	---
GEN401	Professional Ethics	2	2	0	0	---
GEN10X	Elective (1) From Language Courses List	2	1	2	0	---
GEN104	History of Science, Engineering & Technology	2	2	0	0	---
GEN202	Communication & Presentation Skills	2	1	2	0	---
GEN407	Entrepreneurship	2	1	2	0	---
(B) Faculty Requirements (39 Credits)						
BAS101	Differential Calculus and Algebra	3	2	2	0	-
BAS102	Integral Calculus & Analytical Geometry	3	2	2	0	BAS101
BAS103	Physics of Materials	3	2	0	3	-
BAS104	General Chemistry	3	2	0	2	-
BAS105	Statics & Dynamics (1)	3	2	2	0	-
BAS106	Physics of Electricity & Magnetism	3	2	0	3	BAS103
BAS107	Statics & Dynamics (2)	3	2	2	0	BAS105
ENG101	Production Engineering	3	2	0	3	-
ENG102	Engineering Graphics	3	1	0	4	-
ENG104	Computer Programming with MATLAB	3	2	0	3	---
MAE230	Field Training (I)	1	0	0	3	60 Credits
MAE340	Field Training (II)	1	0	0	3	90 Credits
MAE430	Graduation Project (1)	3	1	2	2	100 Credits
MAE440	Graduation Project (2)	4	2	2	2	MAE430
(C) Major Specialization Subjects (53 Credits)						
BAS201	Probability and Statistical Methods	3	2	2	0	---
BAS203	Differential Equations	3	2	2	0	BAS102
BAS301	Partial Differential Equations & Numerical Analysis	3	2	2	0	BAS203
MAE201	Computer Aided Mechanical Drafting	3	2	0	2	ENG102
MAE203	Electric Circuits	3	2	0	2	BAS106
MAE205	Kinematics of Mechanisms	3	2	2	0	BAS107
MAE207	Fluid Mechanics	3	2	1	2	BAS101
MAE202	Mechanics of Materials	3	2	0	2	BAS107
MAE208	Machine Design I	3	2	0	2	MAE205
MAE204	Electronic Devices and Circuits	3	2	0	2	MAE203
MAE206	Measurement and Instrumentations	3	2	0	2	BAS106
MAE209	Thermodynamics	3	2	1	2	BAS103& MAE207
MAE304	Machine Design II	3	2	2	0	MAE208
MAE305	Digital Logic Design	3	2	0	2	MAE204

Code	Course	CR	Lec	Tut	Lab	Pre Req.
MAE307	Industrial Robotics	3	2	1	2	MAE205
MAE302	Mechanical Vibration	3	2	0	2	MAE205
MAE308	Electrical Machines	2	2	1	0	MAE203
MAE306	Design of Mechatronic Systems	3	2	0	2	MAE305
(D) Minor Specialization Subjects (40 Credits)						
MAE309	Computer Architecture/Interface	3	1	2	2	MAE204
MAE303	CAD/CAM	3	2	0	2	MAE201
MAE310	Microprocessors and Microcontrollers	3	2	0	2	MAE305
MAE311	Programmable Logic Controllers (PLC)	3	2	0	2	MAE204
MAE3xx	Elective (2) (Mech. or Auto. Courses List)	3	2	0	2	---
MAE401	Linear Control Theory	3	2	0	2	MAE302
MAE403	Fluid Power Control	3	2	0	2	MAE207&MAE311
MAE405	Electric Drives and Power Electronics	4	2	2	2	MAE311
MAE4xx	Elective (3) (Mech. or Auto. Courses List)	3	2	0	2	xxxx
MAE4xx	Elective (4) (Mech. or Auto. Courses List)	3	2	0	2	xxxx
MAE402	Linear Control Design	3	2	0	2	MAE401
MAE4xx	Elective (5) (Mech. or Auto. Courses List)	3	2	0	2	xxxx
MAE4xx	Elective (6) (Mech. or Auto. Courses List)	3	2	0	2	xxxx
Elective Courses for Mechatronics Engineering Concentration						
MAE311	Mobile robots	3	2	0	2	MAE306
MAE411	Playware Technology	3	2	0	2	MAE306
MAE412	Embedded System Design	3	2	0	2	MAE310
MAE413	Machine Vision Systems	3	2	0	2	BAS102&BAS108
MAE414	Intelligent Control	3	2	0	2	MAE401
MAE415	Robust and Fault-Tolerant Control	3	2	2	0	MAE401
MAE416	Bio-mechatronics	3	2	2	0	MAE306
MAE417	Machine Learning	3	2	2	0	MAE414
MAE418	Robot Operating Systems	3	2	0	2	MAE310
MAE419	Computer Numerical Controllers	3	2	0	2	MAE303
MAE420	Autonomous Robotic Systems	3	2	0	2	MAE310
Elective Courses for Automation Engineering Concentration						
MAE321	Industrial Automation	3	2	0	2	MAE307
MAE421	Sensors and Actuators	3	2	0	2	MAE306
MAE422	Industrial Material Flow Management	3	2	2	0	MAE321
MAE423	Advanced Autonomous Robots	3	2	0	2	MAE307
MAE424	Advanced Topics in Robotics	3	2	2	0	MAE307
MAE425	Theory of Automata	3	2	2	0	MAE309
MAE426	Internet of things	3	2	2	0	MAE310&MAE311
MAE428	Computer Numerical Controllers (CNC)	3	2	0	2	MAE303
MAE429	Advanced Programmable Logic Controllers (PLC)	3	2	0	2	MAE311
MAE430	Autotronics	3	2	0	2	MAE421
Basic Science & Mathematics Courses						
BAS101	Differential Calculus and Algebra	3	2	2	0	-

Code	Course	CR	Lec	Tut	Lab	Pre Req.
BAS103	Physics of Materials	3	2	0	3	-
ENG102	Engineering Graphics	3	1	0	4	-
BAS105	Statics & Dynamics (1)	3	2	2	0	-
MAE207	Fluid Mechanics	3	2	1	2	BAS101
BAS102	Integral Calculus & Analytical Geometry	3	2	2	0	BAS101
BAS106	Physics of Electricity & Magnetism	3	2	0	3	BAS103
BAS107	Statics & Dynamics (2)	3	2	2	0	BAS105
BAS104	General Chemistry	3	2	0	2	-
MAE204	Electronic Devices and Circuits	3	2	0	2	MAE203
BAS201	Probability and Statistical Methods	3	2	2	0	---
BAS203	Differential Equations	3	2	2	0	BAS102
BAS301	Partial Differential Equations & Numerical Analysis	3	2	2	0	BAS203

MECATRONICS & AUTOMATION ENGINEERING (MAE) PROGRAM
STUDY PLAN

STUDY PLAN FOR MECATRONICS & AUTOMATION ENGINEERING PROGRAM

1st Level

FIRST SEMESTER

Code	Subject	Credits	Contact Hours			Prerequisites
			Lec.	Tut.	Lab.	
GEN10X	Elective (1) From Language Courses List	2	1	2	0	---
BAS101	Differential Calculus and Algebra	3	2	2	0	---
BAS103	Physics of Materials	3	2	0	3	---
BAS104	General Chemistry	3	2	0	2	---
BAS105	Statics & Dynamics (1)	3	2	2	0	---
ENG101	Production Engineering	3	2	0	3	-
		17	**11**	**6**	**8**	

SECOND SEMESTER

Code	Subject	Credits	Contact Hours			Prerequisites
			Lec.	Tut.	Lab.	
GEN104	History of Science, Eng. & Technology	2	2	0	0	---
BAS102	Integral Calculus & Analytical Geometry	3	2	2	0	BAS101
BAS106	Physics of Electricity & Magnetism	3	2	0	3	BAS103
BAS107	Statics & Dynamics (2)	3	2	2	0	BAS105
ENG102	Engineering Graphics	3	1	0	4	---
ENG104	Computer Programming with MATLAB	3	2	0	3	---
		17	**11**	**4**	**10**	

STUDY PLAN FOR MECATRONICS & AUTOMATION ENGINEERING PROGRAM

2nd Level

FIRST SEMESTER

Code	Subject	Credits	Contact Hours			Prerequisites
			Lec.	Tut.	Lab.	
BAS201	Probability and Statistical Methods	3	2	2	0	---
MAE201	Computer Aided Mechanical Drafting	3	2	0	2	ENG 104
MAE203	Electric Circuits	3	2	0	2	BAS106
MAE205	Kinematics of Mechanisms	3	2	2	0	BAS107
MAE207	Fluid Mechanics	3	2	1	2	BAS101
MAE202	Mechanics of Materials	3	2	0	2	BAS107
		18	**12**	**5**	**8**	

SECOND SEMESTER

Code	Subject	Credits	Contact Hours			Prerequisites
			Lec.	Tut.	Lab.	
BAS203	Differential Equations	3	2	2	0	BAS102
GEN201	Information Technology	1	1	0	0	---
MAE208	Machine Design I	3	2	0	2	MAE205
MAE204	Electronic Devices and Circuits	3	2	0	2	MAE203
MAE206	Measurement and Instrumentations	3	2	0	2	BAS106
MAE209	Thermodynamics	3	2	1	2	BAS103& MAE207
GEN202	Communication & Presentation Skills	2	1	2	0	---
		18	**12**	**5**	**8**	

SUMMER SEMESTER

Code	Subject	Credits	Contact Hours			Prerequisites
			Lec.	Tut.	Lab.	
MAE230	Field Training (I)	1	0	0	3	60 Credits

STUDY PLAN FOR MECATRONICS & AUTOMATION ENGINEERING PROGRAM

3rd Level

FIRST SEMESTER

Code	Subject	Credits	Contact Hours			Prerequisites
			Lec.	Tut.	Lab.	
BAS301	Partial Diff. Eq. & Numerical Analysis	3	2	2	0	BAS203
MAE304	Machine Design II	3	2	2	0	MAE208
MAE305	Digital Logic Design	3	2	0	2	MAE204
MAE307	Industrial Robotics	3	2	1	2	MAE205
MAE302	Mechanical Vibration	3	2	0	2	MAE205
MAE308	Electrical Machines	2	2	1	0	MAE203
GEN301	Current Social Issues in Egypt	1	1	0	0	---
		18	**13**	**6**	**6**	

SECOND SEMESTER

Code	Subject	Credits	Contact Hours			Prerequisites
			Lec.	Tut.	Lab.	
MAE306	Design of Mechatronic Systems	3	2	0	2	MAE305
MAE309	Computer Architecture/Interface	3	1	2	2	MAE204
MAE303	CAD/CAM	3	2	0	2	MAE201
MAE310	Microprocessors and Microcontrollers	3	2	0	2	MAE305
MAE311	Programmable Logic Controllers (PLC)	3	2	0	2	MAE204
MAE3xx	Elective (2) (Mech. or Auto. Courses List)	3	2	0	2	---
		18	**11**	**2**	**12**	

SUMMER SEMESTER

Code	Subject	Credits	Contact Hours			Prerequisites
			Lec.	Tut.	Lab.	
MAE340	Field Training (II)	1	0	0	3	90 Credits

STUDY PLAN FOR MECATRONICS & AUTOMATION ENGINEERING PROGRAM

4th Level

FIRST SEMESTER

Code	Subject	Credits	Contact Hours			Prerequisites
			Lec.	Tut.	Lab.	
MAE401	Linear Control Theory	3	2	0	2	MAE302
MAE403	Fluid Power Control	3	2	0	2	MAE207&MAE311
MAE405	Electric Drives and Power Electronics	4	2	2	2	MAE311
MAE4xx	Elective (3) (Mech. or Auto. Courses List)	3	2	0	2	xxxx
GEN401	Professional Ethics	2	2	0	0	---
MAE430	Graduation Project (1)	3	1	2	2	100 Credits
		18	**11**	**4**	**10**	

SECOND SEMESTER

Code	Subject	Credits	Contact Hours			Prerequisites
			Lec.	Tut.	Lab.	
MAE402	Linear Control Design	3	2	0	2	MAE401
GEN407	Entrepreneurship	2	1	2	0	---
MAE4xx	Elective (4) (Mech. or Auto. Courses List)	3	2	0	2	xxxx
MAE4xx	Elective (5) (Mech. or Auto. Courses List)	3	2	0	2	xxxx
MAE4xx	Elective (6) (Mech. or Auto. Courses List)	3	2	0	2	xxxx
MAE440	Graduation Project (2)	4	2	2	2	MAE430
		18	**11**	**4**	**10**	

MECATRONICS & AUTOMATION ENGINEERING (MAE) PROGRAM
COURSE DESCRIPTIONS

MECATRONICS & AUTOMATION ENGINEERING (MAE) PROGRAM
COURSES DESCRIPTION

MAE201	Computer Aided Mechanical Drafting	3 (2,0,2)
The course provides the students with basic knowledge on production and assembly drawings and representation of mechanical components. The topics include: Sections in machine members, Assembly and detailed drawings, Fits and tolerances, Geometrical tolerances, Surface texture and roughness symbols. The students can Identify the different types of machine elements like gears, shafts and keys, journal bearings, anti-friction bearings, springs ...etc. Applications on assembly drawings of robots, geartrains …etc are provided. Applications using of 3D modeling software (like SolidWorks or Autodesk Inventor) to draw and assemble machine components to construct a complete complex machine in addition to make detailed drawings..		

Prerequisites: ENG 102.

References

1. A Textbook of Engineering Drawing: Along with an Introduction to AutoCAD 2015 by Roop Lal, I K International Publishing House, 2015.
2. Machine Drawing – K.L, Narayana, P. Kannaiah, and K. Venkata Redd, New age Int. Publisher, 3rd Edition.
3. Geometric and Engineering Drawing, Ken Morling, 3rdEdition, 2012.

MAE203	Electric Circuits	3 (2,0,2)
DC circuit analysis: Circuit Variables, Kirchhoff's Laws, Simple Resistive Circuits, The Wheatstone Bridge, Δ to-Y (or π -to-T) Equivalent Circuits, The Node-Voltage Method and Dependent Sources, The Mesh-Current Method and Dependent Sources, The Venin and Norton Equivalents, Maximum Power Transfer, Superposition, Topology in Circuit Analysis, The Operational Amplifier circuits, Inductance and Capacitance, The Natural Response of RL and RC Circuits, Step Response of First-Order RL and RC Circuits.		

Prerequisites: BAS106.

References

1. James, W. Nilsson, "Electric Circuits" 7th Edition, 2009.
2- Joseph, A. "Electric Circuits" McGraw-Hill International Book Company, New York, 1972.

MAE205	Kinematics of Mechanisms	3 (2,2,0)
Kinematic analysis of mechanisms and linkage synthesis, motion analysis of linkage mechanisms, open and closed-chain planar robots, and geared transmission. Direct and inverse kinematics, velocity and acceleration analysis, kinematic path generation for robots, singularities in kinematic chains, principle of virtual work and force analysis, and kinematic analysis of gear transmission.		

Prerequisites: BAS107.

References

1. R.C. Hibbeler, "Engineering Mechanics: Dynamics," 9th edition, Prentice Hall, 2001.
2. Bedford and W. Fowler, "Engineering Mechanics: Statics & Dynamics Principles," Prentice Hall, 2003.
3. Thomson, William T., Theory of Vibration with Applications, Prentice Hall, Inc., 1981.

MAE207	Fluid Mechanics	3 (2,1,2)
Fundamental notions, Physical properties of Fluids, Fluid viscosity and its importance's, viscous and non-viscous flow, compressibility and surface tensions and their applications on practical problems, fluid statics, buoyancy and stability of floating and immersed bodies, fluid in rigid body motion, fluid kinematics and Foundations of flow analysis; basic laws for finite systems and finite control volumes, differential forms of the basic laws, dimensional analysis and similitude analysis; Types of Flow (steady, uniform, incompressible viscous flow, General viscous flows , Potential flow).		

Prerequisites: BAS101.

References

1. Fundamentals of Fluid Mechanics By B.R. Munson, D.F. Young, T.H. Okiishi, W.W. Huebsch 6th Editon, Wiley, NY (2010).
2. Roberson Crowe, Engineering Fluid Mechanics, Houghton Mifflin Co., 1975.
3. John, James E. A., Introduction to Fluid Mechanics, Prentice Hall, 1983.
4. Munson, Yound and Okiishi, Fundamental of Fluid Mechanics, John Wiley and Sons, 1990.

MAE202	Mechanics of Materials	3 (2,0,2)
Concepts of stress and strain, normal stress and strain, shear stress and strain, general state of stress, and design of simple connections. Stress analysis, materials' behavior, constitutive relationship, Hooks law, stress concentration, St-Venant principle, transformation equations, and Mohr's circle. Axially loaded members, torsion, power transmission, and statically indeterminate structures. Bending, shear and moment diagrams, shear force, transverse loading relationship, and flexure formulas. The concepts of deflection of beams, differential equation of deflection curve, method of super-position, and Castiglianos theorem. Design of engineering structures from a materials point of view.		

Prerequisites: BAS107.

References

1. Testing of Engineering Materials by: Carl William Muhlenbruch.
2. Hibbeler, R. C. Mechanics of Materials. 6thed. East Rutherford, NJ: Pearson Prentice Hall, 2004. ISBN: 9780131913455.
3. Crandall, S. H., N. C. Dahl, and T. J. Lardner. An Introduction to the Mechanics of Solids. 2nd ed. New York, NY: McGraw Hill, 1979. ISBN: 9780070662308

MAE204	Electronic Devices and Circuits	2 (2,0,2)
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 configurations in electronic circuits, Oscillators circuits.		

Prerequisites: MAE203.

References

1. Grob's Basic Electronics, tenth edition, Schultz, May 3, 2006.

2. Electronic devices and circuit theory, tenth edition, Robert Boylestad, 2005.

MAE206	Measurement and Instrumentations	3 (2,0,2)
Introduction, Error analysis and accuracy, Operating principles of sensors and transducers. Analog measuring instruments. General consideration for selection and evaluation of measurement equipment. Measuring of mechanical quantities (Temperatures, Pressures static and dynamic, Flow, and velocity, stress and strain,) Measurement of Electric quantities (currents, voltage, resistance, power). Comparisons methods for measurements. Active and reactive power measurements. Oscilloscopes. Digital millimeters- Uncertainty analysis.		

Prerequisites: BAS106.

References

1. Sawhney, A. K., A Course in Mechanical Measurements and Instrumentation, Dhanpat and Sons, Delhi, 1989.
2. Doebelin, Erest O., Measurement Systems Applications and Design, McGraw Hill, 1990.

MAE209	Thermodynamics	3 (2,1,2)
Definitions and basic concepts, Properties of pure substances and steam tables, Ideal gases properties, Heat and work, First Law of Thermodynamics (closed system, open system, steady flow), Applications of first law of thermodynamics. Second Law of thermodynamics (heat engines, refrigerators, heat pumps), reversible and irreversible process, irreversibility, Carnot cycles, Entropy and entropy increase principles, Entropy change for pre substances, solids and liquids, ideal gases, isentropic process relations of ideal gases, adiabatic and isentropic efficiency.		

Prerequisites: BAS103& MAE207.

References

1. Sonntag, R. E.; Borgnakke, C. and Van Wylen, G. J., Fundamentals of Thermodynamics, John Wiley and Sons Inc., 1998.
2. Cengel, Y. A. and M. A., Thermodynamics: An Engineering Approach, WCB/McGraw Hill, 1998.

MAE208	Machine Design I	3 (2,0,2)
Materials for shafts; strength of shafts under torsion and bending; factor of safety in shafts: fatigue strength reduction factors, modified moments of inertia of shaft section; stiffness of shafts, factors affecting shaft deflection. Design of keys, couplings, fasteners, power screws. Design of bolted, riveted and welded joints. Static and fatigue failure theories. Study of stimulus to failure (force, stress, geometry) versus the resistance to failure (material selection, material thermal & deformation history). Drafting with the help of standard CAD software.		

Prerequisites: MAE205.

References

1. Richard G. Budynas, and J. Keith Nisbett, Shigley's Mechanical Engineering Design 9th Edition, McGraw Hill, ISBN 978-0-07-352928-8 (alk. paper) .
2. R.S. Khurmi, J.K. Gupta, A Textbook of Machine Design, Eurasia Publishing House (PVT.) LTD., 2005.

MAE305	Digital Logic Design	3 (2,0,2)
Hardware Description Language (HDL), Digital logic gates, Analysis and Design of logic circuits, Synchronous sequential circuits, flip-flops, Analysis and design of clocked sequential circuits, synchronous counters, ripple counters. Memory and Programmable Logic and sequential programmable devices. Basic logic gates and design of combinational logic circuits, Design and analysis.		

Prerequisites: MME204.

References

1. Digital Electronics, A. D. Godse, D. A. Godse, Technical Publication Pune, 2nd. Ed., 2008.
2. Digital logic design, Brian Holdsworth, Clive Woods. British Library Cataloguing, 4th. Ed., 2002.
3. Farhat, H.A., Digital Design and Computer Organization, CRC Press, 2003.

MAE307	Industrial Robotics	3 (2,1,2)
Historical development, definitions, Basic structure of robots, robot anatomy, Complete classification of robots, Fundamentals of robot technology. Types of drive systems. Kinematics of robot manipulator, differential kinematics, Homogenous representation, Robotic manipulator joint coordinate system, Euler transformations, Roll-Pitch-Yaw Transformation, Direct and Inverse Kinematics Solution, DH Representation. Geometrical Approach to Inverse Kinematics. Jacobian Transformation in Robotic Manipulation. Robotic workspace and motion trajectory, Trajectory Interpolators. General design consideration on trajectories- 4-3-4 and 3-5-3 trajectories, Admissible motion trajectories. PTP and CP trajectory planning. Dynamics of robotic manipulators, Robotic mass distribution and Inertia tensors, Application of Lagrange-Euler dynamic modeling of robotic manipulators.		

Prerequisites: MAE205.

References

1. Murphy, Robin R., Introduction to Al Robotics, MIT Press, 2000.
2. Jadran Lenarcic and Federico Thomas, Advances in Robot Kinematics: Theory and Applications, Kluwer Academic Publishers, 2002.

MAE309	Computer Architecture/ Interface	3 (1,2,2)
Basics of Computer architecture – Computer Arithmetic: fixed- and floating-point arithmetic operations – multiplication techniques–Instruction set Architecture (ISA) – Instruction formats – Instruction types and Addressing modes – Memory Hierarchy Design – Memory Types (Cache memory, main memory, virtual memory) - Computer Interface types - Serial Communication – Parallel communication – Interfacing cards.		

Prerequisites: MAE204.

References

1.IEEE MICRO, Selected Papers, , 1990-Now.
2.Hintz, K. and Tabak, D., Microcontrollers: Architecture, Implementation and Programming, McGraw Hill, 1992.

MAE302	Mechanical Vibration	3 (2,0,2)
Foundation of mechanical systems, mathematical models of mechanical systems, systems modeling, electromechanical systems, algorithms to solve equations of motion, Laplace transform, matrix method, computer generated solutions, dynamic response and evaluation of first and second order response, 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.		

Prerequisites: MAE205.

References

1. Rao, Singiresu S.S., Mechanical Vibrations with Disk, Addison Wesley, 1995.
2. Thomson, William T. and Marie Dillon Dahleh, Theory of Vibration with Applications, Simon and Schuster, 1997.

MAE304	Machine Design II	3 (2,2,0)
Design of rolling and sliding bearings. Design of springs. Design of spur, helical, bevel and worm gears. Design of flexible drives (belts and chains); clutches and brakes. Design for quality and cost. Optimization, optimum vs. optimal, optimum and robust design. Complete design calculation and checking of stress concentration, shafts for power transmission through belts and gears, Manufacturing aspects and mechanical assembly (limits and fits).		

Prerequisites: MAE208.

References

1. Shigley, M., Mechanical Engineering Design, McGraw Hill, 1997.
2. Orlov, P., Fundamentals of Machine Design, MIR Publisher, 1998.

MAE306	Design of Mechatronic Systems	3 (2,0,2)
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. Micro-controllers and electrical components, Electromechanical actuators and control, Mechanical components and mechanisms, Programmable motion control and algorithm development, Closed loop control, Case studies of various mechatronics systems.		

Prerequisites: MAE305.

References

1. Mechatronic Systems: Analysis, Design, and Implementation, Boukas, El-Kébir, Al-Sunni, Fouad M., 2012.
2. Mechatronic Systems Design: Methods, Models, Concepts, Authors: Janschek, and Klaus, 2012.
3. Alciatore, D. G. and Histand, M.B., Introduction to Mechatronics and Measurement Systems, McGraw Hill, 2003.

MAE308	Electrical Machines	3 (2,1,0)
Rotating electrical machines, operating principles, main terminology and industrial standards. Static conversion of electrical energy: three-phase inverter and current control. DC motor: principle of operation, main characteristics and construction, electrical drives with DC motor,		

sizing of real application examples. Synchronous motor ("brushless"): principle of operation, main characteristics and construction, electrical drives with synchronous motor. Asynchronous motor: principle of operation, main characteristics and construction, electrical drives with asynchronous motor. Stepper motors.

Prerequisites: MAE203.

References

1. Fundamentals of Electrical Drives: Edition 2, Andre VeltmanDuco W.J. PulleR.W. de Doncker 2016.
2. E. Fitzgerald, C. Kingsley and S. Umans, Electric Machinery, McGraw - Hill, 6th. Ed., 2003.
3. Chapman, S. J., Electric Machinery fundamentals, McGraw Hill Co., 1991.

MAE311	Programmable Logic Controllers (PLC)	3 (2,0,2)

This course covers basic to intermediate theory & applications of programmable logic controllers. PLCs are used in many industrial and commercial processes. The intent of this course is to make students able to develop the basic technician level skills required by industry. Topics include processor units, numbering systems, memory organization, relay type devices, timers, counters, data manipulators, and programming. By the end of this course student will be able to write a working PLC program using ladder logic; install and troubleshoot the program; and integrate PLCs into electro-mechanical systems. Students will apply concepts and techniques learned to complete a team based case study project to solve problems encountered in industry.

Prerequisites: MAE204.

References

1. Programmable Logic Controllers: Edition 5, William Bolton, Sep 2009.
2. Programmable Logic Controllers: Industrial Control, Khaled KamelEman Kamel, Jul 2013.

MAE401	Linear Control Theory	3 (2,0,2)

Introduction to mathematical modeling and analysis of physical system, Feedback control theory, Laplace transforms, Block diagrams, System stability, Analysis of static and dynamic response, concepts of stability and stability margin from open loop design, error analysis. Root locus, Lead-Lag compensation. Frequency analysis Bode plots and stability criteria. Basic design methods. Application of standard controllers and compensators. State variable system models, Controllability and Observability, Pole placement. Apply analysis, design and simulation of control systems using MATLAB/LabVIEW software.

Prerequisites: MAE302.

1. References
   Ching Fang Lin, Advanced Control Systems Design, Prentice Hall Inc., 1994.
2. Astrom, K.J. and Wittenmark, B., Adaptive Control, 2nd Ed., Addison Wesley, 1995.
3. Nonlinear Control Systems: An Introduction, Edition 2, Alberto Isidori, Apr 2013.

MAE403	Fluid Power Control	3 (2,0,2)

Introduction to oil hydraulics and pneumatics, their structure, advantages and limitations. Properties of fluids, Fluids for hydraulic systems, governing laws. Distribution of fluid power, ISO symbols, energy losses in hydraulic systems. Applications, Basic types and constructions of Hydraulic pumps and motors. Pump and motor analysis. Performance curves and parameters.

Hydraulic actuators, types and constructional details, lever systems, control elements. Proportional control valves and servo valves. Components of pneumatic systems; Direction, flow and pressure control valves in pneumatic systems.

Prerequisites: MAE207&MAE311.

References

1- Introduction To Hydraulics and Pneumatics, 3rd Ed, Ilango Sivaraman, PHI Learning Pvt. Ltd., 2017.

2- Fluid Power Dynamics, By R. Keith Mobley, Newnes Publisher, 2000.

3- Hydraulics and Pneumatics: A Technician's and Engineer's Guide, Andrew Parr, Elsevier, 2011

MAE405	Electric Drives and Power Electronics	4 (2,2,2)
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.		

Prerequisites: MAE311.

References

1. Advanced Electrical Drives: Analysis, Modeling, Control, Rik De DonckerDuco W.J.Pulle André Veltman 2010.

2. Advanced Electric Drive Vehicles, Ali Emadi 2014.

3.Bose, B.K., Power Electronics and AC Drives, Prentice Hall, 1986.

4.Mohan, N., Undeland, T.M. and Robbines, W.P., Power Electronics: Converters, Applications and Design, John Wiley and Sons Inc., 1990.

MAE310	Microprocessors and Microcontrollers	3 (2,0,2)
Historical background - Organization & Architectural Features of Microprocessor & Micro Controllers - Instructions Set - Instruction format, addressing modes - Assembly language programming of 8085 and 8051 - Interfacing of memory devices - Data transfer techniques and I/O ports - Interfacing of keyboard and display devices; Programmable Interrupt - Interfacing of sensors, actuators, A/D & D/A Converters - Analog Signal Conditioning Circuits, Standard Interfaces – RS232, USB - Application examples.		

Prerequisites: MAE305.

References:

1. Digital Design, Fifth Edition, M. Morris Mano and Michael D. Cilettii, 2016.

2. Tokheim, R., Microprocessor Fundamentals, Schaum's Series McGraw Hill, N.Y., 1986.

3-. Barry Brey, The Intel Microprocessors, Prentice Hall, 2000.

MAE402	Linear Control Design	3 (2,0,2)
State-space formulation. Linearization and design of linear control systems for SISO/MIMO physical systems. Full state feedback controllers, Design full/reduced order state estimators, Synthesize output feedback controllers. Design linear quadratic optimal feedback controllers and		

state estimators. Introduction to stochastic processes and Kalman filters, LQG design. Development of computer aided techniques, Practical design and implementation of the control systems using MATLAB/LabVIEW software.

Prerequisites: MAE401.

References

1. John R. Buck, Computer Explorations in Signals and Systems Using MATLAB, Prentice Hall, 2nd. Ed., 2002. 2. Automatic Control Systems 7th Edition, Kuo, Benjamin C., JhonWiely& Sons, 2003.
3. Modern Control Engineering, K. Ogata, Printice Hill, 2010.

MAE303	**CAD-CAM**	**3 (2,0,2)**
Introduction to CAD/CAM, Principles of NC and CNC machines (types and operations), CNC programming, industrial robots, components of CAD systems, computer graphics, modeling techniques, introduction of finite element analysis. Design projects using computer software e.g. SolidWorks, Simulation Xpress and Ansys ..etc. Laboratory exercises in CNC Lab.		

Prerequisites: MAE201.

References

1. Computer-Aided Design, Engineering, and Manufacturing: Systems Techniques and Applications, Volume III, Operational Methods in Computer-Aided Design Cornelius T. Leondes, 2000.
2. Advanced Computer-Aided Fixture Design Yiming (Kevin) RongSamuel Huang, 2005.
3. Computer Aided Design of Gating System For A Die-Casting Die Dr. Chandan Deep Singh, Dr. Jatinder MadanAmrik Singh, 2018.

MAE311	**Mobile Robots**	**3 (2,0,2)**
Introduction to the design and implementation of intelligent mobile robot systems. Fundamental elements of mobile robot systems from a computational standpoint. Kinematics and dynamic analysis of mobile robots. Issues such as software control architectures, sensor interpretation, map building and navigation will be covered, drawing from current research in the field.		

Prerequisites: MAE306.

References

1. John J. Craig, “Introduction to Robotics Mechanics and Control”, PEARSON Prentice Hail, 3rd edition, 2017.
2. Saeed B. Niku, “Introduction to robotics, Analysis, control, Application”, John Wiley, 2nd edition, 2017.
3. Ulrich Nehmzow, Mobile Robotics: A Practical Introduction, Springer Verlag, 1999.

MAE411	**Playware Technology**	**3 (2,0,2)**
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. Challenges in man-machine interaction and human-robot interaction. Programming of application interplay with embedded system. Adaptivity and implementations of adaptivity in playware.		

Prerequisites: MAE306.

References

1. Bruner, J. S., Acts of meaning. Cambridge, MA: Harvard University Press. 1990.
2. Carroll, J. M., HCI Models, Theories, and Frameworks - Towards a Multidisciplinary Science. San Francisco: Morgan Kaufmann Publishers. 2003.
3. Nardi, B., Context and Consciousness: Activity Theory and Human-Computer Interaction. Cambridge, MA: MIT Press. 1996.
4. Nano- and Micro-Electromechanical Systems: Fundamentals of Nano- and Microengineering, Second Edition, Edition 2, Sergey Edward Lyshevski, Oct 2018

MAE412	Embedded System Design	3 (2,0,2)
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. The architecture and instruction set of the microcontrollers, wire wrapped microcontroller board construction and debugging. Developmentof embedded software in C language. Grasp the main principles of embedded system design and understand the concept of hardware-software co-design. Study of microcontroller interface with sensors, actuators, motors, peripheral devices and communication.		

Prerequisites: MAE310.

References

1. Programming Embedded Systems, 2nd Edition, Michael Barr and Anthony Massa, 2006, Publisher(s): O'Reilly Media, Inc., ISBN: 9780596009830.
2. Introduction to Embedded Systems - A Cyber-Physical Systems Approach, 2nd Edition, Edward Ashford Lee, and Sanjit Arunkumar Seshia, Publisher: The MIT Press, 2016

MAE413	Machine Vision Systems	3 (2,0,2)
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. Projects involving image processing, information extraction, and vision-based control of mobile robots and manipulators will be assigned during the course.		

Prerequisites: BAS102&BAS108.

References

1. Pedram Azad, TiloGockle, R. Dillmann, Computer Vision: Principles and Practice, Elektor Electronics Publishing, 2008.
2. Mechatronics and Machine Vision in Practice 3 , John BillingsleyPeter Brett, 2018.

MAE414	Intelligent Control	3 (2,0,2)
This course introduces the basics of intelligent control. Many commercial products use intelligent control. For example: washing machines use it to determine the amount of detergent and cameras use it to counteract vibrations. This course helps students to understand and design		

simple intelligent controllers. The syllabus includes the following: Artificial intelligence basics, fuzzy set theory, fuzzy logic, Fuzzy reasoning, Fuzzy controllers, Fuzzy PID control, Neural networks introduction, 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, application examples.

Prerequisites: MAE401.

References

1. Beginning Artificial Intelligence with the Raspberry Pi Donald J. Norris, Jun 2017
2. Principles of Artificial Intelligence Nils J. Nilsson, Jun 2014

MAE415	Robust and Fault-Tolerant Control	3 (2,2,0)
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. Several small exercises/examples relevant to machining plants and robotics will be applied together with two larger assignments with associated test setup in the simulation laboratory and tutorials.		

Prerequisites: MAE401.

References

1. Optimal Control, Richard Vinter, Jun 2010.
2. “Robotics: Everything You Need to Know About Robotics from Beginner to Expert”, by Peter Mckinnon, CreateSpace Independent Publishing Platform, 2016.
3. Optimal Control: Theory, Algorithms, and Applications, William W. Hager Panos M. Pardalos, Apr 2013.

MAE416	Biomechatronics	3 (2,2,0)
Interdisciplinary elements of biomechatronic systems, Physiological and Bio-mechanical Systems, Nervous System, Musculoskeletal System. Biomedical and Bioelectric Signals, Biological Feedback Mechanisms. Case studies: Mathematical Models and Biomechatronics design, Closed-Loop Deep Brain Stimulation, Wearable Exoskeletal Rehabilitation, Motion Capture Systems for Therapy Optimization etc.		

Prerequisites: MAE306.

References

1. “HANDBOOK OF BIOMECHATRONICS” by JACOB SEGIL, Academic Press is an imprint of Elsevier. 2019.
2. Advances in Robot Design and Intelligent Control: Proceedings of the 24th International Conference on Robotics in Alpe-Adria-Danube Region (RAAD), Theodor Borangiu 2015

MAE417	Machine Learning	3 (2,2,0)
Logistic regression, Non-parametric methods, Decision trees, classification, mixture models, neural networks, deep learning, ensemble methods and reinforcement learning.		

Prerequisites: MAE414.

References:
1. “Machine Learning Engineering”, By Andriy Burkov, True Positive Inc., 2020.
2. “Building Machine Learning powered applications”, by Emmanuel Ameisen, 1st edition, O'Reilly Media, 2020.

MAE418	Robot Operating Systems	3 (2,0,2)
Introduction to the Robot Operating System (ROS) including many of the available tools that are commonly used in robotics. With the help of different examples, the course should provide a good starting point for students to work with robots. They learn how to create software including simulation, to interface sensors and actuators, and to integrate control algorithms.		

Prerequisites: MAE310.
References:
1. “Operating Systems Internals and Design Principles” by William Stallings, 9th edition, Pearson, 2017.
2. “Robot Operating System (ROS): The Complete Reference” by Anis Koubaa, The Complete Reference, Springer Cham. 2021.

MAE419	Computer Numerical Controllers	3 (2,0,2)
Numerical Theory – Control Units of Mechanical Systems – Control of Manufacturing processes – Sensing Elements – Programming Languages of Numerical Control Machines – Programming Applications in Manufacturing – Computer Control in Manufacturing Machines – CAM software e.g. Artcam - CNC-PLC integration and communication		

Prerequisites: MAE303.
References
1.John Polywka and Stanley Gabrel, Programming of Numerical Controlled Machines, Industrial Press Inc., 1992.
2.Mikel Ynch, Computer Numerical Control for Machining, McGraw- Hill, Inc., 1992.

MAE420	Autonomous Robotic Systems	3 (2,0,2)
Construction and application of autonomous robotic systems. Application and limitations of mobile robots. Construction and testing of hardware and software in computer based robot systems. Mobile robot Kinematics, Robot Navigation: Path planning, Localization Navigation mapping, Fundamental of computer vision. Humanoid Robots, Swarm Robotics.		

Prerequisites: MAE310.
References
1. Autonomous Control Systems and Vehicles: Intelligent Unmanned Systems, Kenzo Nonami Muljowidodo Kartidjo Kwang-Joon Yoon Agus Budiyono, May 2013.
2. Autonomous Cooperation and Control in Logistics: Contributions and Limitations Theoretical and Practical Perspectives, Michael Hülsmann Bernd Scholz-Reiter Katja Windt, May 2011.

MAE321	Industrial Automation	3 (2,0,2)
Principles of integrating robots in factories, emphasizing computer numerical control (NC, CNC, DNC), computer aided design (CAD), and computer integrated manufacturing (CIM). Computer aided process planning, Process Systems and automated machinery, Automated material		

handling and storage systems, Simulation of automated Systems. Components of automation lines, industrial robot programming, system drivers and sensors. Construction of 3D CAD drawings of mechanical parts of automated manufacturing systems. Study of famous applications such as: Binder-Processing machine, Sagger load station, Tray handlers, Cotton classing system.

Prerequisites: MAE307.

References

1.Industrial Automation: Hands On 1st Edition by Frank Lamb (Author)

MAE421	Sensors and Actuators	3 (2,0,2)
Sensors: Sonar and Optical Sensors, Inertial Measurement Units, Temperature, Pressure, and Tactile Sensing, Body-Surface Biopotential Electrodes. Actuators: Solenoids, DC Motors, Stepper Motors, Servo Motors, Linear Actuators, Pneumatic Muscles, Shape Memory Alloys.		

Prerequisites: MAE306.

References

1.Sawhney, A. K., A Course in Mechanical Measurements and Instrumentation, Dhanpat and Sons, Delhi, 1989.

2.Doebelin, Erest O., Measurement Systems Applications and Design, McGraw Hill, 1990.

3.Holman, J. P., Experimental Methods for Engineers, McGraw Hill, 1999.

MAE422	Industrial Material Flow Management	3 (2,2,0)
Modeling methodologies to analyze operational problems in complex industrial plants. Human-machine interaction, Knowledge based systems for diagnosis, planning and design from a plant-wide perspective. Principles of industrial material flow management, sustainability management and reporting, and industrial aspects of cleaner production. Develop strategies that lead to a reduction in material and energy demand in industry. Ecological efficiency, Economic competitiveness.		

Prerequisites: MAE321.

References

□□□"Handbook of Material Flow Analysis For Environmental, Resource, and Waste Engineers", Second Edition By Paul H. Brunner, Helmut Rechberger, CRC Press, 2016.

2. "A Handbook of Industrial Ecology" by Robert U. Ayres and Leslie W. Ayres, eISBN: 9781843765479, 2002.

MAE423	Advanced Autonomous Robots	3 (2,0,2)
Design of robotic systems that navigate independently in complex environments. Basic concepts and algorithms required to develop mobile robots that act autonomously in complex environments. Mobile robot locomotion and kinematics, environment perception, probabilistic map-based localization and mapping, and motion planning. Several types of exercises of robotic applications such as wheeled robots, legged robots and drones.		

Prerequisites: MAE307.

References

1. Mechatronics and Robotics: New Trends and Challenges, Marina IndriRoberto Oboe, 2020.

2. Mechatronics and Machine Vision in Practice 3 , John BillingsleyPeter Brett, 2018.

MAE424	Advanced Topics in Robotics	3 (2,2,0)
Advanced topics of robot learning and bio-inspired robots in addition to current robot research topics. Practical, hands-on dimension that comprises introduction to relevant software tools (simulators and operating systems) and hands-on experiments with simulated and physical robots.		

Prerequisites: MAE307.

References

1. Advances in Robot Design and Intelligent Control: Proceedings of the 24th International Conference on Robotics in Alpe-Adria-Danube Region (RAAD), Theodor Borangiu 2015
2. Efficient Dynamic Simulation of Robotic Mechanisms, Kathryn Lilly 2012

MAE425	Theory of Automata	3 (2,2,0)
Fundamental concepts in automata theory and formal languages including grammar, finite automaton, regular expression, formal language, pushdown automaton. Deterministic finite automaton and nondeterminism. Minimization of automata and applications. Turing machines and (un)decidability. Form basic models of computation. Foundation of computer science, compilers, software engineering, concurrent systems. The properties of these models will be studied and various rigorous techniques for analyzing and comparing them will be discussed, by using both formalism and examples		

Prerequisites: MAE309.

References

1. Advanced Control of Industrial Processes: Structures and Algorithms Piotr Tatjewski, Feb 2007
2. Supervision and Control for Industrial Processes: Using Grey Box Models, Predictive Control and Fault Detection Methods Bjorn Sohlberg, Dec 2012
3. Simulation of Industrial Processes for Control Engineers Philip J Thomas, Jul 1999
4. Designing Controls for the Process Industries Wayne Seames, Sep 2017

MAE426	Internet of things	3 (2,2,0)
Introduction to Internet of Things, physical design of IOT. Logical design of IOT, IOT enabling technologies, IOT Levels. Interconnection and integration of the physical world and the cyber space. Home automation, cities, environment, energy, retail, logistics. Agriculture, industry, Health and Lifestyle. Simple Network Management Protocol (SNMP), Limitations of SNMP, Network Operator Requirements. IOT design and Methodology. IOT Devices, exemplary device, Board, Linux on Raspberry Pi, Interfaces, and Programming & IOT Devices		

Prerequisites: MAE310&MAE311.

References:

1. “The Internet of Things”, by Samuel Greengard, The MIT Press, 2015.
2. “Internet of Things (A Hands-on-Approach)”, by Arshdeep Bahga, Vijay Madisetti, 1st edition, VPT, 2014

MAE428	Computer Numerical Controllers (CNC)	3 (2,0,2)
Covers computer numerical control (CNC) lathe operations, program format, and machine setup. G & M codes, control functions, the letter address system, and math issues related to CNC are		

included. Coding system, data entry, manual programming for complex work pieces, manual programming using fixed cycles, Looping, Subroutines.

Prerequisites: MAE303.

References

Steve Krar and Arthur Gill, CNC Technology and Programming, McGraw Hill Publishing Co., 1990.

2. Advanced Computer-Aided Fixture Design Yiming (Kevin) Rong Samuel Huang, 2005.

3. Mikel Ynch, Computer Numerical Control for Machining, McGraw- Hill, Inc., 1992.

MAE429	Advanced Programmable Logic Controllers (PLC)	3 (2,0,2)
Introduction and Review of:(PLC hardware, Logic sensors and actuators, Ladder diagram, Analog inputs and outputs) – Timers and Counters – PLC Extension Units - Applications of PLC - HMI interface- Types of Scada systems. Scada benefits. Scada system topology.		

Prerequisites: MAE311.

References

1- Programmable Logic Controllers: Industrial Control, Khaled KamelEman Kamel, Jul 2013

2- Manufacturing Systems Control Design: A Matrix-based Approach, Stjepan BogdanFrank L. LewisZdenkoKovacicJose Mireles, Aug 2006

MAE430	Autotronics	3 (2,0,2)
Basics of control and electronic systems. Signal processing – Communication Technology and Data Transfer. Vehicle control systems; Electronic Ignition Systems – Electronic Injection – Automatic transmission system– ABS system – Self-Steering – Air conditioning Control Systems.		

Prerequisites: MAE421.

References

1.Harper and Row, Automotive Electrical Systems, Check Chart Automotive Series, 1978.

2.Automotive Electric and Electronic Systems, , By Robert Bosch, 1988.

3.James, E., Duffy, Auto Electricity, Electronics, Computers, The Good Heart- Willcox Co., Inc., 1989.

4.Ronald Jurgen, Automotive Electronics Handbook, McGraw Hill Book Co., 1994.

برنامج هندسة نظم الاتصالات

COMMUNICATION SYSTEMS ENGINEERING PROGRAM

(CSE)

COMMUNICATION SYSTEMS ENGINEERING (CSE) PROGRAM

1. FACULTY VISION

The faculty of Engineering at BNU, looking forward to being a leading faculty at the national, regional, and international levels in engineering education fields, scientific research, innovation, and entrepreneurship to achieve the sustainable development of humankind.

2. FACULTY MISSION

The faculty of Engineering at BNU is committed to prepare graduates with the skills and attitudes to attain competence as professional engineers and researchers, and to interact with industry and community within the framework of human values and social responsibility.

3. PROGRAM VISION

The CSE program at BNU, aspires to be a leading program in education and scientific research in the fields of Communication Systems engineering at the regional and international levels and to provide an outstanding community service.

4. PROGRAM MISSION

The program is committed to preparing a distinguished graduate who possesses the knowledge and skills that qualify him to compete in the labor market, locally and regionally, and to provide international scientific research in the field of communication system engineering, and to help him innovate and participate effectively in community development while applying professional ethical standards.

5. PROGRAM OBJECTIVES

1. Providing students with the ability to apply knowledge in mathematics and basic sciences to model problems related to communication systems.
2. Providing students with basic knowledge in various fields of communication system engineering such as: computer programming, electronic and electrical circuit testing, fundamentals of communication systems, wireless communication, mobile communication, satellite communication, communication networks, software defined radio, software defined networks, wireless sensors networks …etc.
3. Providing students with the communication skills and responsible teamwork, establish professional attitudes and ethics, so that graduates are prepared for a complex modern work environment and lifelong learning.
4. Providing students with the ability to identify, formulate, and find optimal solutions to complex system problems, considering the physical, economic and safety constrains... etc.

5. Provide an environment that enables students to achieve their goals in a program that supports innovation.

6. GRADUATE ATTRIBUTES

1. Master a wide spectrum of engineering knowledge and specialized skills and can apply acquired knowledge using theories and abstract thinking in real life situations.
2. Apply analytic critical and systemic thinking to identify, diagnose and solve engineering problems with a wide range of complexity and variation.
3. Behave professionally and adhere to engineering ethics and standards.
4. Work in and lead a heterogeneous team of professionals from different engineering specialties and assume responsibility for own and team performance.
5. Recognize his/her role in promoting the engineering field and contribute in the development of the profession and the community.
6. Value the importance of the environment, both physical and natural, and work to promote sustainability principles.
7. Use techniques, skills, and modern engineering tools necessary for engineering practice.
8. Assume full responsibility for own learning and self-development, engage in lifelong learning and demonstrate the capacity to engage in post-graduate and research studies.
9. Communicate effectively using different modes, tools, and languages with various audiences; to deal with academic/professional challenges in a critical and creative manner.
10. Demonstrate leadership, business administration and entrepreneurial skills.
11. Professional integration of knowledge, engineering understanding and feedback to improve product and service design.
12. Create and re-design a component or system process and implement specialized engineering designs
13. Using laboratories and equipment efficiently and safely, monitoring, recording, and analyzing data in the lab.
14. Use measurement tools and laboratory equipment to design experiments to collect, analyze and interpret results
15. Use the advanced engineering tools for digital and analog communication systems, mobile communication, coding and decoding systems, Optical communication systems, antenna, and microwave applications

7. PROGRAM COMPETENCIES

According to the National Academic Reference Standard (NARS) 2018, the program in Communication Systems Engineering must satisfy the following Competencies:

1- General Engineering Competencies in NARS 2018		
Level A (NARS)	A.1	Identify, formulate, and solve complex engineering problems by applying engineering fundamentals, basic science and mathematics.
	A.2	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.
	A.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.
	A.4	Utilize contemporary technologies, codes of practice and standards, quality guidelines, health and safety requirements, environmental issues, and risk management principles.
	A.5	Practice research techniques and methods of investigation as an inherent part of learning.
	A.6	Plan, supervise and monitor implementation of engineering projects, taking into consideration other trades requirements.
	A.7	Function efficiently as an individual and as a member of multi-disciplinary and multi-cultural teams.
	A.8	Communicate effectively – graphically, verbally and in writing – with a range of audiences using contemporary tools.
	A.9	Use creative, innovative, and flexible thinking and acquire entrepreneurial and leadership skills to anticipate and respond to new situations.
	A.10	Acquire and apply new knowledge; and practice self, lifelong and other learning strategies.

2- Electrical Engineering Competencies in NARS 2018		
Level B (NARS)	B.1	Select, model and analyze electrical power systems applicable to the specific discipline by applying the concepts of: generation, transmission and distribution of electrical power systems.
	B.2	Design, model and analyze an electrical/electronic/digital system or component for a specific application; and identify the tools required to optimize this design.
	B.3	Design and implement: elements, modules, sub-systems or systems in electrical/electronic/digital engineering using technological and professional tools.
	B.4	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.
	B.5	Adopt suitable national and international standards and codes to: design, build, operate, inspect and maintain electrical/electronic/digital equipment, systems and services.

3- Communication Systems Engineering ARS		
Level C (ARS)	**C.1**	Design and implement the performance of digital and analog communication, mobile communication, coding, and decoding systems
	C.2	Use the professional tools for communication system engineering.
	C.3	Design, model and analyze electronic, microwave, optical, and communication systems or components for a specific application and identify the tools required to optimize this design.
	C.4	Resolve imbedded systems and analyze signal processing
	C.5	Synthesis and integrate electronic systems for certain specific function using the right equipment

For determination the compatibility of program objectives with its competencies, the following matrix can be used:

Program Competencies	Program Objectives																			
	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	B1	B2	B3	B4	B5	C1	C2	C3	C4	C5
Objective #1	√								√		√					√				
Objective #2				√		√						√			√			√		√
Objective #3			√			√								√						
Objective #4		√						√					√						√	
Objective #5					√		√			√							√			

MATRIX RELATING THE PROGRAM COURSES WITH COMPETENCIES

Course Code	Course Name	Engineering Competencies NARS (2018)										Electrical Engineering Competencies (NARS)					"Discipline" Communication Systems Engineering Competencies (ARS)				
		A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	B1	B2	B3	B4	B5	C1	C2	C3	C4	C5
GEN000	English Language (A remedy course)							√	√												
GEN201	Information Technology	√	√								√										
GEN301	Current Social Issues in Egypt			√				√	√												
GEN401	Professional Ethics			√	√																
GEN101	English Language							√	√												
GEN102	German Language							√	√												
GEN104	History of Science, Engineering & Technology				√					√	√										
GEN202	Communication & Presentation Skills							√	√												
GEN407	Entrepreneurship						√			√											
BAS101	Differential Calculus and Algebra	√		√																	
BAS102	Integral Calculus & Analytical Geometry	√		√																	
BAS105	Statics & Dynamics (1)	√		√		√															
BAS103	Physics of Materials	√	√																		
BAS106	Physics of Electricity & Magnetism	√	√			√															
BAS201	Probability and Statistical Methods	√	√													√					

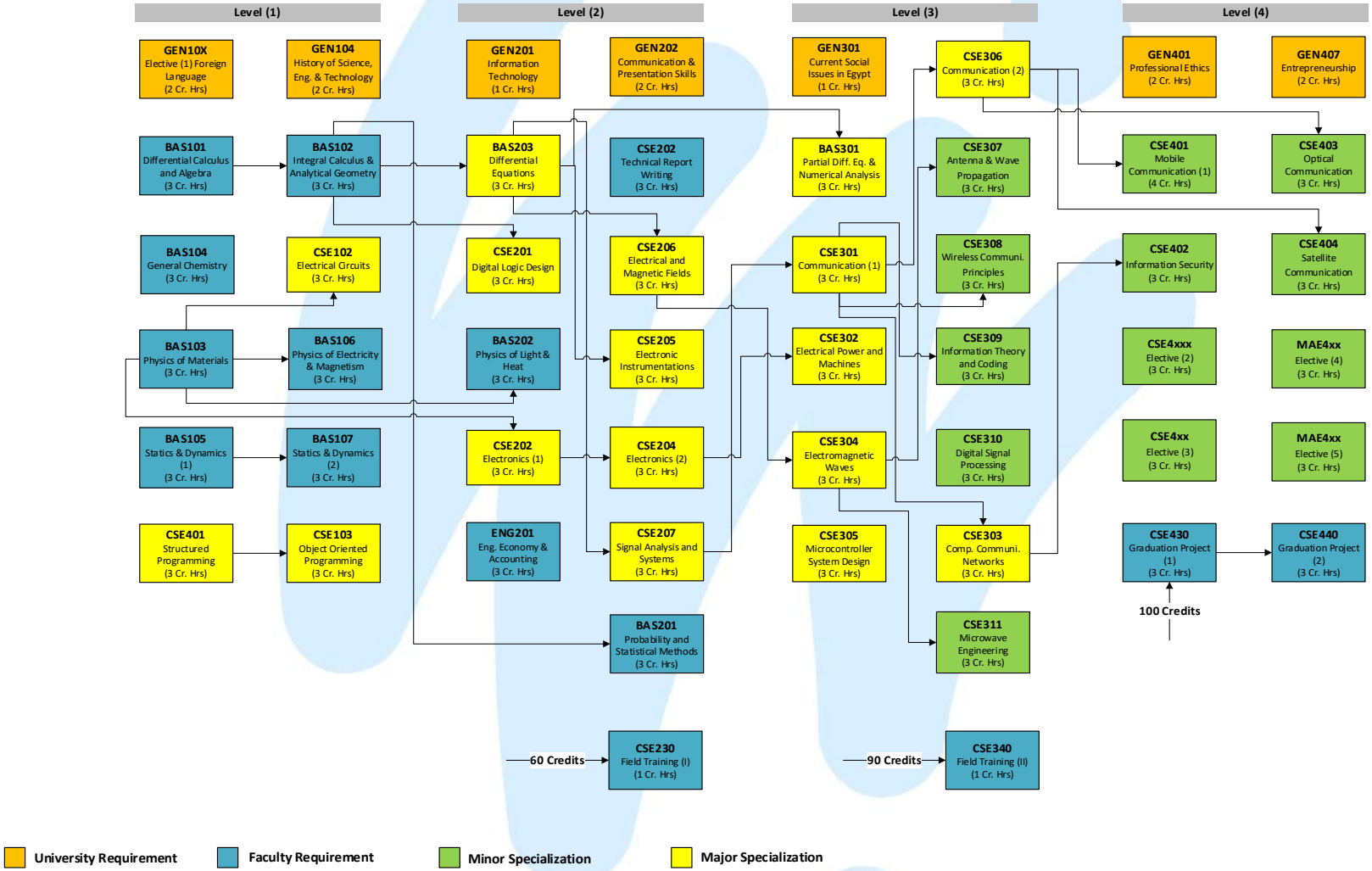
Course Code	Course Name	Engineering Competencies NARS (2018)										Electrical Engineering Competencies (NARS)					"Discipline" Communication Systems Engineering Competencies (ARS)				
		A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	B1	B2	B3	B4	B5	C1	C2	C3	C4	C5
BAS202	Physics of Light & Heat	√	√			√															
ENG202	Technical Report Writing					√	√		√												
BAS107	Statics & Dynamics (2)	√		√		√															
ENG201	Engineering Economy & Accounting			√	√																
CSE230	Field Training (I)		√						√				√		√						
CSE340	Field Training (II)														√	√		√			
CSE430	Graduation Project (1)																√	√	√	√	√
CSE440	Graduation Project (2)																√	√	√	√	√
BAS104	General Chemistry	√	√																		
BAS203	Differential Equations	√		√																	
BAS301	Partial Differential Equations &Numerical Analysis	√		√																	
CSE101	Structured Programming		√						√				√								
CSE103	Object Oriented Programming		√						√				√								
CSE102	Electrical Circuits	√	√									√									
CSE201	Digital Logic Design		√	√											√						
CSE202	Electronics (1)	√	√										√								

Course Code	Course Name	Engineering Competencies NARS (2018)										Electrical Engineering Competencies (NARS)					"Discipline" Communication Systems Engineering Competencies (ARS)				
		A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	B1	B2	B3	B4	B5	C1	C2	C3	C4	C5
CSE204	Electronics (2)		√	√										√		√					√
CSE205	Electronic Instrumentations		√								√				√	√					
CSE206	Electrical and Magnetic Fields	√				√						√									
CSE207	Signal Analysis and Systems			√									√	√							
CSE301	Communication (1)		√												√		√				
CSE302	Electrical Power and Machines										√		√		√						
CSE303	Computer Communication Networks																√	√			
CSE304	Electromagnetic Waves																		√		
CSE305	Microcontroller System Design																			√	
CSE306	Communication (2)																√				
CSE307	Antenna and Wave Propagation																		√		
CSE308	Wireless Communication Principles																√				
CSE309	Information Theory and Coding													√				√			
CSE310	Digital Signal Processing														√	√				√	
CSE311	Microwave Engineering												√		√				√		
CSE401	Mobile Communication (1)															√	√				

Course Code	Course Name	Engineering Competencies NARS (2018)										Electrical Engineering Competencies (NARS)					"Discipline" Communication Systems Engineering Competencies (ARS)				
		A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	B1	B2	B3	B4	B5	C1	C2	C3	C4	C5
CSE402	Information Security													√				√			
CSE403	Optical Communication														√	√	√				
CSE404	Satellite Communication														√	√	√				
CSE405	Selective Topics in Communication Engineering																√	√	√	√	√
CSE406	Software Defined Radio													√			√		√		
CSE407	Software Defined Networks														√					√	
CSE408	Wireless Sensors Networks														√					√	
CSE409	Radio Frequency Circuits														√	√			√		
CSE410	High Level ASIC Design																√				√
CSE411	Energy and Renewable Energy											√							√		

جامعة بنها الأهلية
Benha National University
BNU

FLOWCHART FOR COMMUNICATION SYSTEMS ENGINEERING PROGRAM COURSES



COMMUNICATION SYSTEMS ENGINEERING PROGRAM
COURSES CLASSIFICATION AND PERCENTAGES

#	Subject Area	CR	%	Min. Percentage according to reference framework (%)
1	University Requirements	12	8.33	8
2	Faculty Requirements	39	27.08	20
3	Major Specialization Subjects	53	36.81	35
4	Minor Specialization Subjects	40	27.78	Maximum 30
		144	**100**	**100**

COMMUNICATION SYSTEMS ENGINEERING PROGRAM
LIST OF COURSES

Code	Course	CR	Lec	Tut	Lab	Pre Req.
(A) University Requirements (12 Credits)						
GEN000	English Language (A remedy course)	0	0	0	0	---
GEN201	Information Technology	1	1	0	0	---
GEN301	Current Social Issues in Egypt	1	1	0	0	---
GEN401	Professional Ethics	2	2	0	0	---
GEN10X	Elective (1) From Language Courses List	2	1	2	0	---
GEN104	History of Science, Engineering & Technology	2	2	0	0	---
GEN202	Communication & Presentation Skills	2	1	2	0	---
GEN407	Entrepreneurship	2	1	2	0	---
(B) Faculty Requirements (39 Credits)						
BAS101	Differential Calculus and Algebra	3	2	2	0	-
BAS102	Integral Calculus & Analytical Geometry	3	2	2	0	BAS101
BAS103	Physics of Materials	3	2	0	3	-
BAS104	General Chemistry	3	2	0	2	-
BAS105	Statics & Dynamics (1)	3	2	2	0	-
BAS106	Physics of Electricity & Magnetism	3	2	0	3	BAS103
BAS107	Statics & Dynamics (2)	3	2	2	0	BAS105
ENG101	Production Engineering	3	2	0	3	-
ENG102	Engineering Graphics	3	1	0	4	-
ENG104	Computer Programming with MATLAB	3	2	0	3	---
CSE230	Field Training (I)	1	0	0	3	60 Credits
CSE340	Field Training (II)	1	0	0	3	90 Credits
CSE430	Graduation Project (1)	3	1	2	2	100 Credits
CSE440	Graduation Project (2)	4	2	2	2	CSE430
(C) Major Specialization Subjects (53 Credits)						
ENG201	Engineering Economy & Accounting	3	2	2	0	-
BAS203	Differential Equations	3	2	2	0	BAS102
BAS301	Partial Differential Equations &Numerical Analysis	3	2	2	0	BAS203
BAS201	Probability and Statistical Methods	3	2	2	0	-
CSE103	Object Oriented Programming	3	2	0	2	CSE101
CSE102	Electrical Circuits	3	2	0	3	BAS103

CSE201	Digital Logic Design	3	2	0	2	BAS102
CSE202	Electronics (1)	3	2	0	2	BAS103
CSE204	Electronics (2)	3	2	0	2	CSE202
CSE205	Electronic Instrumentations	3	2	0	3	BAS203
CSE206	Electrical and Magnetic Fields	3	2	0	2	BAS203
CSE207	Signal Analysis and Systems	3	2	2	0	BAS203
CSE301	Communication (1)	3	2	1	1	CSE207
CSE302	Electrical Power and Machines	2	2	1	0	CSE204
CSE303	Computer Communication Networks	3	2	1	2	CSE301
CSE304	Electromagnetic Waves	3	2	2	0	CSE206
CSE305	Microcontroller System Design	3	2	0	3	CSE203
CSE306	Communication (2)	3	2	1	1	CSE301
(D) Minor Specialization Subjects (40 Credits)						
CSE307	Antenna and Wave Propagation	3	2	0	2	CSE304
CSE308	Wireless Communication Principles	3	2	0	2	CSE301
CSE309	Information Theory and Coding	3	2	0	2	CSE301
CSE310	Digital Signal Processing	3	2	2	0	CSE207
CSE311	Microwave Engineering	3	2	0	2	CSE304
CSE401	Mobile Communication (1)	4	2	2	2	CSE306
CSE402	Information Security	3	2	0	2	CSE303
CSE403	Optical Communication	3	2	1	1	CSE306
CSE404	Satellite Communication	3	2	2	0	CSE306
CSE4xx	Elective (2)	3	2	2	0	xxxxxx
CSE4xx	Elective (3)	3	2	2	0	xxxxxx
CSE4xx	Elective (4)	3	2	2	0	xxxxxx
CSE4xx	Elective (5)	3	2	2	0	xxxxxx
Elective Courses						
CSE405	Selective Topics in Communication Engineering	3	2	2	0	CSE306
CSE406	Software Defined Radio	3	2	2	0	CSE308
CSE407	Software Defined Networks	3	2	2	0	CSE303
CSE408	Wireless Sensors Networks	3	2	2	0	CSE303
CSE409	Radio Frequency Circuits	3	2	2	0	CSE204
CSE410	High Level ASIC Design	3	2	2	0	CSE201
CSE411	Energy and Renewable Energy	3	2	2	0	BAS202

Basic Science & Mathematics Courses						
BAS101	Differential Calculus and Algebra	3	2	2	0	-
BAS102	Integral Calculus & Analytical Geometry	3	2	2	0	BAS001
BAS103	Physics of Materials	3	2	0	3	-
BAS104	General Chemistry	3	2	0	2	-
BAS105	Statics & Dynamics (1)	3	2	0	2	-
BAS106	Physics of Electricity & Magnetism	3	2	0	3	BAS103
BAS201	Probability and Statistical Methods	3	2	2	0	-
CSE207	Signal Analysis and Systems	3	2	2	0	BAS203
BAS107	Statics & Dynamics (2)	3	2	0	2	BAS105
BAS203	Differential Equations	3	2	2	0	BAS102
BAS301	Partial Differential Equations &Numerical Analysis	3	2	2	0	BAS203
CSE206	Electrical and Magnetic Fields	3	2	0	3	BAS203
CSE202	Electronics (1)	3	2	0	3	BAS103

COMMUNICATION SYSTEMS ENGINEERING (CSE) PROGRAM
STUDY PLAN

COMMUNICATION SYSTEMS ENGINEERING PROGRAM
1st Level

FIRST SEMESTER

Code	Subject	Credits	Contact Hours			Prerequisites
			Lec.	Tut.	Lab.	
GEN10X	Elective (1) From Language Courses List	2	1	2	0	---
BAS101	Differential Calculus and Algebra	3	2	2	0	---
BAS103	Physics of Materials	3	2	0	3	---
BAS104	General Chemistry	3	2	0	2	---
BAS105	Statics & Dynamics (1)	3	2	2	0	---
ENG101	Production Engineering	3	2	0	3	-
		17	**11**	**6**	**8**	

SECOND SEMESTER

Code	Subject	Credits	Contact Hours			Prerequisites
			Lec.	Tut.	Lab.	
GEN104	History of Science, Eng. & Technology	2	2	0	0	---
BAS102	Integral Calculus & Analytical Geometry	3	2	2	0	BAS101
BAS106	Physics of Electricity & Magnetism	3	2	0	3	BAS103
BAS107	Statics & Dynamics (2)	3	2	2	0	BAS105
ENG102	Engineering Graphics	3	1	0	4	---
ENG104	Computer Programming with MATLAB	3	2	0	3	---
		17	**11**	**4**	**10**	

COMMUNICATION SYSTEMS ENGINEERING PROGRAM

2nd Level

FIRST SEMESTER

Code	Subject	Credits	Contact Hours			Prerequisites
			Lec.	Tut.	Lab.	
GEN201	Information Technology	1	1	0	0	---
CSE103	Object Oriented Programming	3	2	0	2	CSE101
BAS203	Differential Equations	3	2	2	0	BAS102
CSE201	Digital Logic Design	3	2	0	2	BAS102
CSE202	Electronics (1)	3	2	0	2	BAS103
CSE102	Electrical Circuits	3	2	0	3	BAS103
GEN202	Communication & Presentation Skills	2	1	2	0	---
		18	**12**	**4**	**9**	

SECOND SEMESTER

Code	Subject	Credits	Contact Hours			Prerequisites
			Lec.	Tut.	Lab.	
CSE204	Electronics (2)	3	2	0	2	CSE202
CSE205	Electronic Instrumentations	3	2	0	3	BAS203
CSE206	Electrical and Magnetic Fields	3	2	0	2	BAS203
BAS201	Probability and Statistical Methods	3	2	2	0	BAS102
ENG201	Engineering Economy & Accounting	3	2	2	0	---
CSE207	Signal Analysis and Systems	3	2	2	0	BAS203
		18	**12**	**6**	**7**	

SUMMER SEMESTER

Code	Subject	Credits	Contact Hours			Prerequisites
			Lec.	Tut.	Lab.	
CSE230	Field Training (I)	1	0	0	3	60 Credits

COMMUNICATION SYSTEMS ENGINEERING PROGRAM

3rd Level

FIRST SEMESTER

Code	Subject	Credits	Contact Hours			Prerequisites
			Lec.	Tut.	Lab.	
BAS301	Partial Diff. Eq. & Numerical Analysis	3	2	2	0	BAS203
GEN301	Current Social Issues in Egypt	1	1	0	0	---
CSE301	Communication (1)	3	2	1	1	CSE207
CSE302	Electrical Power and Machines	2	2	1	0	CSE204
CSE310	Digital Signal Processing	3	2	2	0	CSE207
CSE304	Electromagnetic Waves	3	2	2	0	CSE206
CSE305	Microcontroller System Design	3	2	0	3	CSE203
		18	**13**	**8**	**4**	

SECOND SEMESTER

Code	Subject	Credits	Contact Hours			Prerequisites
			Lec.	Tut.	Lab.	
CSE306	Communication (2)	3	2	1	1	CSE301
CSE307	Antenna and Wave Propagation	3	2	0	2	CSE304
CSE308	Wireless Communication Principles	3	2	0	2	CSE301
CSE309	Information Theory and Coding	3	2	0	2	CSE301
CSE303	Computer Communication Networks	3	2	1	2	CSE301
CSE311	Microwave Engineering	3	2	0	2	CSE304
		18	**12**	**2**	**11**	

SUMMER SEMESTER

Code	Subject	Credits	Contact Hours			Prerequisites
			Lec.	Tut.	Lab.	
CSE340	Field Training (II)	1	0	0	3	90 Credits

COMMUNICATION SYSTEMS ENGINEERING PROGRAM

4th Level

FIRST SEMESTER

Code	Subject	Credits	Contact Hours			Prerequisites
			Lec.	Tut.	Lab.	
GEN401	Professional Ethics	2	2	0	0	---
CSE401	Mobile Communication (1)	4	2	2	2	CSE306
CSE402	Information Security	3	2	0	2	CSE303
CSE4xx	Elective (2)	3	2	2	0	xxxxxx
CSE4xx	Elective (3)	3	2	2	0	xxxxxx
CSE430	Graduation Project (1)	3	1	2	2	100 Credits
		18	**11**	**8**	**7**	

SECOND SEMESTER

Code	Subject	Credits	Contact Hours			Prerequisites
			Lec.	Tut.	Lab.	
GEN407	Entrepreneurship	2	1	2	0	---
CSE403	Optical Communication	3	2	1	1	CSE306
CSE404	Satellite Communication	3	2	2	0	CSE306
CSE4xx	Elective (4)	3	2	2	0	xxxxxx
CSE4xx	Elective (5)	3	2	2	0	xxxxxx
CSE440	Graduation Project (2)	4	2	2	2	CSE430
		18	**11**	**12**	**3**	

COMMUNICATION SYSTEMS ENGINEERING PROGRAM
COURSES DISCERPTION

COMMUNICATION SYSTEM ENGINEERING PROGRAM
COURSES DESCRIPTION

CSE102	Electrical Circuits	3(2,0,3)
Basic DC circuit elements, series and parallel network, Ohm's law and 1st and 2nd Kirchoff's laws, Nodal analysis, Mesh analysis, Basic network theorems (source transformation, super position theorem, Thevenin's theorem, Norton's theorem, maximum power transfer, Time response of R-L and R-C circuits). Practical part: Use of ammeters, voltmeters and function generators - Ohm's law - Series and parallel connections of resistors Voltage divider under load and no-load - Capacitor in a DC circuit - Relay circuit - Capacitor in an AC circuit - Coil in an AC circuit - Series and parallel connections of R , L and C- Resonance. Use of Function generators Diode in the DC and AC circuit - Half-wave and bridge rectifiers - Zener diode.		

Prerequisites: BAS103.

References:

1. "Electric Circuit Fundamentals", Thomas l. Floyed ,9th Edition, Prentice Hall, 2009.
2. "Fundamentals of Electric Circuits", Charles Alexander, Matthew Sadiku, McGraw-Hill Education; 7th Edition, 2020.
3. ELO Training Kit Course for AC

BCS103	Object Oriented Programming	3 (2,0,2)
The course presents the principles of object-oriented program design and advanced algorithmic problem solving illustrated through an object-oriented language. Topics include encapsulation and information hiding; classes, subclasses, and inheritance; polymorphism; class hierarchies, and the creation, implementation, and reuse of APIs (application programming interfaces).		

Prerequisites: CSE101.

References:

1. "Python 3 Object Oriented Programming", by Dusty Phillips, Packt Publishing, 2018.
2. "Effective Java" , by Joshua Bloch, 3rd Edition, Addison-Wesley Professional, 2018 .

CSE201	Digital Logic Design	3(2,0,2)
Number systems, Boolean algebra, basic logical operations, gates and truth tables. Combinational logic: Minimization techniques, multiplexers and de-multiplexers, encoders, decoders, adders and subtractors. Sequential logic: Flip flops, mono-stable multi-vibrators, latches, registers, counters, and memories.		

Prerequisites: BAS102.

References:

1. "Digital Logic and Computer Design" By M. Morris Mano, Kindle Edition, Pearson, 2020.
2. "Logic and Computer Design Fundamentals", by Morris Mano , Charles Kime, and Tom Martin, 5th Edition, Pearson, 2015.

CSE202	Electronics (1)	3(2,0,2)
Diode applications such as rectification, logic circuits, peak detectors, voltage multipliers-Applications of special diodes such as photodiode, light emitting diode, and zener diode-BJT Low frequency analysis for the three different amplifier configurations - Different BJT Applications-Power supplies and switching mode power supplies-Regulators.		

Prerequisites: BAS103.

References:

1. Microelectronic circuits, Adel Sedra and Kenneth Smith, 8th Edition, 2020.
2. Electronic Principles, Albert Malvino and David Bates, 8th Edition, 2015.

CSE204	Electronics (2)	3(2,0,2)
Field Effect Transistors (FET) and Metal Oxide Semiconductor Field Effect Transistors (MOSFET), physical operations, DC and AC characteristics, Special Effects, Applications-Fabrication of integrated circuits-TTL and MOS circuits-Optoelectronic Devices-Switching devices (four layer devices: Thyristor, Diac, Triac,..).		

Prerequisites: CSE202

References:

1- Microelectronic circuits, Adel Sedra and Kenneth Smith, 8th Edition, 2020.
2- Louis E. Frenzel, Jr. “CONTEMPORARY ELECTRONICS: FUNDAMENTALS, DEVICES, CIRCUITS, AND SYSTEMS”, McGraw-Hill 2014.

CSE205	Electronic Instrumentations	3(2,0,3)
Measurements of errors, accuracy, judgments, sensitivity, and statistical analysis (mean - deviation - standard deviation - variance). Measurement units and standards, electromechanical measuring instruments, analog instruments (DC ammeter, DC voltmeter, ohmeter, bridge measurements (DC and AC bridges)-Transducers-Analog and digital oscilloscopes-Signal generators-Miscellaneous devices and circuits (Strip chart Recorders, X-Y recorders, plotters, printers)- Introduction to Data acquisition and computerized control measurements.		

Prerequisites:BAS203

References:

1- "Electronic Instrumentation and Measurements", David A. Bell, 2013.

CSE206	Electrical and Magnetic Fields	3(2,0,2)
Vector analysis, Electrostatic fields: Coulomb’s law and electric field intensity, electric flux density, Gauss’s law and divergence, energy and potential, conductors, dielectrics and capacitance, Poisson and Laplace equations. Steady magnetic fields: Magnetostatic fields: Biot-Savart’s w, Ampere’s law, curl and Stokes’s theorem, magnetic flux density, magnetic forces, Lorentz force, materials and inductance.		

Prerequisites: BAS203

References:

1- Introduction to Electromagnetic fields, Clayton R. Paul, McGraw-Hill, 1987.
2- Engineering Electromagnetics, William H. Hayt, McGraw-Hill, 1989.

CSE207	Signal Analysis and Systems	3(2,2,0)
Representation of signals in the time and frequency domain, classifications of signals and systems, signal processes, linear time invariant systems representations, convolution. Laplace transform and its applications. Fourier series; the continuous and intermittent Fourier transform and their applications, spectral representation, sampling, power and energy spectrum. Applications using Matlab.		

Prerequisites: BAS203

References:

1. "Signals and systems", Alan V.Oppenheim, Alan S.Wilsky, 2nd edition, Prentice Hall, 1997.
1. "Signals and systems", Simon Haykin, Barry Van Veen, 2nd edition, Wiley India Pvt. Limited, 2007.

CSE301	Communication (1)	3(2,1,1)
Introduction to Communication systems, meaning of modulation, Analog modulation, Amplitude Modulation (AM, DSS-SC, SSB and VSB generation and detection), Angle modulation (PM, FM generation and detection), PCM - DPCM - Delta Modulation, Multiplexing, Spread spectrum, Digital modulation.		

Prerequisites: CSE207

References:

1. Modern Digital and analog communication system, Lathi Ding, Oxford University Press; 5th Edition, 2018.
2. Electronic communication, Roddy and Coolen, Pearson Education, 4th Edition, 2008.

CSE302	Electrical Power and Machines	2(2,1,0)
DC machines: installation of DC machine, electric motors, DC generators (working theory, types, equivalent circuit, benefits and efficiency), DC motors (working theory, types, equivalent circuit, efficiency, torque), single-phase electric transformers (working theory, equivalent circuit, vector shape drawing, tests, voltage regulation and efficiency). Automatic control: definition of open-loop and closed-loop systems, control system components, mathematical models of physical systems (mechanical, electrical, electromechanical systems), simplification of the box diagram, signal flow graph, transient response of first and second order control systems, poles / zeros, Stability analysis by Ruth Herwitz.		

Prerequisites: CSE204

References:

1. "Fundamentals of Electrical Power Engineering", Isaak D Mayergoyz, Patrick Mcavoy, World Scientific, 2014.

CSE303	Computer Communication Networks	3(2,1,2)
Networking basics (building and configuring networks - types of networks - network components) - OSI reference model and practical model TCP/ IP - Physical layer (cables - data encryption and decoding - determination of data rates) - Data link layer (Error detection and correction) - Network layer (Internet protocol, routing and switching) - Transport layer (TCP and UDP protocols)		

- Application layer (Telnet-HTTP-DHCP-DNS protocols) - Using simulation tool (packet tracer) to implement static and dynamic switch protocols.

Prerequisites: CSE301.

References:

1. Data Communications and Networking, Behrouz A Forouz, McGraw-Hill Education; 5th Edition, 2012.
2. Data Communications and Networking, by M Chandra Sekhar Reddy and Dr P.V.N Reddy, LAP LAMBERT Academic Publishing, 2020.

CSE304	Electromagnetic Waves	3(2,2,0)
Time-varying fields. Maxwell's equations and the wave equation. Plane waves in homogeneous media. Phasor form of time-varying electromagnetic fields. Poynting theorem in real and complex form. Types of wave polarization. Boundary conditions. Reflection and transmission of electromagnetic waves at plane interfaces. Standing wave phenomenon. Normal and inclined incidence of electromagnetic waves at planar interfaces. Total internal reflection. Brewster angle. Elementary waveguide: the parallel-plate waveguide, modes of propagation, cutoff, group and phase velocities.		

Prerequisites: CSE206.

References:

1. "Field and Wave Electromagnetics", David K. Cheng, PEARSON INDIA; 2nd Edition , 2014.
2. "Engineering Electromagnetics", W. Hayt, 8th edition, McGraw-Hill , 2011.

CSE305	Microcontrollers System Design	3(2,0,3)
Microprocessor structural architecture - Microprocessor internal modules - Assembly language - Programming using assembly language - Microprocessor coping devices - Introduction to microcontroller - Microcontroller structural construction - Microcontroller applications.		

Prerequisites: CSE203.

References:

1. "Computer Organization & Design: The Hardware/Software Interface", David A. Patterson and John L. Hennessy, 4th Edition, Morgan Kaufmann Publishers, 2013.

CSE306	Communication (2)	3(2,1,1)
Digital and analog communication systems, multiple access techniques, Digital transmission, Channel coding, OFDM , Multi-path propagation, Delay spread values ,Guard time and cyclic extension ,OFDM parameters ,OFDM versus single carrier modulation , Multiple-Input Multiple-Output (MIMO) Systems , Relay-based Wireless systems , Network Coding (Analog/digital/Lattice) ,Simulation of wireless communication systems.		

Prerequisites: CSE301.

References:

1. Digital Communications , John G. Proakis, McGraw-Hill Companies , 5th edition, 2018.
2. Fundamentals of Digital Communication , Upamanyu Madhow ,2012.
3. Wireless Communications Systems: an Introduction, by Haupt, Wiley-IEEE Press; 1st Edition, 2019.

CSE307	Antenna and Wave propagation	3(2,0,2)
Concepts of radiative elements in electromagnetism. Basic antenna parameters. Radiation and antenna characteristics. Receiving and transmitting antennas. Types and characteristics of linear antennas. Types and characteristics of antenna arrays. HF and microwave antennas.		

Prerequisites: CSE304.

References:

1. "Antenna theory analysis and design", Constantine A. Balanis, Wiley; 4th Edition, 2016.

CSE308	Wireless Communication Principles	3(2,0,2)
The course provides an introduction to wireless communication systems. The course will introduce radio propagation and transmission principles used in different wireless communication systems such as mobile telephone, satellite communication, radio transmissions. The course will discuss radio channel characteristics such as fading, interference and doppler shift to develop a good understanding of the radio engineering area. The course will discuss different techniques used to support voice, data and video communication in wireless systems. The course will also discuss the wireless networks and their basic design thereof from both theoretical and practical points of view.		

Prerequisites: CSE301.

References:

1. Digital Communications , John G. Proakis, McGraw-Hill Companies , 5th edition, 2018.
2. Wireless Communications Systems: an Introduction, by Haupt, Wiley-IEEE Press; 1st Edition, 2019.

CSE309	Information Theory and Coding	3(2,0,2)
Entropy, Relative entropy, Mutual information, Source entropy rate, Kraft inequality, Huffman code, Typical sequences and the asymptotic equipartition property, Lempel-Ziv coding, Channel capacity, Noisy channel coding theorem for discrete memoryless channels, Jointly typical sequences, Error exponents, Joint source channel coding theorem, Feedback, Low-density parity check codes and iterative decoding, Polar codes and successive decoding, Multiple access channels, Broadcast channels, Distributed source coding.		

Prerequisites: CSE301

References:

1. Information Theory for Electrical Engineers (Signals and Communication Technology) by Orhan Gazi, 2018.
2. “Information theory”, James V Stone, Sebtel Press; 1st Edition, 2015.

CSE310	Digital Signal Processing	3(2,2,0)
Discrete-time sequences and systems, the Z-transform and its inverse, Fourier transforms and frequency response, periodic sampling and reconstruction of band limited signals, digital filter design, filter transformations, the discrete and fast Fourier transform, Fourier analysis, the effect of windowing, correlation, convolution and de-convolution.		

Prerequisites: CSE207

References:

1. Digital Signal Processing; A practical guide for Engineers and Scientists, Steven Smith, Newnes,2002.
2. Digital Signal Processing: Fundamentals and Applications, Lizhe Tan, Jean Jiang, Academic Press; 3rd Edition , 2018.
3. Understanding Digital Signal Processing, Richard G. Lyons, Second Edition, PEARSON INDIA; 3rd Edition , 2011.

CSE 311	Microwave Engineering	3(2,0,2)
Theory of guided waves and the concept of “modes”. Rectangular Waveguides. Cylindrical waveguides. Losses in waveguides. Types of cavity resonators. Characteristics of elementary planar waveguide structures. The strip lines as a guiding structure.		

Prerequisites: CSE304.

References:

1. "Microwave Engineering" David M. Pozar ,4th Edition Wiley publishing:2011 (ISBN-10: 0470631554).
2. "Handbook of Microwave Technology, Volume 1: Components and Devices" T. Koryu Ishii, Academic press 1995.

CSE401	Mobile Communications	4(2,2,2)
Introduction to mobile communications. Cellular concepts: cell design, hand-off, traffic intensity. Radio wave propagation effects. Multipath and fading channel, diversity reception, RAKE receiver. Digital modulation and multiple access techniques. Overviews of existing and emerging wireless mobile communication systems.		

Prerequisites: CSE306

References:

1. "Data_Communications_and_networking", A. Behrouz Forouzan, 5th edition, McGraw-Hill Education (India), 2012.
2. "Communication Systems for the Mobile Information Society", Martin Sauter,2006
3. "Fundamentals of Digital Communication" ,Upamanyu Madhow, Cram101, 2012.
4. "Fundamentals of wireless communication", David Tse, Pramod Viswanath, 2005.

CSE402	Information Security	3(2,0,2)
This course introduces an overview of information security. Principles of security including confidentiality, integrity, and availability. Exploration of topics in computer security, threats and defense mechanisms for computer systems by introducing classic cryptographic algorithms, Encryption and privacy: Public key, private key, symmetric key, protocol analysis, access control, authentication protocols, Packet filtering, Firewalls, Virtual private networks, Intrusion detection systems.		

Prerequisites: CSE303.

References:

1. “Fundamentals of Information Systems Security”, by David Kimis and Michel Solomon, 3rd edition, Jones & Bartlett Learning, 2016.

2. "Introduction to Cryptography and Network Security", by Behrouz A.Forouzan, McGraw-Hill International Edition, 2014.

CSE403	Optical Communications	3(2,1,1)
Foundations of recombination processes in semiconductors. Radiative and non- radiative recombination. Electroluminescence in semiconductors. Radiative recombination spectrum of light emitting diodes. Frequency response and modulation characteristics of LED. Fundamentals of laser action in semiconductors. The Laser Diode: operation and Power-Current characteristics. The frequency response of the laser diode. Laser radiation pattern. Basic laser diode circuitry. Semiconductor photo detectors. Fiber modes and types of dispersion. Fundamental characteristics of practical fibers. Optical fiber link design and power budget evaluation. Speed of data transmission over attenuation and dispersion-limited fiber link.		

Prerequisites: CSE306.

References:

1. "Fiber-Optic Communication Systems" Third Edition, GOVIND P. AGRAWAL, John Wiley & Sons, Inc. , 2010.
2. "Laser Communication Systems", W. K. Pratt, Wiley, New York , 1969.
3. "Optical Fiber Communication Systems", L. Kazovsky, S. Bendetto, and A. E.Willner, Artec House, Norwood, MA, 1996.

CSE404	Satellite Communications	3(2,2,0)
Orbital aspects of satellite communication, Spacecraft and its related systems, Satellite link design, Modulation and multiplexing techniques for satellite links, Multiple access techniques; FDMA, TDMA. Spread-Spectrum technique, Forward error correction code for digital satellite links, Earth station technology, Satellite TVRO network.		

Prerequisites: CSE306

References:

1. "Satellite Communications Systems: Systems, Techniques and Technology", Gerard Maral, Michel Bousquet, et al. , 2020.
2. "Satellite Communication", Timothy Pratt, Jeremy E. Allnutt, Wiley; 3rd Edition, 2019.

CSE405	Selective Topics in Communication Engineering	3(2,2,0)
Selected topics related to the state of the art of Advanced Communications.		

Prerequisites: CSE306.

Selected topics related to the state of the art of Advanced Communications.

References:

1. "Advanced Communication Systems", by Djordjevic, Springer; 1st Edition, 2018.
2. "Design of High-Speed Communication Circuits (Selected Topics in Electronics and Systems)" by Ramesh Harjani, 2006.

CSE406	Software Defined Radio	3(2,2,0)
Basic concepts and introduction to software defined radio (SDR), Practice steps with universal software radio peripherals (USRP), Implementation of communication systems with USRP.		

Prerequisites: CSE308.

References:

1. Software-Defined Radio for Engineers, by Travis F. Collins, Robin Getz, Di Pu, and Alexander M. Wyglinski, 2018, ISBN-13: 978-1-63081-457-1.

CSE407	Software Defined Networks	3(2,2,0)
Networks SDN: Background and Motivation, Architecture, Open Flow protocol, SDN Deployment Models - Modern Network Applications: Cloud Computing, Big Data Systems, The Internet of Things.		

Prerequisites: CSE303.

References:

2. Software Networks: Virtualization, SDN, 5G, and Security (Networks & Telecommunications; Advanced Networks) by Guy Pujolle, 2020.
3. A Practical Guide to Advanced Networking, Jeffrey S. Beasley, Piyasat Nilkaew, Pearson IT Certification; 3rd Edition, 2012.

CSE408	Wireless Sensors Networks	3(2,2,0)
This course will cover the latest research in the area of Wireless Sensor Networks. We will cover all aspects of these unique and important systems, from the hardware and radio architecture through protocols and software to applications. Topics will include sensor network architectures, hardware platforms, physical layer techniques, medium access control, routing, topology control, quality of service (QoS) management, localization, time synchronization, security, storage, and other advanced topics. Each student must complete a semester-long course project related to wireless sensor networks.		

Prerequisites: CSE303.

References:

1. Wireless Sensor Networks: Technology, Protocols, and Applications 1st Edition by Kazem Sohraby , Daniel Minoli , Taieb Znati , Wiley-Interscience; 1st edition , 2007.
2. Wireless Sensor Networks: From Theory to Applications 1st Edition, by Ibrahiem M. M. El Emary , S. Ramakrishnan, CRC Press; 1st edition , 2013.

CSE409	Radio Frequency Circuits	3(2,2,0)
This course deals with design of CMOS circuits for wireless communications. The theoretical component consists of: introduction to wireless communications, modulation schemes for wireless communications, characterization of RF circuits, architecture of RF transceivers, building block of RF transceivers (LNAs, mixers, RF filters, VCOs, frequency synthesizers, and power amplifiers), and electromagnetic compatibility. Students are required to complete a design project with a professionally prepared project report.		

Prerequisites: CSE204.

References:

1. Radio Frequency Circuit Design 2nd Edition, by W. Alan Davis, Wiley-IEEE Press; 2nd edition, 2010.

2. Radio-Frequency Electronics: Circuits and Applications, by Jon B. Hagen, Cambridge University Press, 1996.

CSE410	High Level ASIC Design	3(2,2,0)
An application-specific integrated circuit (ASIC) is an integrated circuit (IC) customized for a particular use, rather than intended for general-purpose use. Application-specific standard products (ASSPs) are intermediate between ASICs and industry standard integrated circuits like the7400 or the 4000 series. As feature sizes have shrunk and design tools improved over the years, the maximum complexity (and hence functionality) possible in an ASIC has grown from 5,000 gates to over 100 million.		

Prerequisites: CSE201.

References:

1. High Performance ASIC Design :Using Synthesizable Domino Logic in an ASIC Flow, by Razak Hossain, Cambridge University Press, 2009.
2. High Level Synthesis of ASICs under Timing and Synchronization Constraints (The Springer International Series in Engineering and Computer Science, 177) 1992nd Edition, by David C. Ku , Giovanni De Micheli, Springer; 1992.

CSE411	Energy and Renewable Energy	3(2,2,0)
Introduction to renewable energy and the exciting new technologies that are making it possible, new ways of generating energy and storing that energy, learn more about the environmental and social effects of renewable technologies and examine how people's energy decisions impact policies, energy harvesting in wireless communication systems.		

Prerequisites: BAS 202.

References:

1- Aldo V. da Rosa, "Fundamentals of Renewable Energy Processes", 2005, Academic Press.
2- Gilbert M. Masters, "Renewable and Efficient Electric Power Systems", Wiley- IEEE Press, Barker Library, 2004

برنامج الهندسة الطبية

MEDICAL ENGINEERING PROGRAM

(MDE)

MEDICAL ENGINEERING (MDE) PROGRAM

1. FACULTY VISION

The faculty of Engineering at BNU, looking forward to being a leading faculty at the national, regional, and international levels in engineering education fields, scientific research, innovation, and entrepreneurship to achieve the sustainable development of humankind.

2. FACULTY MISSION

The faculty of Engineering at BNU is committed to prepare graduates with the skills and attitudes to attain competence as professional engineers and researchers, and to interact with industry and community within the framework of human values and social responsibility.

3. PROGRAM VISION

The MDE program at BNU, aspires to be a leading program in education and scientific research in the fields of medical engineering at the regional and international levels and to provide an outstanding community service.

4. PROGRAM MISSION

The mission of the MDE program is to provide the highest standard of excellence in higher education and to pursue continuous quality improvement of various engineering and management aspects in the healthcare field.

5. PROGRAM OBJECTIVES

1. Utilize effective communication, learning, and teamwork skills to facilitate continued professional development.
2. Develop into successful and ethical medical engineers, healthcare professionals, or other related practitioners.
3. Pursue lifelong learning to expand technical skills and professional knowledge through academic, industrial, and research training.
4. Use experiences and skills acquired through their medical engineering education to improve the local, national, and global healthcare communities.
5. Create innovative solutions to problems in the life sciences and clinical applications such as medicine, dentistry, nursing, and physical therapy.
6. Generate high quality technical documentation.

6. GRADUATE ATTRIBUTES

1. Master a wide spectrum of engineering knowledge and specialized skills and can apply acquired knowledge using theories and abstract thinking in real life situations.

2. Apply analytic critical and systemic thinking to identify, diagnose and solve engineering problems with a wide range of complexity and variation.
3. Behave professionally and adhere to engineering ethics and standards.
4. Work in and lead a heterogeneous team of professionals from different engineering specialties and assume responsibility for own and team performance.
5. Recognize his/her role in promoting the engineering field and contribute to the development of the profession and the community.
6. Value the importance of the environment, both physical and natural, and work to promote sustainability principles.
7. Use techniques, skills, and modern engineering tools necessary for engineering practice.
8. Assume full responsibility for own learning and self-development, engage in lifelong learning and demonstrate the capacity to engage in post-graduate and research studies.
9. Communicate effectively using different modes, tools, and languages with various audiences; to deal with academic/professional challenges in a critical and creative manner.
10. Demonstrate leadership, business administration and entrepreneurial skills.
11. Professional integration of knowledge, engineering understanding and feedback to improve product and service design.
12. Create and re-design a component or system process and implement specialized engineering designs
13. Using laboratories and equipment efficiently and safely, monitoring, recording, and analyzing data in the lab.
14. Use measurement tools and laboratory equipment to design experiments to collect, analyze and interpret results

7. PROGRAM COMPETENCIES

According to the National Academic Reference Standard (NARS) 2018, the program in medical Engineering must satisfy the following Competencies:

1- General Engineering Competencies in NARS 2018		
Level A (NARS)	**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, analyze 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, taking into consideration other trades requirements.
	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.

2- Electrical Engineering Competencies in NARS 2018		
Level B (NARS)	**B1**	Select, model and analyze electrical power systems applicable to the specific discipline by applying the concepts of: generation, transmission and distribution of electrical power systems.
	B2	Design, model and analyze an electrical/electronic/digital system or component for a specific application; and identify the tools required to optimize this design.
	B3	Design and implement elements, modules, sub-systems or systems in electrical/electronic/digital engineering using technological and professional tools.
	B4	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.
	B5	Adopt suitable national and international standards and codes to: design, build, operate, inspect and maintain electrical/electronic/digital equipment, systems and services.

3- Medical Engineering ARS		
Level C (ARS)	**C1**	Apply the fundamentals of either mechanical or electrical engineering to solve issues in medicine and health care.
	C2	Design medical instruments, devices, and software; integrates data and specifications to develop new medical procedures and conduct innovative research.
	C3	Understand anatomy, physiology as well as the mechanics of the human body.
	C4	Apply the fundamentals of control theory in the design of dynamic systems for medicine and health care.
	C5	Apply the fundamentals of image processing in analyzing the digital medical images.

For determination the compatibility of program objectives with its competencies, the following matrix can be used:

Program Competencies	Program Objectives																			
	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	B1	B2	B3	B4	B5	C1	C2	C3	C4	C5
Objective #1					√		√	√		√										
Objective #2			√	√		√														
Objective #3					√					√					√					
Objective #4	√								√		√					√	√	√	√	√
Objective #5									√			√	√				√		√	
Objective #6		√												√						√

MATRIX RELATING THE PROGRAM COURSES WITH COMPETENCIES

Course Code	Course Name	Engineering Competencies NARS (2018)										Electrical Engineering Competencies (NARS)					"Discipline" 3-Medical Engineering Competencies (ARS)				
		A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	B1	B2	B3	B4	B5	C1	C2	C3	C4	C5
GEN000	English Language (A remedy course)							√	√												
GEN201	Information Technology	√	√								√										
GEN301	Current Social Issues in Egypt			√				√	√												
GEN401	Professional Ethics			√					√	√											
GEN101	English Language							√	√												
GEN102	German Language							√	√												
GEN104	History of Science, Engineering & Technology			√	√																
GEN202	Communication & Presentation Skills					√		√	√												
GEN407	Entrepreneurship									√	√										
BAS101	Differential Calculus and Algebra	√		√																	
BAS102	Integral Calculus & Analytical Geometry	√		√																	
BAS105	Statics & Dynamics (1)	√		√																	
BAS106	Properties of Electricity & Magnetism	√	√			√															
BAS104	General Chemistry	√	√																		
BAS203	Differential Equations	√						√													

Course Code	Course Name	Engineering Competencies NARS (2018)										Electrical Engineering Competencies (NARS)					"Discipline" 3-Medical Engineering Competencies (ARS)				
		A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	B1	B2	B3	B4	B5	C1	C2	C3	C4	C5
BAS301	Partial Differential Equations & Numerical Analysis	√	√			√															
BAS201	Probability and Statistical Methods	√	√								√										
BAS202	Properties of Light & Heat	√	√			√															
BAS107	Statics & Dynamics (2)	√		√		√															
MDE230	Field Training (I)														√	√	√				
MDE340	Field Training (II)															√			√		√
MDE430	Graduation Project (1)											√	√				√	√			
MDE440	Graduation Project (2)													√	√					√	√
BAS103	Properties of Materials	√		√	√																
ENG102	Engineering Graphics	√	√		√		√		√												
BAS310	Operations Research		√			√															
MDE102	Computer Programming				√								√	√							
MDE103	Object Oriented Programming				√								√								
MDE203	Electric Circuits	√					√		√												
MDE207	Measurements and Instrumentations	√	√			√									√						
MDE208	Data structures and Algorithms										√		√	√		√					

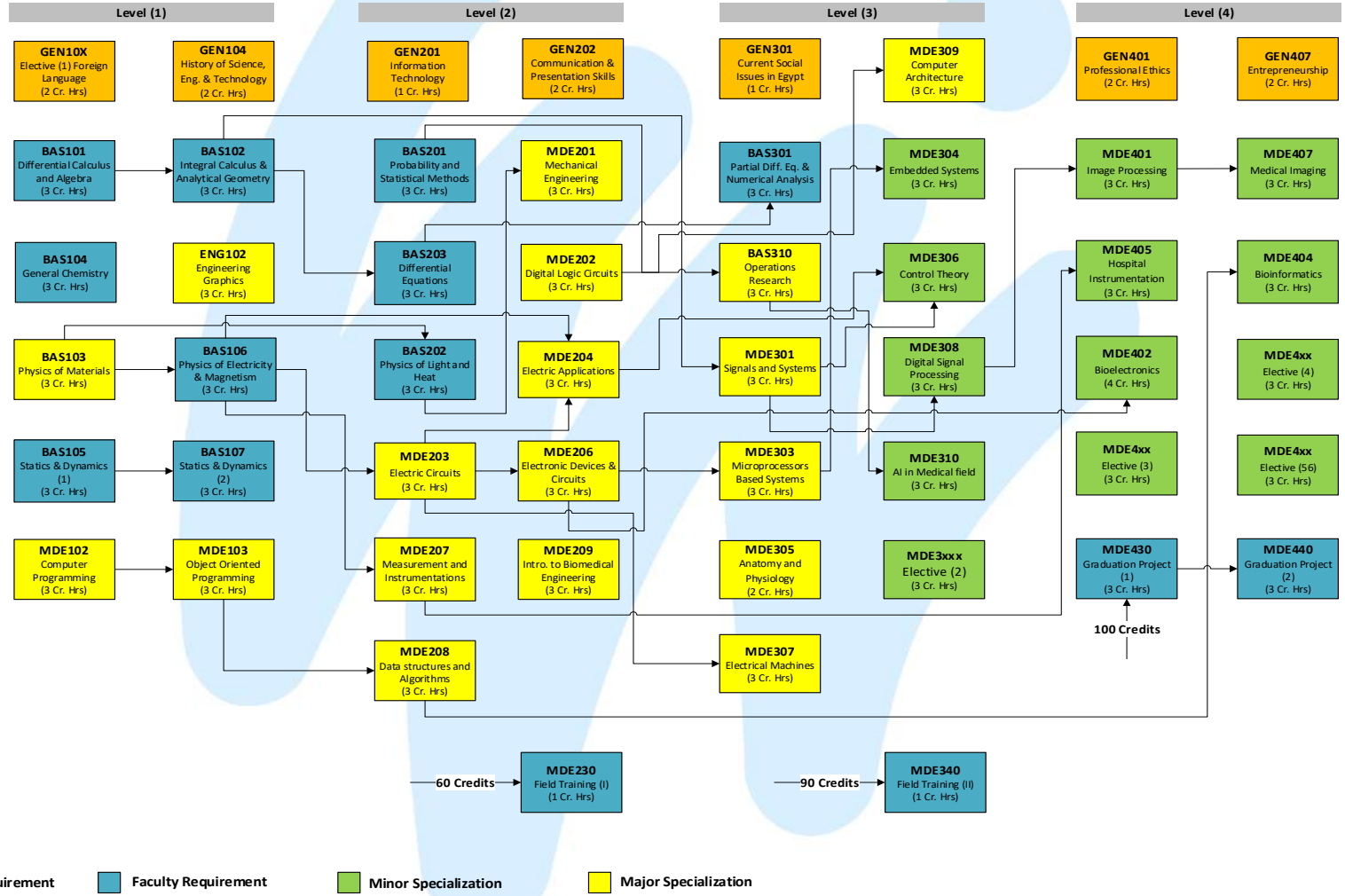
Course Code	Course Name	Engineering Competencies NARS (2018)										Electrical Engineering Competencies (NARS)					"Discipline" 3-Medical Engineering Competencies (ARS)				
		A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	B1	B2	B3	B4	B5	C1	C2	C3	C4	C5
MDE201	Mechanical Engineering	√		√	√												√				
MDE202	Digital Logic Circuits												√	√	√			√			
MDE204	Electric Applications											√	√			√	√				
MDE206	Electronic Devices & Circuits												√	√	√			√			
MDE209	Introduction to Biomedical Engineering																√		√	√	√
MDE301	Signals and Systems												√	√							√
MDE303	Microprocessors Based Systems												√	√							√
MDE305	Anatomy and Physiology																	√	√	√	
MDE307	Electric Machines											√			√	√	√				
MDE309	Computer Architecture													√				√			√
MDE304	Embedded Systems												√	√				√		√	
MDE306	Control Theory															√	√			√	
MDE308	Digital Signal Processing												√	√							√
MDE310	AI in Medical field																	√		√	√
MDE401	Image Processing													√		√	√				√
MDE405	Hospital Instrumentation											√					√	√		√	

Course Code	Course Name	Engineering Competencies NARS (2018)										Electrical Engineering Competencies (NARS)					"Discipline" 3-Medical Engineering Competencies (ARS)				
		A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	B1	B2	B3	B4	B5	C1	C2	C3	C4	C5
MDE402	Bioelectronics													√				√		√	
MDE407	Medical Imaging																	√	√		√
MDE404	Bioinformatics																		√	√	√
MDE411	Biomechanics																√		√	√	√
MDE412	Rehabilitation Engineering and Assistive Technology														√	√	√	√			
MDE413	Medical Robotics												√	√			√			√	
MDE 414	Cardiovascular Biomechanics																√		√		
MDE415	Advanced Human Biodynamics																		√	√	
MDE416	Artificial Organs															√	√	√		√	
MDE417	Kinematics and Kinetics of Human Movement																	√	√	√	
MDE418	Machine Learning in Medicine												√			√		√		√	
MDE419	Deep Learning in Medicine												√			√		√		√	
MDE421	Medical Image Computing														√			√			√
MDE422	Advanced Medical Imaging Systems														√			√			√
MDE423	Computational Methods for Medical Image Analysis													√	√			√			√
MDE427	RF (Radiofrequency) Medical Devices												√	√			√	√			

Course Code	Course Name	Engineering Competencies NARS (2018)										Electrical Engineering Competencies (NARS)					"Discipline" 3-Medical Engineering Competencies (ARS)				
		A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	B1	B2	B3	B4	B5	C1	C2	C3	C4	C5
MDE428	Biomedical Optical Microscopy														√			√			√
MDE431	Bioinstrumentation: Biosignals and Biosensors															√		√		√	
MDE432	Clinical Engineering Fundamentals											√		√			√			√	
MDE433	Clinical Equipment Management														√			√			
MDE434	Medical Instrumentation in the Hospital											√					√	√		√	
MDE436	Clinical Systems Engineering															√	√	√		√	
MDE437	Medical Device Cybersecurity												√					√			
MDE441	Computer Applications in Bioengineering												√	√				√			
MDE442	Biomedical Applications of Signal Processing													√	√			√			√
MDE443	Analog Communication Systems													√		√					√
MDE444	Digital Communication Systems															√					√
MDE445	Digital and Analog Filters Design												√	√				√			
MDE446	Vision Sensors														√			√			√

جامعة بنها الأهلية
Benha National University
BNU

FLOWCHART FOR MEDICAL ENGINEERING PROGRAM COURSES



MEDICAL ENGINEERING PROGRAM
COURSES CLASSIFICATION AND PERCENTAGES

#	Subject Area	CR	%	Min. Percentage according to reference framework (%)
1	University Requirements	12	8.33	8
2	Faculty Requirements	39	27.08	20
3	Major Specialization Subjects	53	36.81	35
4	Minor Specialization Subjects	40	27.78	Maximum 30
		144	**100**	**100**

MEDICAL (MDE) ENGINEERING PROGRAM
LIST OF COURSES

Code	Course	CR	Lec	Tut	Lab	Pre Req.
(A) University Requirements (12 Credits)						
GEN000	English Language (A remedy course)	0	0	0	0	---
GEN201	Information Technology	1	1	0	0	---
GEN301	Current Social Issues in Egypt	1	1	0	0	---
GEN401	Professional Ethics	2	2	0	0	---
GEN10X	Elective (1) From Language Courses List	2	1	2	0	---
GEN104	History of Science, Engineering & Technology	2	2	0	0	---
GEN202	Communication & Presentation Skills	2	1	2	0	---
GEN407	Entrepreneurship	2	1	2	0	---
(B) Faculty Requirements (39 Credits)						
BAS101	Differential Calculus and Algebra	3	2	2	0	-
BAS102	Integral Calculus & Analytical Geometry	3	2	2	0	BAS101
BAS103	Physics of Materials	3	2	0	3	-
BAS104	General Chemistry	3	2	0	2	-
BAS105	Statics & Dynamics (1)	3	2	2	0	-
BAS106	Physics of Electricity & Magnetism	3	2	0	3	BAS103
BAS107	Statics & Dynamics (2)	3	2	2	0	BAS105
ENG101	Production Engineering	3	2	0	3	-
ENG102	Engineering Graphics	3	1	0	4	-
ENG104	Computer Programming with MATLAB	3	2	0	3	---
MDE230	Field Training (I)	1	0	0	3	60 Credits
MDE340	Field Training (II)	1	0	0	3	90 Credits
MDE430	Graduation Project (1)	3	1	2	2	100 Credits
MDE440	Graduation Project (2)	4	2	2	2	MDE430
(C) Major Specialization Subjects (53Credits)						
BAS201	Probability and Statistical Methods	3	2	2	0	-
BAS203	Differential Equations	3	2	2	0	BAS102
BAS301	Partial Differential Equations & Numerical Analysis	3	2	2	0	BAS203
BAS310	Operations Research	3	2	2	0	BAS201
MDE103	Object Oriented Programming	3	2	0	2	MDE102
MDE203	Electric Circuits	3	2	1	2	BAS106
MDE207	Measurements and Instrumentations	3	2	0	2	BAS106
MDE208	Data structures and Algorithms	3	2	0	2	MDE103
MDE201	Mechanical Engineering	3	2	0	2	BAS202
MDE202	Digital Logic Circuits	3	2	1	1	---
MDE204	Electric Applications	3	2	0	2	BAS106 & MDE203
MDE206	Electronic Devices & Circuits	3	2	1	2	MDE203
MDE209	Introduction to Biomedical Engineering	3	2	0	2	---

Code	Course	CR	Lec	Tut	Lab	Pre Req.
MDE301	Signals and Systems	3	2	2	1	BAS102
MDE303	Microprocessors Based Systems	3	2	2	1	MDE206
MDE305	Anatomy and Physiology	2	2	0	0	---
MDE307	Electric Machines	3	2	0	2	MDE203
MDE309	Computer Architecture	3	2	1	1	MDE202
(D) Minor Specialization Subjects (40Credits)						
MDE304	Embedded Systems	3	2	0	2	MDE303
MDE306	Control Theory	3	2	1	1	MDE204 & MDE301
MDE308	Digital Signal Processing	3	2	1	1	MDE301
MDE310	AI in Medical field	3	2	1	1	BAS310
MDE3xx	Elective (2)	3	2	2	1	---
MDE401	Image Processing	3	2	1	0	MDE308
MDE405	Hospital Instrumentation	3	2	2	0	MDE207
MDE4xx	Elective (3)	3	2	2	1	---
MDE4xx	Elective (4)	3	2	2	1	---
MDE402	Bioelectronics	4	2	2	2	MDE206
MDE407	Medical Imaging	3	2	1	0	MDE401
MDE404	Bioinformatics	3	2	1	0	MDE208
MDE4xx	Elective (5)	3	2	2	1	---
Elective Courses for Biomechanics and Rehabilitation (Concentration)						
MDE411	Biomechanics	3	2	2	1	BAS107& MDE308
MDE312	Rehabilitation Engineering and Assistive Technology	3	2	2	1	BAS107
MDE313	Medical Robotics	3	2	2	1	BAS107
MDE 314	Cardiovascular Biomechanics	3	2	2	1	BAS107
MDE415	Advanced Human Biodynamics	3	2	2	1	BAS107& MDE308
MDE416	Artificial Organs	3	2	2	1	MDE308
MDE317	Kinematics and Kinetics of Human Movement	3	2	2	1	BAS107
MDE418	Machine Learning in Medicine	3	2	2	1	MDE310
MDE419	Deep Learning in Medicine	3	2	2	1	MDE310
Elective Courses for Bioimaging & Biomedical Image processing (Concentration)						
MDE421	Medical Image Computing	3	2	2	1	MDE407 & BAS301
MDE422	Advanced Medical Imaging Systems	3	2	2	1	MDE407
MDE423	Computational Methods for Medical Image Analysis	3	2	2	1	MDE407
MDE418	Machine Learning in Medicine	3	2	2	1	MDE310
MDE419	Deep Learning in Medicine	3	2	2	1	MDE310
MDE327	RF (Radiofrequency) Medical Devices	3	2	2	1	BAS202
MDE328	Biomedical Optical Microscopy	3	2	2	1	MDE202
Elective Courses for Bioinstrumentation & Clinical Engineering						
MDE331	Bioinstrumentation: Biosignals and Biosensors	3	2	2	1	MDE209
MDE332	Clinical Engineering Fundamentals	3	2	2	1	MDE209
MDE333	Clinical Equipment Management	3	2	2	1	MDE209

Code	Course	CR	Lec	Tut	Lab	Pre Req.
MDE434	Medical Instrumentation in the Hospital	3	2	2	1	MDE209
MDE436	Clinical Systems Engineering	3	2	2	1	MDE209
MDE437	Medical Device Cybersecurity	3	2	2	1	MDE209
Elective Courses for Biological Signal Processing						
MDE341	Computer Applications in Bioengineering	3	2	2	1	MDE103
MDE442	Biomedical Applications of Signal Processing	3	2	2	1	MDE308
MDE443	Analog Communication Systems	3	2	2	1	MDE304
MDE444	Digital Communication Systems	3	2	2	1	MDE304
MDE345	Digital and Analog Filters Design	3	2	2	1	MDE206
MDE346	Vision Sensors	3	2	2	1	BAS202
MDE418	Machine Learning in Medicine	3	2	2	1	MDE310
MDE419	Deep Learning in Medicine	3	2	2	1	MDE310
Basic Science & Mathematics Courses						
BAS101	Differential Calculus and Algebra	3	2	2	0	-
BAS102	Integral Calculus & Analytical Geometry	3	2	2	0	BAS101
BAS103	Physics of Materials	3	2	0	3	-
BAS104	General Chemistry	3	2	0	2	-
BAS105	Statics & Dynamics (1)	3	2	0	2	-
BAS106	Physics of Electricity & Magnetism	3	2	0	3	BAS103
BAS201	Physics and Statistical Methods	3	2	2	0	-
BAS201	Probability and Statistical Methods	3	2	2	0	-
BAS107	Statics & Dynamics (2)	3	2	0	2	BAS105
MDE206	Electronic Devices & Circuits	3	2	1	2	MDE203
BAS203	Differential Equations	3	2	2	0	BAS102
BAS301	Partial Differential Equations & Numerical Analysis	3	2	2	0	BAS203
BAS310	Operations Research	3	2	2	0	BAS201

MEDICAL ENGINEERING PROGRAM
STUDY PLAN

STUDY PLAN FOR MEDICAL ENGINEERING PROGRAM

1st Level

FIRST SEMESTER

Code	Subject	Credits	Contact Hours			Prerequisites
			Lec.	Tut.	Lab.	
GEN10X	Elective (1) From Language Courses List	2	1	2	0	---
BAS101	Differential Calculus and Algebra	3	2	2	0	---
BAS103	Physics of Materials	3	2	0	3	---
BAS104	General Chemistry	3	2	0	2	---
BAS105	Statics & Dynamics (1)	3	2	2	0	---
ENG101	Production Engineering	3	2	0	3	-
		17	**11**	**6**	**8**	

SECOND SEMESTER

Code	Subject	Credits	Contact Hours			Prerequisites
			Lec.	Tut.	Lab.	
GEN104	History of Science, Eng. & Technology	2	2	0	0	---
BAS102	Integral Calculus & Analytical Geometry	3	2	2	0	BAS101
BAS106	Physics of Electricity & Magnetism	3	2	0	3	BAS103
BAS107	Statics & Dynamics (2)	3	2	2	0	BAS105
ENG102	Engineering Graphics	3	1	0	4	---
ENG104	Computer Programming with MATLAB	3	2	0	3	---
		17	**11**	**4**	**10**	

STUDY PLAN FOR MEDICAL ENGINEERING PROGRAM

2nd Level

FIRST SEMESTER

Code	Subject	Credits	Contact Hours			Prerequisites
			Lec.	Tut.	Lab.	
BAS201	Probability and Statistical Methods	3	2	2	0	---
BAS203	Differential Equations	3	2	2	0	BAS102
MDE103	Object Oriented Programming	3	2	0	2	MDE102
MDE203	Electric Circuits	3	2	1	2	BAS106
MDE207	Measurements and Instrumentations	3	2	0	2	BAS106
MDE208	Data structures and Algorithms	3	2	0	2	MDE103
		18	**12**	**5**	**8**	

SECOND SEMESTER

Code	Subject	Credits	Contact Hours			Prerequisites
			Lec.	Tut.	Lab.	
MDE201	Mechanical Engineering	3	2	0	2	BAS202
GEN202	Communication & Presentation Skills	2	1	2	0	---
MDE202	Digital Logic Circuits	3	2	1	1	---
MDE204	Electric Applications	3	2	0	2	BAS106 & MDE203
MDE206	Electronic Devices & Circuits	3	2	1	2	MDE203
GEN201	Information Technology	1	1	0	0	---
MDE209	Introduction to Biomedical Engineering	3	2	0	2	---
		18	**12**	**4**	**9**	

SUMMER SEMESTER

Code	Subject	Credits	Contact Hours			Prerequisites
			Lec.	Tut.	Lab.	
MDE230	Field Training (I)	1	0	0	3	60 Credits

STUDY PLAN FOR MEDICAL ENGINEERING PROGRAM

3rd Level

FIRST SEMESTER

Code	Subject	Credits	Contact Hours			Prerequisites
			Lec.	Tut.	Lab.	
BAS310	Operations Research	3	2	2	0	BAS201
MDE301	Signals and Systems	3	2	2	1	BAS102
MDE303	Microprocessors Based Systems	3	2	2	1	MDE206
MDE305	Anatomy and Physiology	2	2	0	0	---
MDE307	Electric Machines	3	2	0	2	MDE203
GEN301	Current Social Issues in Egypt	1	1	0	0	---
BAS301	Partial Diff. Eq. & Numerical Analysis	3	2	2	0	BAS203
		18	**13**	**8**	**4**	

SECOND SEMESTER

Code	Subject	Credits	Contact Hours			Prerequisites
			Lec.	Tut.	Lab.	
MDE309	Computer Architecture	3	2	1	1	MDE202
MDE304	Embedded Systems	3	2	0	2	MDE303
MDE306	Control Theory	3	2	1	1	MDE204 & MDE301
MDE308	Digital Signal Processing	3	2	1	1	MDE301
MDE310	AI in Medical field	3	2	1	1	BAS310
MDE3xx	Elective (2)	3	2	2	1	---
		18	**12**	**6**	**7**	

SUMMER SEMESTER

Code	Subject	Credits	Contact Hours			Prerequisites
			Lec.	Tut.	Lab.	
MDE340	Field Training (II)	1	0	0	3	90 Credits

STUDY PLAN FOR MEDICAL ENGINEERING PROGRAM

4th Level

FIRST SEMESTER

Code	Subject	Credits	Contact Hours			Prerequisites
			Lec.	Tut.	Lab.	
MDE401	Image Processing	3	2	1	0	MDE308
MDE405	Hospital Instrumentation	3	2	2	0	MDE207
MDE4xx	Elective (3)	3	2	2	1	---
GEN401	Professional Ethics	2	2	0	0	---
MDE402	Bioelectronics	4	2	2	2	MDE206
MDE430	Graduation Project (1)	3	1	2	2	100 Credits
		18	**11**	**9**	**5**	

SECOND SEMESTER

Code	Subject	Credits	Contact Hours			Prerequisites
			Lec.	Tut.	Lab.	
MDE407	Medical Imaging	3	2	1	0	MDE401
MDE404	Bioinformatics	3	2	1	0	MDE208
GEN407	Entrepreneurship	2	1	2	0	---
MDE4xx	Elective (4)	3	2	2	1	---
MDE4xx	Elective (5)	3	2	2	1	---
MDE440	Graduation Project (2)	4	2	2	2	MDE430
		18	**11**	**10**	**4**	

MEDICAL ENGINEERING PROGRAM
COURSE DESCRIPTIONS

MEDICAL ENGINEERING PROGRAM
COURSE DESCRIPTIONS

MDE103	Object Oriented Programming	3 (2,0,2)
The course presents the principles of object-oriented program design and advanced algorithmic problem solving illustrated through an object-oriented language. Topics include encapsulation and information hiding; classes, subclasses, and inheritance; polymorphism; class hierarchies, and the creation, implementation, and reuse of APIs (application programming interfaces).		

Prerequisites: MDE102.

References:

1. “Python 3 Object Oriented Programming”, by Dusty Phillips, Packt Publishing, 2018.
2. “Effective Java”, by Joshua Bloch, 3rd Edition, Addison-Wesley Professional, 2018.

MDE203	Electric Circuits	3 (2,1,2)
Circuit Variables - Kirchhoff s Laws - Simple Resistive Circuits - The Wheatstone Bridge - Δ to-Y (or π -to-T) Equivalent Circuits - The Node-Voltage Method and Dependent Sources - The Mesh-Current Method and Dependent Sources - Thevenin and Norton Equivalents - Maximum Power Transfer - Superposition, Topology in Circuit Analysis - The Operational Amplifier circuits - Inductance and Capacitance - The Natural Response of RL and RC Circuits - Step Response of First-Order RL and RC Circuits - Natural and Step Responses of RLC Circuits - Sinusoidal Steady-State Analysis - The Phasor – The Passive Circuit Elements - circuit theorems and Laws in the Frequency Domain - Sinusoidal Steady-State Power Calculations Appliance Ratings. Balanced Three-Phase Circuits - Power Calculations - Mutual Inductance - The Dot Convention – Energy Calculations - The Linear and Ideal Transformer – Series and Parallel Resonance - The Laplace Transform – The Step and Impulse Functions - Functional and Operational Transforms - The Inverse Laplace Transform – Circuit Elements and Circuit Analysis in the s-Domain – The Transfer Function - Fourier Series -The Fourier Transform - Two-Port Circuits.		

Prerequisites: BAS106.

References

1. James, W. Nilsson, "Electric Circuits” 7th Edition, 2009.
2- Joseph, A. "Electric Circuits" McGraw-Hill International Book Company, New York, 1972.

MDE202	Digital Logic Circuits	3 (2,1,1)
Number Systems and Codes - Boolean algebra - Boolean functions - standard forms – simplification - minimization of logic expressions using k-map and tabular methods - Hardware Description Language (HDL) - Digital logic gates - Analysis and Design of combinational logic circuits – combinational logic circuits building blocks - Synchronous sequential circuits -flip-flops - Analysis and design of clocked sequential circuits - synchronous counters - ripple counters. Memory and Programmable Logic; RAM – ROM – PLA - PAL and sequential programmable devices - D/A and A/D converters - Register Transfer Level - Notation, RTL in HDL - Algorithmic State Machine -Binary Multiplier control logic. Asynchronous sequential logic; analysis and design procedure - reduction of states and flow tables - Digital integrated circuits logic families (RTL, DTL, TTL, ECL, MOS and CMOS)		

Prerequisites: ---.

References

1.Digital Electronics, A. D. Godse, D. A. Godse, Technical Publication Pune, 2nd. Ed., 2008.
2.Digital logic design, Brian Holdsworth, Clive Woods. British Library Cataloguing, 4th. Ed., 2002.

MDE204	Electric Applications	3 (2,0,2)
DC machines: Construction - DC windings layout and brushes position – Commutation - DC generator - Voltage regulation - Generator to motor transition - Developed Torque - DC motor-Speed regulation - Armature reaction - Interpoles and compensating winding - Starting DC motor - Losses and efficiency - DC motor characteristics and application - Compound DC motor characteristics - Series motors - Speed control of DC motors - Adjustable-speed drive systems - Dynamic braking, Plugging and Jogging - DC generator characteristics – self excited DC-generator – Voltage build-up– Compound generators – Load characteristics. Transformers Principles – Construction - Phasor diagrams - Equivalent circuits - Transformer losses and efficiency - Transformer tests - Inrush current - Auto transformer - Parallel operation of transformers - 3-Phase transformer and connection groups - Current transformer - Voltage transformer. Laboratory: Basic experiments of DC machines and transformers		

Prerequisites: BAS106 & MDE203.

References

1. Fundamentals of Electrical Drives: Edition 2, Andre VeltmanDuco W.J. PulleR.W. de Doncker 2016.
2. E. Fitzgerald, C. Kingsley and S. Umans, Electric Machinery, McGraw - Hill, 6th. Ed., 2003.
3. Chapman, S. J., Electric Machinery fundamentals, McGraw Hill Co., 1991.

MDE206	Electronic Devices & Circuits	3 (2,1,2)
Bipolar junction transistors: static models, small-signal models, large-signal model, H-parameters, the M-S contacts, the Schottky diode, the Field-effect transistors, large signal and small signal models - Metal oxide semiconductor Field-Effect transistors (MOSFET) - Basic transistor amplifier circuits: dc and ac analysis for the CE, CB, CC, CS, CG and CD connections. The Darlington cascade and composite configurations, Junction Field Effect Transistor (JFET) and its applications. Analysis of the basic logic gates: the DTL, TTL, ECL, P-MOS, N-MOS and CMOS gates Circuit simulation. The IC process: the bipolar process, C-MOS process. The elements of integrated circuits: R, C, L, BJT and MOSFET. The basic integrated circuit building blocks; active loads, current sources and sinks, current mirrors, voltage and current references. Amplifiers: operational amplifiers, difference amplifiers, comparators, op-amp applications; linear and non-linear op-amp circuits; analog signal processing. D/A and A/D converters, switched capacitor filters.		

Prerequisites: MDE203.

References

1. Advanced Electric Drive Vehicles, Ali Emadi 2014.
2.Bose, B.K., Power Electronics and AC Drives, Prentice Hall, 1986.
3.Mohan, N., Undeland, T.M. and Robbines, W.P., Power Electronics: Converters, Applications and Design, John Wiley and Sons Inc., 1990.

MDE207	Measurements and Instrumentations	3 (2,0,2)
Electrical measurements - Measurement errors Accuracy - Statistical analysis - Static calibration - Resolution and precision - Dynamic response – Units Systems - Dimensions and standards -		

Moving-coil instruments - Moving iron instruments, Electro-dynamic instruments - Induction.-type instruments - Current and voltage measurements - Dc bridges - Measurement of power - Measurement of energy and charge - Ac bridges - Resistance and capacitance measurement - Allocation of cable faults - Measurement of frequency and power factor - Measurement of non-electrical variables. Cathode ray-oscilloscope (CRO): Block diagram - vertical deflection circuit - horizontal deflection circuit – Triggering circuits - Multiple trace oscilloscopes – Digital storage oscilloscope – Analog storage oscilloscope. - Strain gauges - Temperature transducers – Displacement - Velocity and acceleration transducers - Force and pressure transducers - Light transducers - Data converters -Voltage-to- frequency converters – A/D, D/A – Basics of digital instruments: time base - amplified DC meter - Digital voltmeters - Digital frequency meters.

Prerequisites: BAS106.

References

1. Sawhney, A. K., A Course in Mechanical Measurements and Instrumentation, Dhanpat and Sons, Delhi, 1989.

2. Doebelin, Erest O., Measurement Systems Applications and Design, McGraw Hill, 1990.

MDE208	Data structures and Algorithms	3 (2,0,2)

Data structures implementation and performance. Techniques for designing algorithms including counting, summation, recurrences, and asymptotic relations; techniques for the design of efficient algorithms, including greedy methods, divide and conquer, and dynamic programming - analysis of complexity - complexity bounds of fundamental problems, graph problems and combinatorial problems. Laboratory: emphasize the relationship between experimental and theoretical performance of algorithms. These labs strongly encourage the use object-oriented programming languages as C sharp or Java.

Prerequisites: MDE103.

References:

1. “Data Structures and Algorithms in Python”, by Michael T. Goodrich, Roberto Tamassia, Michael H. Goldwasser, 1st Edition, Wiley, 2015.

2. “Data Structures and Algorithms in JAVA”, by Michael T. Goodrich, Roberto Tamassia, Michael H. Goldwasser, 6th Edition, Wiley, 2014.

MDE201	Mechanical Engineering	3 (2,0,2)

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.

Prerequisites: BAS202.

References

1.Fundamentals of Fluid Mechanics By B.R. Munson, D.F. Young, T.H. Okiishi, W.W. Huebsch 6th Editon, Wiley, NY (2010).

2.Roberson Crowe, Engineering Fluid Mechanics, Houghton Mifflin Co., 1975.
3. Sonntag, R. E.; Borgnakke, C. and Van Wylen, G. J., Fundamentals of Thermodynamics, John Wiley and Sons Inc., 1998.

MDE301	Signals and Systems	1 (2,2,1)
Signals and systems: Continuous time and discrete-time signals - Exponential and sinusoidal signals - The unit Impulse and unit step functions - Basic system properties -Linear time invariant systems: Discrete-time LTI systems: The convolution sum - Continuous-time LTI systems - Properties of LTI systems - Causal LTI systems described by differential and difference equations - Filters described by differential equations and filters described by difference equations - The continuous-time Fourier Analysis – Energy and power spectral densities.		

Prerequisites: BAS102.

References

1. “Signals and systems” by Alan V.Oppenheim, Alan S.Wilsky, 2nd edition, Prentice Hall, 1997.
2. “Signals and systems” by Simon Haykin, Barry Van Veen, 2nd edition, Wiley India Pvt. Limited, 2007.
3. “Signals and Systems for Bioengineers, Second Edition: A MATLAB-Based Introduction (Biomedical Engineering)” by John Semmlow, Academic Press, 2011.

MDE209	Introduction to Biomedical Engineering	2(2,0,2)
Biological instrumentation, low power consuming circuits especially for implantable pass members, digital signal processing, biomedical applications, micro miniaturization, special electromechanical devices.		

Prerequisites: ---.

References

1. “Introduction to Biomedical Engineering, 3rd Edition” by John Enderle, Academic Press, 2011.
2. “Foot and Ankle Motion Analysis: Clinical Treatment and Technology (Biomedical Engineering)”by Gerald F. Harris, 2007.

MDE303	Microprocessors Based Systems	3 (2,2,1)
Number Systems and Computer Codes – fixed point and floating-point arithmetic. Computer Architecture and micro-operations. Central Processing Unit; Hardware Description Languages (VHDL) Simulation, and Synthesis processes; Computer Arithmetic and ALU Design; Structural Designs in VHDL; implementation of simple processor Datapath; Instruction Set Architecture (ISA) Design; RISC ISA for example MIPS R3000; Translation of High-Level C Constructs into MIPS; Assemblers, and Object Code Generation; Single-Cycle Datapath and Control; Multi-cycle Datapath and Control; Micro-programming and Hard-wired Control Units; Behavioral HDL Description of Systems. Basic Architecture of Microprocessor: Instruction format - Addressing Modes. Software: problem definition – Algorithm – flowcharts - Programming language levels and translators. Programming: arithmetic operations - logic operations - data transfer – branching - subroutines – looping – Interfacing: with ROM - with RAM - I/O interfacing - using interrupts - asynchronous I/O - Address decoding - buffering and delays adjustment - standard bus structures. Selected Architectures of 8-bit microprocessors - support chips. Laboratory projects involve programming in MIPS assembly language using for example the SPIM simulator and solving problems in computer architecture and design using the VHDL hardware description language. All tools run on departmental Windows-PC systems.		

Prerequisites: MDE206.

References:

1. IEEE MICRO, Selected Papers, 1990-Now.
2. ”Microcontrollers: Architecture, Implementation and Programming” by Hintz, K. and Tabak, D., McGraw Hill, 1992.
3. “Computer Organization & Design: The Hardware/Software Interface”, David A. Patterson and John L. Hennessy, 4th Edition, Morgan Kaufmann Publishers, 2013.

MDE304	Embedded Systems	3 (2,0,2)
Fundamentals of embedded system hardware and firmware design. Embedded processor selection, hardware/firmware partitioning, glue logic, circuit design, circuit layout, circuit debugging, development tools, firmware architecture, firmware design, and firmware debugging. Intel 8051 microcontroller. The architecture and instruction set of the microcontroller.		

Prerequisites: MDE303.

References

1. “Programming Embedded Systems, 2nd Edition” by Michael Barr and Anthony Massa, 2006, Publisher(s): O'Reilly Media, Inc., ISBN: 9780596009830.
2. “Introduction to Embedded Systems - A Cyber-Physical Systems Approach, 2nd Edition” by Edward Ashford Lee, and Sanjit Arunkumar Seshia, Publisher: The MIT Press, 2016

MDE305	Anatomy and Physiology	2(2,0,0)
Physiology: Cardiovascular system: cardiac system, regulation, hemodynamics - Circulatory system, cardiac output and control - Respiratory system: pulmonary transport, gas exchange, ventilatory mechanics, respiratory control - Renal system: transport processes, fluid exchange, regulation, acid, base regulation - Gastrointestinal system: secretory function, digestion and absorption, carbohydrate and lipid metabolism, liver function, energetics, temperature regulation - Endocrine system: introduction, processes.		

Prerequisites: ---.

References

1. “Laboratory Atlas of Anatomy and Physiology” by Douglas J. Eder, McGraw-Hill, 2004.
2. “Human Anatomy & Physiology” by Elaine N. Marieb, Benjamin Cummings, 2006

MDE307	Electric Machines	3 (2,0,2)
Magnetics, Electromagnetic Forces, Generated Voltage, and Energy Conversion; Motor Action, and Generator Action. Single-Phase Transformer Principles, construction, Transformer Action, Ideal Transformer, Equivalent Impedance of Transformer, Voltage Regulation, Per-Unit Impedance of Transformer, Transformer Losses and Efficiency. Autotransformers, Buck-Boost Transformers, Parallel Operation of Transformers. Three-Phase Transformers, Instrument Transformers (PT and CT). Principles of DC Machines, Commutation, Armature Winding, Brush Position, Basic DC Generator, Voltage Regulation, Generator-to-Motor and Vice Versa, Developed Torque, Basic DC Motor, Speed Regulation, Interpoles, Armature Reaction, Compensating Winding, Equivalent Circuit, Speed Equation, Armature Control, Field Control, Mechanical Power and Developed Torque, Losses and Efficiency, Starting of DC Motor, DC Machines Characteristics and Applications.		

Prerequisites: MDE203.

References

1. Fundamentals of Electrical Drives: Edition 2, Andre VeltmanDuco W.J. PulleR.W. de Doncker 2016.
2. E. Fitzgerald, C. Kingsley and S. Umans, Electric Machinery, McGraw - Hill, 6th. Ed., 2003.
3. Chapman, S. J., Electric Machinery fundamentals, McGraw Hill Co., 1991.

MDE306	Control Theory	3 (2,1,1)
Mathematical modeling of physical systems, complex-variable concept - differential equations - Laplace transform - Transfer function - Block diagrams - Signal-flow graphs - State diagram. Linearization of nonlinear systems. State-variable analysis, relationship between state equations and transfer functions - characteristic equation. Stability of linear control systems. Time-domain analysis and design of control systems. Lead-lag controllers. State-feedback, Pole-placement, Nyquist stability criterion, linear control systems with time delays – data control systems: PI – PID – Phase-Lead – Phase-Lag, Lead-Lag (Lag-Lead) – PID controller design using Ziegler and Nichols tuning methods. PID controller design using other advanced techniques.		

Prerequisites: MDE204 & MDE301.

References:

1. “Modern Control Systems”, by by Richard Dorf and Robert Bishop, 13th Edition, Pearson, 2016.
2. “Electrical Machines, Drives and Power Systems”, by THEODORE WILDI, Pearson New International Edition, 2005.

MDE308	Digital Signal Processing	3 (2,1,1)
Introduction to DSP systems and A/D and D/A converters - Fundamentals of discrete-time signals and systems. Frequency domain representation - the DTFT. Sampling theory - The Z-transform and realization of discrete-time systems - Design of digital FIR filters - Design of Digital FIR filters using Fourier series and other methods - The DFT and the FFT: definitions, properties, and applications - Introduction to the architecture of DSP chips and comparing it to microprocessors - Advanced topics: under-sampling - over-sampling – decimation – interpolation - the use of dithering - the effect of finite register lengths - and other recent topics.		

Prerequisites: MDE301.

References:

1. “Digital Signal Processing; A practical guide for Engineers and Scientists” by Steven Smith, Newnes,2002.
2. “Digital Signal Processing: Fundamentals and Applications” by Lizhe Tan, Jean Jiang, Academic Press; 3rd Edition, 2018.
3. “Understanding Digital Signal Processing” by Richard G. Lyons, Second Edition, PEARSON INDIA; 3rd Edition, 2011.

MDE401	Image Processing	3(2,1,0)
Introduction, A/D and D/A Conversion, Fundamental steps in Digital Image Processing, Elements of Visual Perception, Image sampling and quantization, Histogram Processing, DSP and Digital Filter Design, Two-dimensional Fourier transform, Image degradation models and Restoration, Periodic noise reduction in frequency domain, Color transformation, Color Enhancement, Wavelet and Multi-resolution image Processing, Image Compression Models, Signal Compression, Morphological Image Processing, Image Segmentation, Medical Imaging Systems,		

Prerequisites: MDE308.

References

1. “Digital Image Processing”, R. C. Gonzalez and R. E. Woods, 4th edition, Pearson Inc., 2018.
2. “Principles of Digital Image Processing”, by Wilhelm Burger, Mark J. Burge, Kindle edition, Springer, 2013

MDE402	Bioelectronics	4 (2,2,2)
Examines the implementation of modern measurement techniques and associated instrumentation using distributed computers. Practical hardware aspects, including measurement and actuation, data conditioning, acquisition and transmission, microprocessor devices, and other distributed computing components. Commercial realizations ranging from PLCs to full process control computing systems.		

Prerequisites: MDE206.

References:

1. "Bioelectronics: From Theory to Applications", Itamar Willner, Wiley-VCH, 2005.
2. "Electronic Instrumentation and Measurements", David A. Bell, 2013.

MDE405	Hospital Instrumentation	3 (2,2,0)
Basics of Therapeutic and Prosthetic Devices – Implementable Devices – Lithotripsy Types and Instrumentation – Artificial Kidney and Dialysis Machines – Heart-Lung Machines – Surgical Instrumentation – Electrical Safety in Medical Devices. Data Acquisition and Distribution System: Principles, Review of Sampling Theory, Analog to Digital Converters, Digital to Analog Converters, Sample and Hold Circuits, and Analog Multiplexers, Biomedical Measurements: Respiratory System Measurements (Air Flow and Flow Rate), Cardiac Measurements (Blood Flow, Blood Pressure and Cardiac Output).		

Prerequisites: MDE207.

References:

1. “Encyclopedia of Medical Devices and Instrumentation” by Akay M., Wiley-Liss, 2006.
2. “Design and development of medical electronic instrumentation: a practical perspective of the design, construction, and test of medical devices” by David Prutchi, Wiley-Liss, 2004.

MDE309	Computer Architecture	3 (2,1,1)
Basics of Computer Architecture, Computer arithmetic: Fixed-point arithmetic operations, Floating-point Arithmetic Operations, multiplication techniques, Instruction Set Architecture: introduction to ISA, Instruction formats- Instruction types and addressing modes, instruction cycle , Assembly language programming, Single cycle Data path design, RISC and CISC architecture, Memory Hierarchy Design: A Top Level View, Cache Memory, Main Memory, Virtual Memory.		

Prerequisites: MDE202.

References

1. “Microprocessors Interfacing and Application” by Renu Singh, B. P. Singh, New Age International Publishers, 2002.
2. “Microcontrollers: Architecture, Implementation and Programming” by Hintz, K. and Tabak, D., McGraw Hill, 1992.

MDE407	Medical Imaging	3 (2,1,0)
Physical principles of medical imaging. Principles of operation for imaging modalities such as x-ray, ultra-sound, magnetic resonance, and nuclear medicine.		

Prerequisites: MDE401.

References:

1. "Medical Imaging Physics" by William R. Hendee, Wiley-Liss, 2002.
2. "Introduction to medical imaging" by A. A. Bharath, Morgan and Claypool Publishers, 2008.
3. "Biomedical Imaging and Computational Modeling in Biomechanics" by Marina E. Plissiti, Springer, 2013.

MDE404	Bioinformatics	3 (2,1,0)
Introduction to the storage, representation, integration, analysis, and retrieval of bioinformatics data. Introduction to genomics and basic sequence manipulations and analyses (e.g. sequence assembly and editing; gene prediction; database searching, retrieval, and similarity analysis).		

Prerequisites: MDE208.

References:

1. "Knowledge discovery in bioinformatics: techniques, methods, and applications" by Xiaohua Hu, 2007.
2. "Algorithms in Bioinformatics" by Eric Tannier, 8th International Workshop, WABI 2008, Karlsruhe, Germany, 2008.

MDE310	Artificial Intelligence (AI) in Medical field	3 (2,1,1)
Introduction to decision theory, artificial intelligence, heuristic search, uncertain reasoning, classification and machine learning. Acquisition and representation of clinical expertise in the computer. Example applications of using AI in medical diagnosis.		

Prerequisites: BAS310.

References

1. "Beginning Artificial Intelligence with the Raspberry Pi Donald" by J. Norris, Jun 2017
2. "Principles of Artificial Intelligence" by Nils J. Nilsson, Jun 2014

MDE411	Biomechanics	3 (2,2,1)
Application of statics to the musculoskeletal system: Systems in equilibrium, joints, muscle forces, joint reaction forces, indeterminate problems. Application of dynamics to study human motion: Linear and angular kinematics, linear and angular kinetics, impulse and momentum, work and energy. Strength of materials: stress and strain, elastic and viscoelastic materials, linear and nonlinear constitutive equations. Material properties of biological tissues: bone, muscle, cartilage, tendons and ligaments. Assessment of failure of bone under different loading conditions. Selected advanced topics: prosthetics design, total hip joint replacement.		

Prerequisites: BAS107& MDE308.

References

1. "Biomechanics: Principles, Trends and Applications" by Jerrod H. Levy, Nova Science Publishers, 2009.
2. "Engineering Biomaterials for Regenerative Medicine: Novel Technologies for Clinical

Applications" by Srinivas D. Narasipura, Springer, 2012.

MDE312	Rehabilitation Engineering and Assistive Technology	3 (2,2,1)
Seminar in musculoskeletal rehabilitation: gait analysis, kinetic and kinematic measurement systems. Design of orthotic and prosthetic devices, design of robotic rehabilitation devices, functional electrical stimulation (FES), BCI for rehabilitation, evaluation of rehabilitation and orthotic devices, neural engineering. Current research will be reviewed and discussed.		

Prerequisites: BAS107.

References

1. "Rehabilitation engineering applied to mobility and manipulation" by Rory A. Cooper, Institute of Physics Pub, 1995.
2. "Intelligent systems and technologies in rehabilitation engineering" by Horia-Nicolai Teodorescu, CRC Press, 2001.

MDE313	Medical Robotics	3 (2,2,1)
An introduction to the kinematics, dynamics, and control of robot manipulators, robotic vision, sensing, and the programming of robots. Inverse kinematics of serial chain manipulators. The manipulator Jacobian, force relations, dynamics and control-position, and force control. Trajectory generation, collision avoidance, automatic planning of the gross motion strategies, robot programming languages. Proximity, tactile, and force sensing. Network modeling, stability are fidelity in tele-surgery. Biological analogies and medical applications of robotics.		

Prerequisites: BAS107.

References

1. "Autonomous Control Systems and Vehicles: Intelligent Unmanned Systems" by Kenzo Nonami Muljowidodo Kartidjo Kwang-Joon Yoon Agus Budiyono, May 2013.
2. "Introduction to Al Robotics" by Murphy, Robin R., MIT Press, 2000.
3. "Efficient Dynamic Simulation of Robotic Mechanisms" by Kathryn Lilly, 2012.

MDE314	Cardiovascular Biomechanics	3 (2,2,1)
Review of relevant theories in Fluid Mechanics, followed by anatomy and physiology of the cardiovascular system, including blood rheology and vessel tissue mechanics. Cardiovascular anatomy using state-of-the-art Virtual Reality equipment. Modelling, analytical and experimental methods applied to several parts of the cardiovascular system. Application of modelling techniques to investigate correlations with disease.		

Prerequisites: BAS107.

References

1. "Biomechanics of Soft Tissue in Cardiovascular Systems" by Gerhard A. Holzapfel, Springer, 2003.
2. "Cardiovascular Biomechanics" by Peter R. Hoskins, Springer-Verlag London, 2017.

MDE415	Advanced Human Biodynamics	3 (2,2,1)
Human muscular-skeletal system explored in relation to engineering principles, focusing on torso, back, hip, neck and shoulder, hand, wrist, elbow, and knee. Emphasis is placed on function, biomechanics, biodynamics and modeling. Basic principles of human physiology presented from		

the engineering perspective. Bodily functions, their regulation and control discussed in quantitative terms and illustrated by mathematical models where feasible.

Prerequisites: BAS107& MDE308.

References

1. “The Muscular System Manual: The Skeletal Muscles of the Human Body” by Joseph E. Muscolino, Mosby, 2016.
2. “Foot and Ankle Motion Analysis: Clinical Treatment and Technology (Biomedical Engineering)”by Gerald F. Harris, 2007.

MDE416	Artificial Organs	3 (2,2,1)
Introduction of existing artificial organs, prostheses, and rehabilitation systems, focusing on their goals, working principles, and limitations. It further stimulates the student's innovation skills through the deep understanding of the global problem of interfacing a human with such a device.		

Prerequisites: MDE308.

References

1. “Artificial Organs” by Michael Devile, Springer-Verlag London, 2009.
2. “Biomaterials for Artificial Organs” by Michael Lysaght, Woodhead Publishing, 2011.

MDE317	Kinematics and Kinetics of Human Movement	3 (2,2,1)
Basic mechanical principles of physical activity and exercise. Quantitative and qualitative biomechanical analyses of human movement. The structure, composition, and behavior of basic skeletal and muscular tissue, pathomechanics of injury, adaptation to load and degenerative changes associated with aging are discussed within the scope of scholarly literature		

Prerequisites: BAS107.

References:

1. ArthurG. Erdman, George N. sandor, Sridhar Kota, Mechanism design: analysis and synthesis,. Prentice hall, 4th Ed., 2001.
2. Hans dreig franz holzweibig dynamics of machinery theory and applications springer 1st ed 2010.
3. David Hmyszka machines and mechanisms applied kinematic analysis prentice hall 3rd ed 2004.
4. Meriam I.L & Kraige L.G Engineering Vol #2 Dynamics wiley 6th ed 2006.
5. Wilson CE sadler JP kinematics & dynamics of machinery prentice hall 3rd ed 2006.

MDE418	Machine Learning in Medicine	3 (2,2,1)
Introduction to Machine Learning; Univariate and Multivariate linear regression; Logistic regression; Neural Networks; Genetic Algorithms; Support Vector Machines; Unsupervised learning; Reinforcement Learning; Anomaly detection; Recommender systems; Large-scale machine learning.		

Prerequisites: MDE310.

References:

1. “Machine Learning Engineering”, By Andriy Burkov, True Positive Inc., 2020.
2. “Building Machine Learning powered applications”, by Emmanuel Ameisen, 1st edition, O'Reilly Media, 2020.

MDE419	Deep Learning in Medicine	3 (2,2,1)
Foundations of Deep Learning, how to build neural networks, and how to lead successful machine learning projects. How to drive performance, effectively use the common neural network, including initialization, L2 and dropout regularization, Batch normalization, gradient checking.		

Prerequisites: MDE310.

References

1. “Deep Learning and Convolutional Neural Networks for Medical Image Computing: Precision Medicine, High Performance and Large-Scale Datasets” by Le Lu, Apress, (2020).

2.“Applied Machine Learning for Health and Fitness: A Practical Guide to Machine Learning with Deep Vision, Sensors and IoT” by Kevin Ashley, Springer, (2017).

MDE421	Medical Image Computing	3 (2,2,1)
Application of new parallel processing platforms in solving biomedical engineering problems: introduction to programming parallel processing platform such as multi-core processors and GPUs; pitfalls in parallel computing; developing parallel algorithms for different biomedical applications such as image reconstruction, visualization, in silico methods in genomics and proteomics; advanced topics and applications.		

Prerequisites: MDE407 & BAS301.

References

1. “Introduction to Medical Imaging: Physics, Engineering and Clinical Applications” by Andrew Webb, Cambridge University Press, (2010).

2.” Handbook of Medical Imaging: Processing and Analysis Management” by Isaac Bankman, Academic Press, (2000).

MDE422	Advanced Medical Imaging Systems	3 (2,2,1)
Introduction to Digital Image Processing, Digital Imaging Information Technology, Digital Image Acquisition, X-Ray and Radiology, Magnetic Resonance Imaging, Computed Tomography, Digital Imaging and Diagnosis.		

Prerequisites: MDE407.

References

1. “Advances in Optical Imaging for Clinical Medicine” by Nicusor Iftimia, Wiley Series, (2011).

2.”Computational Intelligence: An Introduction (2nd ed.)” by Engelbrecht A., John Willey and Sons, (2007).

MDE423	Computational Methods for Medical Image Analysis	3 (2,2,1)
Comprehensive overview on the mathematical techniques and methods used in the image processing science. Inverse problems in image processing, regularization methods for ill-posed problems and solutions to large scale inverse problems. Stochastic image analysis, modeling of image intensity distribution, local smoothing filters, wiener filters, image segmentation, and shape analysis. Practical implementation and numerical case studies of real image processing problems.		

Prerequisites: MDE407.

References

1.“Computational Intelligence. In: Encyclopedia of Life Support Sciences” by Craenen B., Eiben A., EOLSS Publishers Co., (2003).

2.”Computational Intelligence: An Introduction (2nd ed.)” by Engelbrecht A., John Willey and Sons, (2007).
3.”Artificial Intelligence: A Modern Approach, (2nd ed.)” by Russell S., Norwig P., Prentice Hall, (2003).

MDE327	RF (Radiofrequency) Medical Devices	3 (2,2,1)
Applications of electromagnetics and RF in medicine and in other devices that can cause thermal safety hazards. Topics such as Maxwell Equations, Wave Equations, Transmission Lines, Electromagnetic Theorems, Introduction to Antennas, and Introduction to Computational Electromagnetics will be presented. The class will include analyses of several RF devices used in medical applications and/or have electromagnetic safety implications such as magnetic resonance imaging (MRI), biological sensors (brain machine interface), RF ablation, and cell phones. Upon completing the course, the student should be able to describe how to apply fundamental electromagnetic principles to set up and solve problems in RF devices used in medical applications.		

Prerequisites: BAS202.
References
1. "Data_Communications_and_networking" by A. Behrouz Forouzan, 5th edition, McGraw-Hill Education (India), 2012.
2. "Communication Systems for the Mobile Information Society" by Martin Sauter, 2006.

MDE328	Biomedical Optical Microscopy	3 (2,2,1)
Fundamental background of tissue optics; Understanding of physics, strengths, and limitations of various existing bio-optical imaging technologies. Optical properties of tissue, and photon-tissue interactions. Monte Carlo simulation. Sensing of optical properties and spectroscopy. Ballistic imaging. Wide-field and dark-field microscopy. Polarization, phase contrast, and differential interference contract microscopy (DIC) microscopy. Fluorescence microscopy. Confocal microscopy. Two-photon microscopy. Optical coherence tomography. Super-resolution imaging		

Prerequisites: MDE202.
References
1. “Basic Physics: A Self-Teaching Guide” by K Kuhn, Noah Books, 2018.
2. “Biomedical Optical Phase Microscopy and Nanoscopy” by Lisa L. Satterwhite, Academic Press, 2012.
3. “Microscopy, Optical Spectroscopy, and Macroscopic Techniques” by Christopher Jones, Humana Press, 1993.

MDE331	Bioinstrumentation: Biosignals and Biosensors	3 (2,2,1)
Measurement principles of sensors found in health technologies, ranging from medical devices used in hospitals to wearables for fitness monitoring. Bio-potential amplifiers, record and interpret bioelectrical data (e.g. heart activity, muscle activity). Principles underlying the instrumentation for measuring respiratory and cardiovascular function such as blood pressure, blood flow as well as biochemical sensors and neuro-stimulators.		

Prerequisites: MDE209.
References

1.” Bioinstrumentation and Biosensors” by Wise D.L. (ed.), Dekker, 1993.
2.” Bioinstrumentation” by John D. Enderle, Morgan & Claypoool, 2006.

MDE332	Clinical Engineering Fundamentals	3 (2,2,1)
Equipment control concepts and techniques and their application in hospitals and in the medical profession; device evaluation specifications; codes & standards; preventive maintenance and service; calibration and medical product liability.		

Prerequisites: MDE209.
References
1.” Clinical Engineering (Principles and Applications in Engineering)” by Yadin David, 2003.
2.” Artificial Sight: Basic Research, Biomedical Engineering, and Clinical Advances” by Hossein Ameri, Springer-Verlag, 2008.

MDE333	Clinical Equipment Management	3 (2,2,1)
The course introduces the students to the main principles of clinical Equipment Management, Device Risk Management and Governance. The aim of the course is to provide students with an insight into the problems and challenges of managing clinical equipment within a healthcare system; to develop an awareness of the business process; to increase their knowledge about Device Risk Management and Governance in Healthcare; to develop awareness of how maintenance of equipment is influenced by its design.		

Prerequisites: MDE209.
References
1.” Spinal Reconstruction: Clinical Examples of Applied Basic Science, Biomechanics and Engineering” by Kai-Uwe Lewandrowski, Informa Healthcare, 2007.
2.” Medical Instrumentation: Accessibility and Usability Considerations” by Winters, Jack M., CRC Press, 2006.

MDE434	Medical Instrumentation in the Hospital	3 (2,2,1)
The course introduces the students to the medical Equipment often used by patients or used medical and nurses in the hospital.		

Prerequisites: MDE209.
References
1.” Medical Instrumentation Application and Design, 4th Edition” by John G. Webster, 2009.
2.” Design and Development of Medical Electronic Instrumentation: A Practical Perspective of the Design, Construction, and Test of Medical Devices” by David Prutchi, Wiley, 2004.

MDE436	Clinical Systems Engineering	3 (2,2,1)
History and evolution of clinical decision support systems; Clinical context of CDSS; The value of CDSS in the modern practice of medicine; Healthcare standards related to CDSS; Design and validation methods of CDSS; Receiver Operating Characteristic (ROC) curves; Policies affecting CDS deployments: ethical/legal issues and clinical trials; Examples of existing CDSS.		

Prerequisites: MDE209.

References
1.” Clinical Engineering Handbook (Biomedical Engineering)” by Joseph Dyro, Academic Press, 2004.
2.” Clinical engineering: from devices to systems” by Dori, Academic Press, 2016.

MDE437	Medical Device Cybersecurity	3 (2,2,1)
Introduction to cybersecurity primitives and algorithms. Key requirements for marketing medical device software, Medical device software life cycle processes, vulnerabilities, Software Safety Classification. Cybersecurity requirements. Software life cycle process with cybersecurity. State-of-the-Art of Cybersecurity for IoT applied to Medical industry. Threat Analysis and Risk Assessment (TARA). Demonstrating Conformity.		

Prerequisites: MDE209.
References:
1. “Fundamentals of Information Systems Security”, by David Kimis and Michel Solomon, 3rd edition, Jones & Bartlett Learning, 2016.
2. “Introduction to Cryptography and Network Security”, by Behrouz A.Forouzan, McGraw-Hill International Edition, 2014.

MDE341	Computer Applications in Bioengineering	3 (2,2,1)
Computer lectures and applications in Bioengineering.		

Prerequisites: MDE103.
References
1.” Computer modeling in bioengineering: theoretical background, examples and software” by Milos Kojic, John Wiley & Sons, 2008.
2. “Circuits, Signals, and Systems for Bioengineers: A MATLAB-Based Introduction” by John Semmlow, Academic Press, 2005.

MDE442	Biomedical Applications of Signal Processing	3 (2,2,1)
This course in biomedical signal processing presents the relationships among different theoretical measures of biomedical signals and an understanding of the information these measures provide regarding the sources of signals and the behaviors of their sources in response to natural or imposed perturbations.		

Prerequisites: MDE308.
References:
1. “Bioelectrical Signal Processing in Cardiac and Neurological Applications”by Leif Sornmo, Academic Press; 2005.
2. “Advanced Signal Processing Handbook: Theory and Implementation for Radar, Sonar, and Medical Imaging Real Time Systems” by Stergios Stergiopoulos, CRC Press; 2000.
3. “Biomedical Signal Processing: Advances in Theory, Algorithms and Applications” by Ganesh NaikSpringer Singapore; 2020.

MDE443	Analog Communication Systems	3 (2,2,1)
Introduction to communication systems, Fourier theory and communication signals. Amplitude modulation. Angle modulation. Random variables and processes. Noise in analog modulation. Frequency bands. RF propagation.		

Prerequisites: MDE304.

References:

1. “Modern Digital and analog communication system” by Lathi Ding, Oxford University Press; 5th Edition, 2018.

2. “Electronic communication”by Roddy and Coolen, Pearson Education, 4th Edition, 2008.

MDE444	Digital Communication Systems	3 (2,2,1)
Introduction of digital communication systems. Mathematical foundation of decomposing the systems into separately designed source codes and channel codes. Principles of commonly used algorithms to convert continuous time waveforms into bits, and vice versa. Comprehensive introduction to the basics of information theory, treatment of Fourier transforms and the sampling theorem, and an overview of the use of vector spaces in signal processing.		

Prerequisites: MDE304.

References

1. “Digital Communications” by John G. Proakis, McGraw-Hill Companies, 5th edition, 2018.

2. “Fundamentals of Digital Communication” by Upamanyu Madhow, 2012.

3. “Wireless Communications Systems: an Introduction” by Haupt, Wiley-IEEE Press; 1st Edition, 2019.

MDE345	Digital and Analog Filters Design	3 (2,2,1)
Analysis, design, and realization of digital filters. Discrete Fourier Transform algorithms, digital filter design procedures, coefficient quantization. Design of Infinite Impulse Response (IIR) digital filters by transformation from analog filters: Impulse Invariance, Bilinear Transformation. Design of Finite Impulse Response (FIR) digital filters by Windowing, Frequency Sampling. Computer Aided Design of FIR and IIR digital filters by Criterion Minimization. Implementation aspects: quantization of parameters, finite word length, and filter structure.		

Prerequisites: MDE206.

References:

1. “Adaptive Signal Processing: Next Generation Solutions”, by Tulay Adali and Simon Haykin, 2010.

2. “Adaptive signal processing”, Bernard Widrow, Pearson; 1st Edition.

MDE346	Vision Sensors	3 (2,2,1)
Fundamentals of vision cameras and other sensors. Mirror-based and solid-state devices (CCD, CMOS). Use of sensors and understand, model and deal with the uncertainty (noise) in measurements. Conventional "single viewpoint" or "perspective" cameras. Recent "multi-viewpoint" or "multi-perspective" cameras that includes a host of lenses and mirrors.		

Prerequisites: BAS202.

References

1.“Computer Vision: Principles and Practice” by Pedram Azad, TiloGockle, R. Dillmann, Elektor Electronics Publishing, 2008.

2. “Computer Vision: Principles, Algorithms, Applications, Learning”, by E. R. Davies , 5th edition, Academic Press, 2017.

3. “Vision Sensors and Edge Detection”, by Francisco Gallegos-Funes, Academic Press, 2012.

برنامج هندسة البناء

BUILDING ENGINEERING PROGRAM

(BLE)

BUILDING ENGINEERING (BLE) PROGRAM

1. FACULTY VISION

The faculty of Engineering at BNU, looking forward to being a leading faculty at the national, regional, and international levels in engineering education fields, scientific research, innovation, and entrepreneurship to achieve the sustainable development of humankind.

2. FACULTY MISSION

The faculty of Engineering at BNU is committed to prepare graduates with the skills and to attain competence as professional engineers and researchers, and to interact with industry and community within the framework of human values and social responsibility.

3. PROGRAM VISION

The BLE program at BNU, aspires to be a leading program in education and scientific research in the fields of building engineering at the regional and international levels and to provide an outstanding community service.

4. PROGRAM MISSION

Our mission is to provide high quality undergraduate education that will prepare graduates for successful careers in building engineering and related fields to support the local, regional, and international needs.

5. PROGRAM OBJECTIVES

1. Providing students with the ability to apply knowledge in mathematics and basic sciences to model problems related to building systems.
2. Providing students with basic knowledge in various fields of building engineering such as:, building materials selection, modern building information modeling techniques, structural analysis, structural design, building safety, building services and energy conservation in buildings …etc.
3. Providing students with the communication skills and responsible teamwork, establish professional attitudes and ethics, so that graduates are prepared for a complex modern work environment.
4. Prepare students for outstanding work in scientific research as well as engage in self-learning and lifelong learning.

5. Qualify students with creative thinking and innovation skills to solve risks problems, cost and time optimization, contracts & bidding issues considering impacts of engineering solutions on society & environment.

6. GRADUATE ATTRIBUTES

From NARS 2018 all engineering graduates must possess the following attributes:

1. Master a wide spectrum of engineering knowledge and specialized skills and can apply acquired knowledge using theories and abstract thinking in real life situations.
2. Apply analytic critical and systemic thinking to identify, diagnose and solve engineering problems with a wide range of complexity and variation.
3. Behave professionally and adhere to engineering ethics and standards.
4. Work in and lead a heterogeneous team of professionals from different engineering specialties and assume responsibility for own and team performance.
5. Recognize his/her role in promoting the engineering field and contribute in the development of the profession and the community;
6. Value the importance of the environment, both physical and natural, and work to promote sustainability principles.
7. Use techniques, skills and modern engineering tools necessary for engineering practice.
8. Assume full responsibility for own learning and self-development, engage in lifelong learning and demonstrate the capacity to engage in post- graduate and research studies.
9. Communicate effectively using different modes, tools and languages with various audiences; to deal with academic/professional challenges in a critical and creative manner.
10. Demonstrate leadership qualities, business administration and entrepreneurial skills.
11. In addition to the above attributes all the building engineering graduates must possess the following technical attributes:
12. Understand the principles and theories of construction engineering and management sciences to solve construction industry and scientific research problems.
13. Apply analytical, experimental and design techniques in the design work and supervision of construction projects using modern technology.
14. Comprehend the national and international laws affecting the building profession.
15. Acquire creative thinking and innovation skills to solve risks problems, cost, resources, and time optimization, contracts & bidding issues.

7. PROGRAM COMPETENCIES

According to the National Academic Reference Standard (NARS) 2018, all engineering programs must satisfy the following Competencies:

1- General Engineering Competencies according to NARS 2018		
Level A (NARS)	**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, analyze 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, taking into consideration other trades requirements.
	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.

In addition to the general engineering competencies and considering that the building program is closely related to civil engineering, the following competencies must be satisfied:

2- Civil Engineering Competencies according to NARS 2018		
Level B (NARS)	**B1**	Select appropriate and sustainable technologies for construction of buildings, infrastructures and water structures; using either numerical techniques or physical measurements and/or testing by applying a full range of civil engineering concepts and techniques of: Structural Analysis and Mechanics, Properties and Strength of Materials, Surveying, Soil Mechanics, Hydrology and Fluid Mechanics.
	B2	Achieve an optimum design of Reinforced Concrete and Steel Structures, Foundations and Earth Retaining Structures; and at least three of the following civil engineering topics: Transportation and Traffic, Roadways and Airports, Railways, Sanitary Works, Irrigation, Water Resources and Harbors; or any other emerging field relevant to the discipline.
	B3	Plan and manage construction processes; address construction defects, instability and quality issues; maintain safety measures in construction and materials; and assess environmental impacts of projects.
	B4	Deal with biddings, contracts and financial issues including project insurance and guarantees.

Moreover, as the building program graduates must exhibit additional competencies as follows:

3- Building Engineering Competencies (ARS)		
Level D (ARS)	D1	Produce designs that meet building users' requirements through understanding the relationship between people and buildings, and between buildings and their environment; and the need to relate buildings and the spaces between them to human needs and scale.
	D2	Generate ecologically responsible, environmental conservation and rehabilitation designs; through understanding of: structural design, construction, technology and engineering problems associated with building designs.
	D3	Demonstrate additional abilities to identify, formulate, and solve a range of construction engineering problems such production and inventory, facility location, logistics, capital investment evaluation and resource allocation.
	D4	Demonstrate additional capabilities to enhance life cycle sustainability of the buildings, building energy systems, taking advantage of climate and natural resources to develop passive design strategies and sustainable architecture.

For determination the compatibility of program objectives with its competencies, the following matrix can be used:

Program Objectives	Program Competencies																	
	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	B1	B2	B3	B4	D1	D2	D3	D4
Objective #1	√		√			√					√	√						
Objective #2											√	√	√				√	√
Objective #3							√	√	√					√	√			
Objective #4					√					√								√
Objective #5				√									√	√		√	√	√

MATRIX RELATING THE PROGRAM COURSES WITH COMPETENCIES

Course Code	Course Name	Engineering Competencies NARS (2018)										Civil Engineering Competencies (NARS)				Building Engineering Competencies (ARS)			
		A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	B1	B2	B3	B4	D1	D2	D3	D4
GEN000	English Language (A remedy course)							√	√										
GEN201	Information Technology	√	√						√		√								
GEN301	Current Social Issues in Egypt			√				√	√										
GEN401	Professional Ethics			√	√														
GEN101	English Language							√	√										
GEN102	German Language							√	√										
GEN104	History of Science, Engineering& Technology								√	√	√								
GEN202	Communication & Presentation Skills							√	√		√								
GEN407	Entrepreneurship						√		√	√	√								
BAS101	Differential Calculus and Algebra	√		√															
BAS102	Integral Calculus & Analytical Geometry	√		√															
BAS103	Physics of Materials	√	√																
BAS105	Statics & Dynamics (1)	√		√															
BAS106	Physics of Electricity & Magnetism	√	√			√													
BAS107	Statics & Dynamics (2)	√		√															
BAS201	Probability and Statistical Methods	√	√																

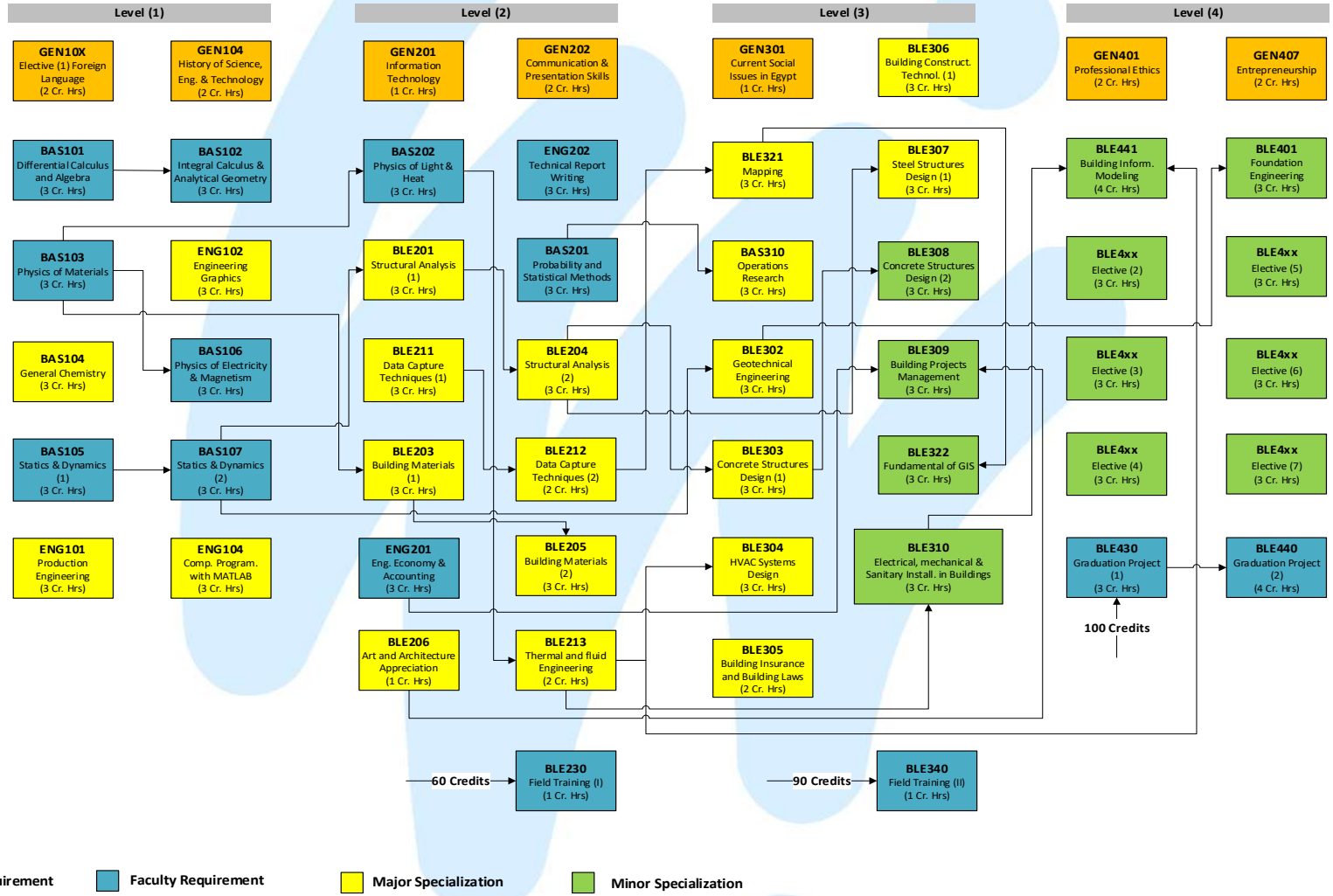
Course Code	Course Name	Engineering Competencies NARS (2018)										Civil Engineering Competencies (NARS)				Building Engineering Competencies (ARS)			
		A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	B1	B2	B3	B4	D1	D2	D3	D4
BAS202	Physics of Light & Heat	√	√			√													
ENG201	Engineering Economy & Accounting	√		√							√								
ENG202	Technical Report Writing							√	√		√								
BLE240	Field Training (I)		√						√					√	√				
BLE340	Field Training (II)		√						√					√	√				
BLE430	Graduation Project (1)					√		√	√				√						
BLE440	Graduation Project (2)					√		√	√				√						
BAS104	General Chemistry	√	√			√													
ENG102	Engineering Graphics	√			√				√										
ENG310	Operations Research	√	√							√	√								
ENG101	Production Engineering		√		√			√											
ENG104	Computer Programming with MATLAB	√	√					√			√								
BLE201	Structural Analysis (1)	√			√							√							
BLE203	Building Materials (1)	√				√						√							
BLE204	Structural Analysis (2)	√			√							√							
BLE211	Data Capture Techniques (1)		√						√			√							
BLE212	Data Capture Techniques (2)		√						√			√							

Course Code	Course Name	Engineering Competencies NARS (2018)										Civil Engineering Competencies (NARS)				Building Engineering Competencies (ARS)			
		A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	B1	B2	B3	B4	D1	D2	D3	D4
BLE213	Thermal and fluid Engineering	√	√									√							
BLE205	Building Materials (2)	√				√						√							
BLE302	Geotechnical Engineering	√	√			√						√							
BLE303	Concrete Structures Design (1)				√								√				√		
BLE304	HVAC Systems Design		√				√	√									√		√
BLE305	Building Insurance and Building Laws							√		√					√	√			
BLE306	Building Construction Technology (1)						√								√	√	√	√	
BLE307	Steel Structures Design (1)				√								√				√	√	
BLE308	Concrete Structures Design (2)				√								√				√		
BLE309	Building Projects Management						√			√	√			√	√				
BLE310	Electrical, Mechanical and Sanitary Installations in Buildings						√	√						√		√			√
BLE321	Mapping								√					√		√		√	
BLE322	Fundamental of GIS (Geographical Information Systems)								√					√		√		√	
BLE441	Building Information Modeling (BIM)								√		√					√	√		
BLE400	Foundation Engineering	√	√			√							√						
BLE401	Network Analysis								√					√		√		√	
BLE402	Advanced Building Projects Management									√	√			√	√			√	

Course Code	Course Name	Engineering Competencies NARS (2018)										Civil Engineering Competencies (NARS)				Building Engineering Competencies (ARS)			
		A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	B1	B2	B3	B4	D1	D2	D3	D4
BLE403	Advanced BIM								√		√					√	√		
BLE404	Building Construction Technology (2)						√								√	√	√	√	
BLE405	Concrete Structures Design (3)				√								√				√		
BLE406	Steel Structures Design (2)				√								√				√		
BLE407	Advanced Building Materials					√						√		√					√
BLE408	Repair and Strengthening of Buildings										√	√		√			√		√
BLE409	Structural Analysis (3)	√			√												√		
BLE410	Computer Aided Structural Analysis	√			√				√								√		
BLE411	Building Construction Equipment													√				√	√
BLE412	Building Life Cycle Costing			√	√									√			√		√
BLE413	Fundamentals of Facility Management			√				√									√	√	√
BLE414	Renovation, Restoration and Adaptive Use										√	√		√			√		√
BLE415	Alternative and Renewable Energy Systems in Buildings			√				√						√					√
BLE416	Building Real Estate Development: Market Studies and Marketing							√		√					√			√	
BLE417	Smart Buildings							√					√			√			√

جامعة بنها الأهلية
Benha National University
BNU

FLOWCHART FOR BUILDING ENGINEERING (BLE) PROGRAM COURSES



BUILDING ENGINEERING (BLE) PROGRAM
COURSES CLASSIFICATION AND PERCENTAGES

#	Subject Area	CR	%	Min. Percentage according to reference framework (%)
1	University Requirements	12	8.33	8
2	Faculty Requirements	39	27.08	20
3	Major Specialization Subjects	53	36.81	35
4	Minor Specialization Subjects	40	27.78	Maximum 30
		144	**100**	**100**

BUILDING ENGINEERING (BLE) PROGRAM
LIST OF COURSES

Code	Course	CR	Lec	Tut	Lab	Pre-Req.
(A) University Requirements (12 Credits)						
GEN000	English Language (A remedy course)	0	0	0	0	---
GEN201	Information Technology	1	1	0	0	---
GEN301	Current Social Issues in Egypt	1	1	0	0	---
GEN401	Professional Ethics	2	2	0	0	---
GEN10X	Elective (1) From Language Courses List	2	1	2	0	---
GEN104	History of Science, Engineering & Technology	2	2	0	0	---
GEN202	Communication & Presentation Skills	2	1	2	0	---
GEN407	Entrepreneurship	2	1	2	0	---
(B) Faculty Requirements (39 Credits)						
BAS101	Differential Calculus and Algebra	3	2	2	0	-
BAS102	Integral Calculus & Analytical Geometry	3	2	2	0	BAS101
BAS103	Physics of Materials	3	2	0	3	-
BAS104	General Chemistry	3	2	0	2	-
BAS105	Statics & Dynamics (1)	3	2	2	0	-
BAS106	Physics of Electricity & Magnetism	3	2	0	3	BAS103
BAS107	Statics & Dynamics (2)	3	2	2	0	BAS105
ENG101	Production Engineering	3	2	0	3	-
ENG102	Engineering Graphics	3	1	0	4	-
ENG104	Computer Programming with MATLAB	3	2	0	3	---
BLE230	Field Training (I)	1	0	0	3	60 Credits
BLE340	Field Training (II)	1	0	0	3	90 Credits
BLE430	Graduation Project (1)	3	1	2	2	100 Credits
BLE440	Graduation Project (2)	4	2	2	2	BLE430
(C) Major Specialization Subjects (53Credits)						
BAS201	Probability and Statistical Methods	3	2	2	0	-
BAS202	Physics of Light & Heat	3	2	0	3	BAS103
ENG201	Engineering Economy & Accounting	3	2	2	0	-
ENG202	Technical Report Writing	3	2	2	0	-
BAS 310	Operations Research	3	2	2	0	BAS201
BLE201	Structural Analysis (1)	3	2	2	0	BAS107
BLE203	Building Materials (1)	3	2	0	2	BAS103
BLE204	Structural Analysis (2)	3	2	2	0	BLE201
BLE211	Data Capture Techniques (1)	3	2	0	2	---
BLE212	Data Capture Techniques (2)	3	2	0	2	BLE211
BLE213	Thermal and fluid Engineering	3	2	0	2	BAS202
BLE205	Building Materials (2)	3	2	0	3	BLE203
BLE302	Geotechnical Engineering	3	2	0	3	BAS107

Code	Course	CR	Lec	Tut	Lab	Pre-Req.
BLE303	Concrete Structures Design (1)	3	2	2	0	BLE204
BLE304	HVAC Systems Design	3	2	2	0	BLE213
BLE305	Building Insurance and Building Laws	2	2	0	0	---
BLE306	Building Construction Technology (1)	3	2	2	0	BLE206
BLE307	Steel Structures Design (1)	3	2	2	0	BLE204
(D) Minor Specialization Subjects (40Credits)						
BLE308	Concrete Structures Design (2)	3	2	2	0	BLE303
BLE309	Building Projects Management	3	2	2	0	ENG201,BLE206
BLE310	Electrical, Mechanical and Sanitary Installations in Buildings	3	2	2	0	BLE213
BLE321	Mapping	3	2	2	0	BLE212
BLE322	Fundamental of GIS (Geographical Information Systems)	3	2	0	3	BLE321
BLE441	Building Information Modeling (BIM)	4	2	0	6	BLE213, BLE310
BLE400	Foundation Engineering	3	2	2	0	BLE302
BLE4xx	Elective (1) (List 1 or List 2 Concentration)	3	2	x	x	
BLE4xx	Elective (2) (List 1 or List 2 Concentration)	3	2	x	x	
BLE4xx	Elective (3) (List 1 or List 2 Concentration)	3	2	x	x	---
BLE4xx	Elective (4) (List 1 or List 2 Concentration)	3	2	x	x	---
BLE4xx	Elective (5) (List 1 or List 2 Concentration)	3	2	x	x	---
BLE4xx	Elective (6) (List 1 or List 2 Concentration)	3	2	x	x	---
List 1 - Elective Courses for Building Structural Systems Concentration						
BLE401	Network Analysis	3	2	0	3	BLE322
BLE402	Advanced Building Projects Management	3	2	2	0	BLE309
BLE403	Advanced BIM	3	2	0	3	BLE441
BLE404	Building Construction Technology (2)	3	2	2	0	BLE306
BLE405	Concrete Structures Design (3)	3	2	2	0	BLE308
BLE406	Steel Structures Design (2)	3	2	2	0	BLE307
BLE407	Advanced Building Materials	3	2	2	0	BLE205
BLE408	Repair and Strengthening of Buildings	3	2	2	0	BLE206, BLE407
BLE409	Structural Analysis (3)	3	2	2	0	BLE204
BLE410	Computer Aided Structural Analysis	3	2	2	0	BLE409
List 2- Elective Courses for Building Services Concentration						
BLE402	Advanced Building Projects Management	3	2	2	0	BLE309
BLE403	Advanced BIM	3	2	0	3	BLE441
BLE404	Building Construction Technology (2)	3	2	2	0	BLE306
BLE411	Building Construction Equipment	3	2	2	0	---
BLE412	Building Life Cycle Costing	3	2	2	0	ENG201
BLE413	Fundamentals of Facility Management	3	2	2	0	---
BLE414	Renovation, Restoration and Adaptive Use	3	2	0	3	BLE206, BLE306
BLE415	Alternative and Renewable Energy Systems in Buildings	3	2	2	0	---
BLE416	Building Real Estate Development: Market Studies and Marketing	3	2	2	0	ENG201, ENG310
BLE417	Smart Buildings	3	2	2	0	BLE322
Basic Science & Mathematics Courses						

Code	Course	CR	Lec	Tut	Lab	Pre-Req.
BAS101	Differential Calculus and Algebra	3	2	2	0	-
BAS102	Integral Calculus & Analytical Geometry	3	2	2	0	BAS101
BAS103	Physics of Materials	3	2	0	3	-
BAS104	General Chemistry	3	2	0	2	-
BAS105	Statics & Dynamics (1)	3	2	0	2	-
BAS106	Physics of Electricity & Magnetism	3	2	0	3	BAS103
BAS107	Statics & Dynamics (2)	3	2	0	2	BAS105
BAS201	Probability and Statistical Methods	3	2	2	0	-
BAS202	Physics of Light & Heat	3	2	0	3	BAS103
BLE203	Building Materials (1)	3	2	0	3	BAS103
BLE205	Building Materials (2)	3	2	0	3	BLE203
BLE302	Geotechnical Engineering	3	2	0	3	BAS107
BAS310	Operations Research	3	2	2	0	BAS201

BUILDING ENGINEERING (BLE) PROGRAM
STUDY PLAN

STUDY PLAN FOR BUILDING ENGINEERING PROGRAM
1st Level

FIRST SEMESTER

Code	Subject	Credits	Contact Hours			Prerequisites
			Lec.	Tut.	Lab.	
GEN10X	Elective (1) From Language Courses List	2	1	2	0	---
BAS101	Differential Calculus and Algebra	3	2	2	0	---
BAS103	Physics of Materials	3	2	0	3	---
BAS104	General Chemistry	3	2	0	2	---
BAS105	Statics & Dynamics (1)	3	2	2	0	---
ENG101	Production Engineering	3	2	0	3	-
		17	**11**	**6**	**8**	

SECOND SEMESTER

Code	Subject	Credits	Contact Hours			Prerequisites
			Lec.	Tut.	Lab.	
GEN104	History of Science, Eng. & Technology	2	2	0	0	---
BAS102	Integral Calculus & Analytical Geometry	3	2	2	0	BAS101
BAS106	Physics of Electricity & Magnetism	3	2	0	3	BAS103
BAS107	Statics & Dynamics (2)	3	2	2	0	BAS105
ENG102	Engineering Graphics	3	1	0	4	---
ENG104	Computer Programming with MATLAB	3	2	0	3	---
		17	**11**	**4**	**10**	

STUDY PLAN FOR BUILDING ENGINEERING PROGRAM

2nd Level

FIRST SEMESTER

Code	Subject	Credits	Contact Hours			Prerequisites
			Lec.	Tut.	Lab.	
GEN201	Information Technology	1	1	0	0	---
BAS202	Physics of Light & Heat	3	2	0	3	BAS103
BLE201	Structural Analysis (1)	3	2	2	0	BAS107
BLE211	Data Capture Techniques (1)	3	2	0	2	
BLE203	Building Materials (1)	3	2	0	2	BAS103
GEN202	Communication & Presentation Skills	2	1	2	0	---
BLE213	Thermal and fluid Engineering	3	2	0	2	BAS202
		18	**12**	**4**	**9**	

SECOND SEMESTER

Code	Subject	Credits	Contact Hours			Prerequisites
			Lec.	Tut.	Lab.	
ENG201	Engineering Economy & Accounting	3	2	2	0	-
ENG202	Technical Report Writing	3	2	2	0	-
BAS201	Probability and Statistical Methods	3	2	2	0	-
BLE204	Structural Analysis (2)	3	2	2	0	BLE201
BLE212	Data Capture Techniques (2)	3	2	0	2	BLE211
BLE205	Building Materials (2)	3	2	0	3	BLE203
		18	**12**	**8**	**5**	

SUMMER SEMESTER

Code	Subject	Credits	Contact Hours			Prerequisites
			Lec.	Tut.	Lab.	
BLE240	Field Training (I)	1	0	0	3	60 Credits

STUDY PLAN FOR BUILDING ENGINEERING PROGRAM

3rd Level

FIRST SEMESTER

Code	Subject	Credits	Contact Hours			Prerequisites
			Lec.	Tut.	Lab.	
GEN301	Current Social Issues in Egypt	1	1	0	0	---
BLE321	Mapping	3	2	2	0	BLE212
BAS310	Operations Research	3	2	2	0	BAS201
BLE302	Geotechnical Engineering	3	2	0	3	BAS107
BLE303	Concrete Structures Design (1)	3	2	2	0	BLE204
BLE304	HVAC Systems Design	3	2	2	0	BLE213
BLE305	Building Insurance and Building Laws	2	2	0	0	
		18	**13**	**8**	**3**	

SECOND SEMESTER

Code	Subject	Credits	Contact Hours			Prerequisites
			Lec.	Tut.	Lab.	
BLE306	Building Construction Technology (1)	3	2	2	0	
BLE307	Steel Structures Design (1)	3	2	2	0	BLE204
BLE308	Concrete Structures Design (2)	3	2	2	0	BLE303
BLE309	Building Projects Management	3	2	2	0	ENG201, BLE206
BLE322	Fundamental of GIS	3	2	0	3	BLE321
BLE310	Electrical, mechanical and Sanitary Installations in Buildings	3	2	2	0	BLE213
		18	**12**	**10**	**3**	

SUMMER SEMESTER

Code	Subject	Credits	Contact Hours			Prerequisites
			Lec.	Tut.	Lab.	
BLE340	Field Training (II)	1	0	0	3	90 Credits

STUDY PLAN FOR BUILDING ENGINEERING PROGRAM

4th Level

FIRST SEMESTER

Code	Subject	Credits	Contact Hours			Prerequisites
			Lec.	Tut.	Lab.	
GEN401	Professional Ethics	2	2	0	0	---
BLE441	Building Information Modeling (BIM)	4	2	0	6	BLE213, BLE310
BLE4xx	Elective (1)	3	2	x	x	xxxxxx
BLE4xx	Elective (2)	3	2	x	x	xxxxxx
BLE4xx	Elective (3)	3	2	x	x	xxxxxx
BLE430	Graduation Project (1)	3	1	2	2	100 Credits
		18	**11**	**x**	**x**	

SECOND SEMESTER

Code	Subject	Credits	Contact Hours			Prerequisites
			Lec.	Tut.	Lab.	
GEN407	Entrepreneurship	2	1	2	0	---
BLE400	Foundation Engineering	3	2	2	0	BLE302
BLE4xx	Elective (4)	3	2	x	x	xxxxxx
BLE4xx	Elective (5)	3	2	x	x	xxxxxx
BLE4xx	Elective (6)	3	2	x	x	xxxxxx
BLE440	Graduation Project (2)	4	2	2	2	BLE430
		18	**11**	**x**	**x**	

STUDY PLAN FOR BUILDING ENGINEERING PROGRAM
COURSE DESCRIPTIONS

BUILDING ENGINEERING PROGRAM
COURSES DESCRIPTION

BLE201	Structural Analysis (1)	3 (2,2,0)
Types of structures and loads - Types of supports and reactions - Analysis of beams and frames under the effect of concentrated loads - Stability and statical determinacy of structures - Study and analysis of trusses and frames - Normal forces, shear forces and bending moments in beams and frames subjected to concentrated loads.		

Prerequisites: BAS107.

References:

1- Course Notes and Solved Examples Prepared by the staff
2- El.Dakhakhny, W.M., "Theory of Structures", Part I & II, 9th edition, Dar-Al-Maaref, Cairo, Egypt, 1995, ISBN: 977-02-4790-1
3- Beer, F., Johnston, R.E., Dewolf, J.T., and Mazurek D., "Statics and Mechanics of Materials", 3rd edition, Prentice Hall; 896 pages, ISBN 978-0132166744, 2010

BLE 203	Building Materials (1)	3 (2,0,2)
Introduction to materials and specifications. Cement (Methods of manufacture – Types – Hydration – Properties – Tests) – Natural and artificial aggregates (Types, Properties – Tests) – Chemical and mineral admixtures (Types – Properties – Tests) – Cement replacement materials – Conformance of concrete materials – Properties and testing of fresh concrete. Polymers- Steel – Bricks, Blocks, Timber, Glass, Aluminum.		

Prerequisites: BAS103.

References:

1- Egyptian code, third appendix, Laboratory testing of concrete materials
2- Egyptian code for design and construction of reinforced concrete buildings
3- 2007 خواص المواد واختباراتها الجزء الأول أ.د/ محمود إمام
4- David Roylance 'MECHANICAL PROPERTIES OF MATERIALS' 2008.
5- Illston, J.M, and Domone, P.L.J."Construction Materials, Their nature and behavior", ISBN 0-419-25860
6- Somayaji, S. "Civil Engineering Materials", ISBN 0-13-177643-6

BLE204	Structural Analysis (2)	3 (2,2,0)
Uniformly and non-uniformly distributed loads - Relationship between loads, shear forces and bending moments for beams and frames under the effect of uniformly and non-uniformly distributed loads - Normal stresses and strains due to axial loads - Normal stresses due to bending moments - Normal stresses due to the combination of axial force and bending moment.		

Prerequisites: BLE201.

References:

1- Course Notes and Solved Examples Prepared by the Instructors
2- El.Dakhakhny, W.M., "Theory of Structures", Part I & II, 9th edition, Dar-Al-Maaref, Cairo, Egypt, 1995, ISBN: 977-02-4790-1
3- Beer, F., Johnston, R.E., Dewolf, J.T., and Mazurek D., "Statics and Mechanics of Materials", 3rd edition, Prentice Hall; 896 pages, ISBN 978-0132166744, 2010

BLE211	Data Capture Techniques (1)	3 (2,0,2)
Concept and basics of spatial Engineering sciences - Terrestrial measurement techniques- Mathematical principles of calculating areas. Applied software - Applications in different tracks "according to the specified programs"		

Prerequisites: ---.

References

1- Daniela Micucci, Francesco Tisato and Marzia Adorni, Engineering spatial concepts, Cambridge University Press: 01 March 2009

2- Marcelo de Carvalho Alves, Luciana Sanches, Surveying with Geomatics and R, CRC Press, ISBN 9781032015033, 2022

BLE212	Data Capture Techniques (2)	3(2,0,2)
Advanced measuring techniques - Computation of the third dimension - Mathematical principles of calculating volumes - Applied software - Applications in different tracks "according to the specified programs".		

Prerequisites: BLE211.

References

1- Daniela Micucci, Francesco Tisato and Marzia Adorni, Engineering spatial concepts, Cambridge University Press: 01 March 2009

2- Marcelo de Carvalho Alves, Luciana Sanches, Surveying with Geomatics and R, CRC Press, ISBN 9781032015033, 2022

BLE213	Thermal and fluid Engineering	3(2,0,2)
This course introduces the fundamentals and techniques of thermodynamics and fluid mechanics. Emphasis is placed on being able to formulate and solve typical problems of engineering importance. The scope of the course covers basic thermal fluid properties, dimensional analysis, incompressible flows, thermal effect on fluid mechanics …etc. Laboratory experiments will demonstrate the principles of fluid mechanics and thermodynamics.		

Prerequisites: BAS202.

References:

1- Finnemore, E.J. and Franzini, J.B., 2013. Fluid mechanics with engineering applications tenth edition.

2- T. Al-Shemmeri (2012). "Engineering Fluid Mechanics". Ventus Publishing ApS and bookboon.com

3- Gerhart, P.M., Gerhart, A.L. and Hochstein, J.I., 2016. Munson, Young and Okiishi's Fundamentals of Fluid Mechanics. John Wiley & Sons.

4- Yunus, A. C, Thermodynamics, An Engineering Approach, McGraw-Hill, 8th edition, 2010.

5- Van Wylen, G. Sonntag R. and Borgnakke, C. Fundamentals of Classical Thermodynamics, John Wiley & Sons, Inc. 6th edition, 2001.

BLE205	Building Materials (2)	3 (2,0,3)
Design of concrete mixes using the British and American methods – Quality control of concrete production on site – Curing of concrete and its effect on properties – Revision on testing of fresh		

and hardened concrete and factors affecting the results – Non-Destructive tests on structures – Schmidt Hammer test – Ultra Sonic Pulse Velocity test - Core test – Loading test for structural members.

Prerequisites: BLE203.

References:

1- Aitcin, P.C., High Performance Concrete, Properties and Applications, McGraw Hill, Inc., 1994.
2- Neville, A. M., Properties of Concrete, LONGMAN, England, 1998.
3- Mehta, P.K., Properties of Concrete and Structures, Prentice Hall Inc., New Jersey, 1998.
4- ECCS 203-2001 Egyptian Code for Design and Construction of Concrete Structures, Ministry of Housing, Utilities and Urban Communities, Giza, Egypt, 2007.

BE302	**Geotechnical Engineering**	**3 (2,0,3)**
Introduction to geotechnical engineering and its applications - Soil formation and types – Basic soil properties – Physical properties – Grain size distribution – Consistency and plasticity (Atterberg limits) – Soil classification systems – Permeability of soil – Effective stress and stress distribution in soil – Settlement and consolidation of soil – Shear strength – Compaction of soil – Laboratory tests for determination of soil properties. Applicable code: Egyptian code for soil mechanics and foundations.		

Prerequisites: BAS107.

References:

1- Soil Mechanics in Engineering Practice, Karl Terzaghi et. al, John Wiley & Sons, 1996
2- Soil Mechanics. R.F. Craig, Springer Science, Third Edition, 1983
3- Principles of Geotechnical Engineering, Braja M. Das, Cengage Learning, Eigth Edition, 2014
4- Geotechnical Engineering: Principles and Practices of Soil Mechanics and Foundation Engineering. V.N.S. Murthy, CRC Press, 2002

BLE303	**Concrete Structures Design (1)**	**3 (2,2,0)**
Statical systems and load distribution- Cases of loadings- Maximum- maximum internal forces - Ultimate limit state design method- Analysis and design of rectangular, T and L-sections under flexure, shear and torsion- Development and anchorage lengths- Integrated design and reinforcement detailing for simple and continuous beams. Design in accordance with the Egyptian code for design of reinforced concrete structures.		

Prerequisites: BLE204.

References:

1- Lecture notes and handouts prepared by the staff.
2- ECP 203-2020 Egyptian Code for Design and Construction of Concrete Structures. Ministry of Housing, Utilities and Urban Communities, Giza, Egypt.
3- Design aids of the Egyptian code for RC structures.
4- Egyptian code for standard reinforcement detailing.
5- Design of concrete structures by A.H. Nilson, 2016.
6- Reinforced concrete: mechanics and design by J.G. MacGregor, 2016.
7- Design of reinforced concrete structures- Vol. 1 and Vol 2 by M. Ghoneim.

BLE304	HVAC Systems Design	3 (2,2,0)
Explore the fundamentals of HVAC design. Topics include heating and cooling systems; load calculations, including building envelopes, U-values, internal and external heat gains, and ventilation criteria; psychrometrics; air handling systems and their components, selection criteria, and classification; duct system design, including pressure loss calculation; fan classification and selection; and relevant laws.		

Prerequisites: BLE213.

References

1- Refrigeration and Air Conditioning: Edition 3, A. R. Trott, T. C. Welch, 1999
2- Refrigeration and Air-Conditioning: Edition 4, G. F. Hundy, A. R. Trott, T. C. Welch, 2008
3- Introduction to Refrigeration and Air Conditioning Systems: Theory and Applications, Allan Kirkpatrick, 2017
4- Principles Of Heating, Ventilation And Air Conditioning With Worked Examples, Nihal E Wijeysundera, 2015

BLE305	Building Insurance and Building Laws	2 (2,0,0)
The course discusses building insurance coverage to protect property owners, developers, third party and contractors while major renovation/construction work is being completed. Current building laws in Egypt are also discussed to help students with their future careers in the construction industry.		

Prerequisites: ---.

References

1- Paul Reed, Construction All Risks Insurance 3rd edition (2021), Sweet & Maxwell Ltd, ISBN13: 9780414074972

2- Nael G. Bunni and Lydia B. Bunni, Risk and Insurance in Construction 3rd Edition(2021), Routledge, ISBN-13 : 978-1032119830

3- قوانين البناء المصرية و تعديلاتها و قانون البناء الموحد رقم 119 لسنة 2008

4- المجمعة المصرية لتامين المسئولية المدنية عن اخطار اعمال البناء

BLE306	Building Construction Technology (1)	3 (2,2,0)
The course covers a range of traditional and modern construction technologies and systems, including load-bearing masonry structures, concrete frame structures, steel frame construction, doors and windows, a quick overview of building services and finishes.		

Prerequisites: BLE206

References:

1- American Institute of Architects, Dennis J. Hall, Nina M. Giglio, Architectural Graphic Standards (Ramsey/Sleeper Architectural Graphic Standards Series) 12th Edition, 2016, Wiley, ISBN-13 : 978-1118909508

2- G A Mitchell, A M Mitchell, Building Construction : Structure and Fabric, part 1, Batsford, 1973.

3- Roger Greeno, Construction Technology, Pearson Education Limited/Addison Wesley; 5th edition (2011), ISBN-13 : 978-043504

4- Ching, F. D. K., Building construction illustrated, Wiley; 6th edition (2020), ISBN-13 : 978-1119583080

BLE307	Steel Structures Design (1)	3 (2,2,0)
Introduction to design of steel structures - Loads and structural systems and their resistance to horizontal forces - Preparation of general site drawings for metal structures - Design of welded and bolted connections - Design of tension members - Buckling analysis of compression members - Design of compression members and columns - Design of beams - design of purlins as cold-formed steel elements- Design of composite elements.		

Prerequisites: BLE204.

References:

1- ANSI/AISC, 360-05, Specifications for Structural Steel Buildings, (ASD/LRFD). Chicago, Illinois, 2012
2- Egyptian Code of Practice for Steel Construction and Bridges, ASD, (Alllowable Stress Design), 2012.
3- Egyptian Code of Practice for Steel Construction (Load and Resistance Factor Design) (LRFD), Ministerial Decree No 359 – 2007, First Edition 2012.
4- Euro Copde n.3-88: Commen Unified Rules for Steel Structuers, EUR 8849 En., 2001
5- Euro Copde n.3-89: Design of Steel Structuers, Part 1- General Rules and Rules for Buildings Vol. 1 and 2, CEC *Industerial Preocesses, Building and Civil Engineereings, 2001
6- Euro Copde n.4-85: Rules for Composite Steel and Concrete Structures, EUR 9886 EN., 2001
7- Loov, R. E., Structural Steel Design: Lecture Notes, 1997, Calgary, Canada. Manual of Steel Construction, Load and Resistance Factor Design, American Institute of Steel Construction (AISC), Thirteenth Edition. 2005
8- Mc Cormac, “Structural steel Design”, 4th Edition, ISBN – 0-06-500060-9
9- Segui, W. T., LRFD Steel Design, Fourth Edition, 2007, Thompson, Brooks/Cole, USA.
10- Manual of Steel Construction, Load and Resistance Factor Design, American Institute of - Steel Construction (AISC), 2010

BLE308	Concrete Structures Design (2)	3 (2,2,0)
Design issues for shear fraction, punching shear, corbels and bearing strength -Design of short columns under axial and eccentric loads- Analysis and design of one way and two-way solid slabs under all types of loads- Design of paneled beams system- Serviceability limit states for deflection of beams.		

Prerequisites: BLE303.

References:

1- Lecture notes and handouts prepared by the staff.
2- ECP 203-2020 Egyptian Code for Design and Construction of Concrete Structures. Ministry of Housing, Utilities and Urban Communities, Giza, Egypt.
3- Design aids of the Egyptian code for RC structures.
4- Egyptian code for standard reinforcement detailing.
5- Design of concrete structures by A.H. Nilson, 2016.
6- Reinforced concrete: mechanics and design by J.G. MacGregor, 2016.
7- Design of reinforced concrete structures- Vol. 1 and Vol 2 by M. Ghoneim.

BLE309	Building Projects Management	3 (2,2,0)
This course discusses the essentials of the modern construction management techniques to maximize the performance efficiency in various phases. The objective of the course is achieved by exploring the following: efficient planning and organizational framework, section analysis, coordination of implementation disciplines, methods and techniques of monitoring and evaluations, Critical Path Method (CPM). The course addressed factors to improve the execution performance of the project .Students understand various management tasks during each phase, such as planning and implementation schedules and resource management.		

Prerequisites: ENG201, BLE206.

Reference

1- Erik Larson and Clifford Gray (2018). Project Management: The Managerial Process (7th Edition), ISBN13: 9781259666094, Mc Graw-Hill Education, USA
2- Kumar Neeraj Jha (2011). Construction Project Management: Theory and Practice, Pearson Education India, 2011.

BLE310	Electrical, Mechanical and Sanitary Installations in Buildings	3 (2,2,0)
This course aims to provide students with the required knowledge about sanitary and electro-mechanical installations in order to achieve a sound environment in buildings. Students will achieve this objective by studying the following; a) various methods, technologies and systems related to water and drainage networks as well as liquid and solid waste disposal, b) best practices for electro-mechanical installation systems including their modem operandi, requirements and safety measures. Students will master the above-mentioned objectives via exploring the various systems and technologies as well as their mechanical installation pre-requisites.		

Prerequisites: BLE213.

References

1. Ching, F. D. K., Building construction illustrated, Wiley; 6th edition (2020), ISBN-13 : 978-1119583080.
2. Graham Bizley (2010). Architecture In Detail II. ROUTLEDGE. ISBN 0080965350
3. McKay, W. B. (2015). McKay's building construction. ISBN 9781317341093
4. Merritt, F. S., and Ricketts, J. T. (2006). Building design and construction handbook. New York: McGraw-Hill. ISBN 0-07-041999-X
5. Egyptian code for design principles and implementation conditions for sanitary installation engineering.
6. The Egyptian Electrical Code in the foundations of design and conditions for implementing electrical connections and installations in buildings
7. The Egyptian Code for the design principles and conditions for the implementation of air conditioning and electricity works.
8. The Egyptian Code for the design principles and conditions for the implementation of electric elevators and landings in buildings.

BLE321	Mapping	3 (2,2,0)
Concept of Cartography - Elements of maps - Introduction to map projection - Datums and transformation.		

Prerequisites: BLE212

References

1- Kenneth Field, Cartography, ISBN 9781589484399, 2018

2- Beau Riffenburgh Mapping the World: The Story of Cartography, ISBN-10: 0233004394, 2015

BLE322	Fundamental of GIS (Geographical Information Systems)	3 (2,0,3)
History and development of GIS – Data types and data sources - Metadata in GIS - Creating layouts - Geo-database - Basics of relational database - Coordination systems and spatial projection - Spatial Data processing - Spatial descriptive statistics - Basic concepts in spatial data analysis - Multiple Criteria Evaluation for Planning & spatial decisions - Theoretical and technical aspects of modeling spatial data – Introduction to remote sensing - Basic satellite image processing tasks - Concepts and tools for representing data in large urban areas - Basic spatial regression models - Practical applications of GIS for building engineers.		

Prerequisites: BLE321

References:

1- Paul Bolstad, GIS Fundamentals: A First Text on Geographic Information Systems, ISBN: 978-1-59399-552-2, 2022

2- Peter A. Burrough, Rachael A. McDonnell, Christopher D. Lloyd, Principles of Geographical Information Systems, ISBN-13 : 978-0198742845, 2015

BLE441	Building Information Modeling (BIM)	4 (2,0,6)
The course introduces BIM (Building Information Modeling) as an intelligent 3D model-based process that gives architecture, engineering, and construction (AEC) professionals the insight and tools to more efficiently plan, design, construct, and manage buildings and infrastructure. This course focuses on the process and tools that help architects to develop their designs and to create, coordinate, and manage the tender drawings. Student will learn how to use one of BIM software such as Revit to develop the schematic design and to generate its tender documents. Application will be on moderate scale architecture projects such as administration building, clubhouse, small MPUs, and similar projects.		

Prerequisites: BLE213, BLE310.

References

1- Karen Kensek, Douglas Noble, Building Information Modeling: BIM in Current and Future Practice, 1st Edition, 2014, ISBN-13 : 978-1118766309

2- Chuck Eastman, Paul Teicholz, Rafael Sacks, Kathleen Liston, BIM Handbook: A Guide to Building Information Modeling for Owners, Managers, Designers, Engineers and Contractors, 1st Edition, 2008, ISBN-13 : 978-0470185285

BLE400	Foundation Engineering	3 (2,2,0)
Soil failure due to excavation, Lateral earth pressure and its coefficients: at-rest, active, and passive, Lateral earth pressure using Rankin Method: assumptions and limitations, Lateral earth pressure determination using Coulomb method: assumptions and limitations, Lateral earth pressure of braced excavation, Classification of soil retaining systems, Factors affecting the choice of specific soil retaining system,,Types of retaining structures, Failure mechanisms of gravity retaining structures – Study and design of gravity retaining structures – Lateral movement of		

retaining walls – Drainage systems behind retaining walls - Factors affecting bearing capacity of soils – Terzaghi's bearing capacity method – bearing capacity calculations using Egyptian Code of Practice Method – Bearing capacity using field methods – Factors of safety – Types of shallow foundations and factors affecting the choice of specific type of foundation – Design of isolated footing, strip footing, combined footing, and neighbor side footings – Egyptian Code of Practice requirements are followed.

Prerequisites: BLE302.

References

1- Foundation analysis and design. Joseph E. Bowles, McGraw-Hill, 1988

2- Analysis and Design of Shallow and Deep Foundations - Volume 10, Lemon C. Reese et al., John Wiley & Sons, 2006

BLE401	Network Analysis	3 (2,0,3)
Network definition – introduction to Networks – Basic components of network – Graph theory - Advanced vector analysis tools – Matrix and topology – network analyst – shortest path distance – salesman problems – Geo-coding process and spatial operations.		

Prerequisites: BLE322.

References

1- Handbook of Transport Geography and Spatial Systems, Publisher: Elsevier, Editors: Hensher D, Button K, Haynes K, Stopher P, 2004, Emerald Publishing, ISBN-13 : 978-0080441085

2- Ningchuan Xiao, GIS Algorithms: Theory and Applications for Geographic Information Science & Technology, 2016, SAGE Publications Ltd, Print ISBN: 9781446274330

BLE402	Advanced Building Projects Management	3 (2,2,0)
Financial planning – Financial calculations - Financial review and evaluation – Cash flow analysis – Financial alternatives – Contract administration – Project cost estimate – Project Monitor and control -Project evaluation (time and cost) - Project time reduction.		

Prerequisites: BLE309.

References:

1. Tarek Hegazy (2013). Computer-Based Construction Project Management, ISBN-9781292027128, Pearson Education Limited, 2013, 360 pages, USA

2. Frederick Harrison, Dennis Lock , Advanced Project Management: A Structured Approach 4th Edition, Routledge; 4th edition, 2016, ISBN-13 : 978-1138270633

BLE403	Advanced Building Information Modeling (BIM)	3 (2,0,3)
The Advanced BIM course will present modeling of lighting design in buildings, lighting circuits, electrical switch systems, electrical power loads, plumbing and piping systems as well as planning and designing fire protection systems. This course is designed to sequentially deliver the following topics: dividing the building model in spaces and zones, assigning space and zone properties, energy analysis of the building model, heating and cooling requirements, placing air terminals, adjusting air flow to fulfill the energy requirements, creating air supply duct work, sizing the ducts according to the air flow, placing and connecting the air conditioners, checking the connectivity of all equipment, specifying electrical settings to determine the voltages, wiring, distribution systems, and demand factors, specifying and scheduling the lighting levels that are required for		

the various spaces within the building, placing light fixtures in the model, using the space analysis schedule, adding the electrical equipment for the distribution systems, creating power circuits/circuit groups, creating a panel schedule report, examining the circuitry, creating the piping for the sanitary plumbing system, domestic cold and hot water systems and adding pipes to connect all fixtures. The modeling will include fire fighting and security CCTV systems.

Prerequisites: BLE441.

References

1- Erica Epstein, Implementing Successful Building Information Modeling , Artech Housem 2012, ISBN : 1608071391

2- Brad Hardin and Dave McCool, BIM and Construction Management: Proven Tools, Methods, and Workflows Paperback, 2015, Wiley, ISBN-10 : 1118942760

BLE404	Building Construction Technology (2)	3 (2,2,0)
This course covers advanced building construction methods & techniques. Topics include advanced construction systems, foundations, façade, cladding technologies, insulation and roofing systems.		

Prerequisites: BLE306.

References:

1- American Institute of Architects, Dennis J. Hall, Nina M. Giglio, Architectural Graphic Standards (Ramsey/Sleeper Architectural Graphic Standards Series) 12th Edition, 2016, Wiley, ISBN-13 : 978-1118909508

2- G A Mitchell, A M Mitchell, Building Construction : Structure and Fabric, part 1, Batsford, 1973.

3- Roger Greeno, Construction Technology, Pearson Education Limited/Addison Wesley; 5th edition (2011), ISBN-13 : 978-043504

4- Ching, F. D. K., Building construction illustrated, Wiley; 6th edition (2020), ISBN-13 : 978-1119583080

BLE405	Concrete Structures Design (3)	3 (2,2,0)
Analysis and design of one way and two-way hollow block slabs– Analysis and design of flat slabs using the empirical method and the equivalent frame method– Design of stairs- Design of slender columns subjected to eccentric loads– Analysis and design of slender columns subjected to biaxial moments– Design of arch slabs and arch girders.		

Prerequisites: BLE308.

References

1- IBC, Manual, International Building Code,2009
2- ACI, Manual, American Concrete Institute, 2019
3- Park and Paulay, Design of Reinforced Concrete Elements, J. W. and Sons,1985
4- ECCS 203-2020 Egyptian Code for Design and Construction of Concrete Structures, Ministry of Housing, Utilities and Urban Communities, Giza, Egypt, 2020

BLE406	Steel Structures Design (2)	3 (2,2,0)
Introduction to the design of steel Frames – Buckling of eccentrically loaded members - Design of eccentrically loaded columns – Lateral torsional buckling of beams - Design of flexural members (beams) – Interactive buckling of beam-columns - Design of members under axial load and		

bending moment (Beam-column Frame Members) – Design of welded rigid connections – Design of bolted rigid connections using bearing type bolts – Design of rigid connections using friction type bolts – Design of extended end plate connections – Design of hinged column bases – Design of fixed column bases – Wind load calculations - Design of wind bracing systems – Structural detailing of steel structures.

Prerequisites: BLE307.

References

1- Egyptian Code of Practice for Steel Construction and Bridges, ASD, (Alllowable Stress Design), 2012.
2- Egyptian Code of Practice for Steel Construction (Load and Resistance Factor Design) (LRFD), Ministerial Decree No 359 – 2007, First Edition 2012.
3- ANSI/AISC, 360-16, Specifications for Structural Steel Buildings, (ASD/LRFD). American Inistitute of Steel Construction, Chicago, Illinois, 2016
4- CEN European Committee forstandarization,EN 1993: 2006, Euro Code 3: Design of Steel Structures, part 1.1 to part 1.12, CEN, Brussels, Belgium, 2006.
5- Patrick J. Dowling, Peter R. Knowles, Graham W. Owens, “Strutural Steel Design” ISBN-10: 0408037059, Publisher; Butterworth-Heinemann, December 1988.
6- Machally, E. B., “Behavior, analysis and design of structural steel elements (volume I to V)” ISBN 977-19-6629-4
7- Gaylor and Graylor, “Steel Structures”. ISBN 0-07-112623-3-6
8- Charles G. Salmon, John E. Johnson, "Steel Structures: Design and Behavior", Edition 5, ISBN-13: 9780131885561, October 2008
9- McCormac, “Structural steel Design”, 4th Edition, ISBN – 0-06-500060-9

BLE407	Advanced Building Materials	3 (2,2,0)
Construction materials and properties – Volume stability of hardened concrete – Durability of hardened concrete – Special types of concrete: high strength, under water, light weight, heavy weight, roller compacted, containing fibers, containing polymers, self-compacting, high performance. Concreting in hot and cold weather– Protection and repair of concrete.		

Prerequisites: BLE205.

References:

1- P. K. Mehta and P. J. M. Monteiro, “Concrete: Microstructure, Properties and Testing”, 2nd Edition, McGraw-Hill Education (2013), ISBN-13: 978-0071797870
2- A.M. Neville, “Properties of Concrete”, 5th Edition, Prentice Hall (2012), ISBN-13: 978-0273755807

BLE408	Repair and Strengthening of Buildings	3 (2,2,0)
Repairing materials and methods of repair – Evaluation of structures to identify the requirements of repair – Repair and strengthening using different materials – Methods of protection of structures – Cathodic protection.		

Prerequisites: BLE206, BLE407.

Reference

1- Egyptian code of practice and design of RC structures, 2013
2- Egyptian code for design aids for RC structures, 2014

3- Egyptian code for standard reinforcement detailing, 2014
4- Norbert Delatte, Failure, Distress and Repair of Concrete Structures (Woodhead Publishing Series in Civil and Structural Engineering), 1st Edition, 2009, ISBN-13 : 978-1845694081
5- POONAM I. MODI , CHIRAG N. PATEL, REPAIR AND REHABILITATION OF CONCRETE STRUCTURES PHI Learning (2016), ISBN-13 : 978-8120352148

BLE409	Structural Analysis (3)	3 (2,2,0)
Shear stresses in beams - Shear stresses under the effect of twisting moments on circular, non-circular and tubular sections - Shear flow and shear center - Bolted and welded connections - Stresses under combined load conditions – Principal normal and shear stresses and use of Mohr's circle – Deflection of beams using double integration method, singularity function and conjugate beam method - Applications for solving statically indeterminate beams using separation and compositing method.		

Prerequisites: BLE204.
References:

1- Course Notes and Solved Examples Prepared by the Instructors
2- El.Dakhakhny, W.M., “Theory of Structures”, Part I & II, 9th edition, Dar-Al-Maaref, Cairo, Egypt, 1995, ISBN: 977-02-4790-1
3- Beer, F., Johnston, R.E., Dewolf, J.T., and Mazurek D., “Statics and Mechanics of Materials”, 3rd edition, Prentice Hall; 896 pages, ISBN 978-0132166744, 2010.
4- Hibbeler, R.C., “Statics and Mechanics of Materials”, 3rd edition, Prentice Hall; 896 pages, ISBN 978-0132166744, 2010
5- Hibbeler, R.C., “Structural Analysis”, 9th edition, Prentice Hall; 720 pages, ISBN 978-0133942842, 2014
6- McCormac, J.C., “Structural Analysis: Using Classical and Matrix Methods”, 4th edition, Wiley, 620 pages; 2012

BLE410	Computer Aided Structural Design	3 (2,0,3)
Flexibility and stiffness methods, applications to trusses, beams and frames; computer analysis of structures; structural analysis programs; formulation of plane stress and plane strain problems; introduction to the finite element method of analysis.		

Prerequisites: BLE409.
References:

1. Karnovsky, I. A., "Advanced Methods of Structural Analysis",2010.

BLE411	Building Construction Equipment	3 (2,2,0)
The course introduces information about building equipment as well as their impact in maximizing productivity. Students learn about the different equipment and construction tools, their capacities, functions and requirements. Student also get acquainted with the technical and scientific approach to select the suitable equipment, learn about their productivity rates, mechanical performance, consumption, operation and maintenance as well as the economics of equipment operation within the various constructions fields.		

Prerequisites: ---.
References

1. Leonhard E. Bernold, " Construction Equipment and Methods: Planning, Innovation, Safety", Wiley (1602), 2013

BLE412	Building Life Cycle Costing	3 (2,2,0)
The course presents the basic understanding of the fundamental concepts and terminology used to compute the life cycle assessment specific to building projects. Life cycle assessment (LCA) is a decision making process that is applied to large scale building projects for evaluating the appropriate selection. The LCA takes into account all capital costs, recurring operation & maintenance (O&M) expenses, replacement costs, energy, environment and the code issues for the life cycle of equipment. LCC are summations of cost estimates from inception to disposal for both equipment and projects as determined by an analytical study and estimate of total costs experienced during their life. The objective of LCC analysis is to choose the most cost-effective approach from a series of alternatives so the least long-term cost of ownership is achieved.		

Prerequisites: ENG201.

References

1- Cost Accounting and Financial Management for Construction Project Managers. 1st Edition, LEN HOLM.
2- Budgeting, Tracking, And Reporting Costs and Profitability. KEVIN R. CALLAHAN, Gary S. Stetz, Lynne M. Brooks.

BLE413	Fundamentals of Facility Management	3 (2,2,0)
In this course, the student will be introduced to the core concepts of facility management and operations. This will cover proven techniques to improve safety and efficiency and to protect and enhance a facility's value. Students will learn how to create a people-friendly work environment that fosters personal productivity. They will also explore communication processes that enable them to coordinate work with all stakeholders.		

Prerequisites: ---.

References

1-Kathy Roper, Richard Payant, The Facility Management Handbook Hardcover, 2014, AMACOM; Fourth edition, ISBN-13 : 978-0814432150

BLE414	Renovation, Restoration and Adaptive Use	3 (2,0,3)
The course describes restoration techniques for old buildings that have minimal impact on original fabric. This includes strategies for upgrading electrical, mechanical and sanitary systems. The needed architectural remodeling to change the use the different spaces will be investigated. The students will identify construction-phasing strategies that can help minimize disruption to building operations during an extensive renovation and expansion project. The students will explore some of the hidden conditions that can complicate and delay renovation projects.		

Prerequisites: BLE206, BLE306.

References:

1-Antonia Edwards, Renovate Innovate: Reclaimed and Upcycled Homes, 2017, ISBN-13: 9783791383095

3- Gregor H Mews, Transforming Public Space through Play, 2022, ISBN-13: 9780367680053
4- 3- Kathryn Rogers Merlino, Building Reuse: Sustainability, Preservation, and the Value of Design, 2020, ISBN-13: 9780295748078

5- 4- Agata Toromanoff, Converted. Reinventing architecture, 2020, ISBN-13: 9789401468930

BLE415	Alternative and Renewable Energy Systems in Buildings	3 (2,2,0)
The world is being faced with a major challenge to alleviate the concentration of CO_2 in the atmosphere to save the earth from the implications climate change. Renewable Energy Technology has been regarded as an alternative to fossil fuel for energy generation, and hence, helps decrease the footprint of buildings. This course is an introduction to current research in and practical application of alternative renewable energy technologies to meet the evolving demand for sustainable development. Established energy systems investigated in the course include wind turbines, solar thermal and photovoltaic (PV) systems, geothermal heat transfer and renewable bio-fuels. This also involves the critical analysis of the different initiatives and the investigation of concepts such as Energy Efficiency in the MENA region.		

Prerequisites: .

References

1- Fundamental of Renewable Energy Processes, Aldo V. Da Rosa, Stanford University, El SEVIER Academic Press, 2005.
2- Solar Engineering of thermal processes, John A. Duffie, William A. Beckman, John Willey & Sons, Second Edition.
3- Renewable Energy and the Environment, Robert Foster, Majid Ghassemi, CRC Press, 2010.
4- Physics of Solar Energy C. Julian Chen, Jhon Wiley & Sons, 2011.

BLE416	Building Real Estate Development: Market Studies and Marketing	3 (2,2,0)
In this course, students explore the fundamentals of real estate market studies and marketing strategies, including promotion and advertising. This includes: identifying the role of market studies and marketing strategies in the real estate development process, estimating and analyzing future market conditions, create a matrix for market condition analysis, evaluating marketing strategies, estimating market absorption rates and rental rates.		

Prerequisites: ENG201, ENG301

References

1- Knut Samset, "Project Evaluation: Making Investments Succeed", Fagbokforlaget, 2003. ISBN-13 : 978-8251918404.
2- Rena Mourouzi-Sivitanidou, Petros Sivitanides, Market Analysis for Real Estate, 2020, Routledge, ISBN 9780367233501.

BLE417	Smart Buildings	3 (2,2,0)
Definition of Smart Building– smart building framework- Physical components of SB – Digital components- types of smart building services- types of uses – different capabilities of SB – Best approach for implementing of SB – Smart solutions.		

Prerequisites: BLE322.

References

1- Ron Bakker, Smart Buildings-Technology and the Design of the Built Environment, 2020, RIBA Publishing, ISBN 9781859468708.
2- James Sinopoli, Advanced Technology for Smart Buildings, Artech House, 2016, ISBN-13 : 978-1608078653.

برنامج الإسكان والتصميم للمجتمعات

HOUSING & DESIGN FOR COMMUNITIES PROGRAM (HDC)

HOUSING & DESIGN FOR COMMUNITIES (HDC) PROGRAM

1. FACULTY VISION

The faculty of Engineering at BNU, looking forward to being a leading faculty at the national, regional, and international levels in engineering education fields, scientific research, innovation, and entrepreneurship to achieve the sustainable development of humankind.

2. FACULTY MISSION

The faculty of Engineering at BNU is committed to prepare graduates with the skills and attitudes to attain competence as professional engineers and researchers, and to interact with industry and community within the framework of human values and social responsibility.

3. PROGRAM VISION

The HDC program at BNU, aspires to be a leading program in education and scientific research in the fields of housing and urban development at the regional and international levels and to provide an outstanding community service.

4. PROGRAM MISSION

HDC Program gives an exhaustive and all-encompassing methodology for making a cohesive healthy community to give a superior personal satisfaction for them. The mission of the HDC Program is authority in housing and urban development education to accomplish greatness and advancement of pleasant sound networks and developed conditions.

5. PROGRAM OBJECTIVES

1. Trough educating, grant, inventive work, exploration, and administration, and subscribes to the most noteworthy goals of the worldwide calling and culture of metropolitan plan.
2. Provide the students with a strong base of information and comprehension of the Engineering sciences, sustainability and technology in architecture and urban design; with high level proficient instruction zeroing in on the field of housing, urban and community development.
3. Engage the students of engineering in a setting of numerous orders to grow his/her points of view and enhance abilities for: self-learning, research, and imaginative practice in this interdisciplinary experience.
4. Provide students with the commonsense and expert abilities essential for work to work in a collaboration along with peers in shared endeavors to learn, comprehend, connect and make and to help a culture that advances and supports hazard taking and encourages risk-taking

and challenges standards in creating, composing and presenting ideas in the field of housing, urban and community development.

5. Provide the students with a solid base of knowledge and understanding of the Engineering sciences, sustainability and technology in architecture and urban design; with an advanced professional education focusing on the field of housing, urban and community development.

6. GRADUATE ATTRIBUTES

1. A graduate who are Familiar with knowledge, theoretical sciences, applied sciences, engineering, humanities and social sciences related to architecture and urban design that qualifies graduates to practice the profession of architecture and be compatible with both the needs of society and the labor market.
2. A graduate who are familiar with continuous self-learning, developing skills, and keeping pace with developments in the field of specialization to generate innovative ideas and achieve sustainability requirements.
3. A graduate who can use the scientific method in monitoring, identifying, and analyzing architectural and urban problems by defining the problem and collecting the necessary information, classifying, analyzing, and developing appropriate solutions for facing problems and produce architectural, urban, and planning design projects with due efficiency and quality.
4. A graduate who can use modern technology techniques in all areas of specialization related to buildings, coordination with constructional and electromechanical disciplines, and the ability to use advanced digital tools in the design and implementation of buildings and virtual simulation to evaluate and produce innovative designs that achieve efficient performance considering the surrounding environmental and urban influences.
5. A graduate who can communicate effectively with presentation, discussion, and persuasion with work teams to suggest various alternatives to the solution and evaluate them to choose the most suitable one.
6. A graduate who has ethics of the profession and has honest of competition with others. He has the scientific understanding and knowledge necessary for the requirements of the architectural specialization.
7. A graduate who can coordinate with all other disciplines. He can work with and lead a team of different engineering disciplines during the design and implementation phase. He also can manage human resources from workers and technicians.
8. A graduate who are familiarity with architectural and urban codes, laws, and requirements, and he can apply them to match local needs and aspirations to keep pace with global developments.

7. PROGRAM COMPETENCIES

According to the National Academic Reference Standard (NARS) 2018, the program in Housing & Design for Communities program must satisfy the following Competencies:

1- General Engineering Competencies according to NARS 2018		
Level A (NARS)	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, analyze 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, taking into consideration other trades requirements.
	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.

2- Architecture Engineering Competencies according to NARS 2018		
Level B (NARS)	B1	Create architectural, urban, and planning designs that satisfy both aesthetic and technical requirements, using adequate knowledge of history and theory, related fine arts, local culture and heritage, technologies, and human sciences.
	B2	Produce designs that meet building users' requirements through understanding the relationship between people and buildings, and between buildings and their environment; and the need to relate buildings and the spaces between them to human needs and scale.
	B3	Generate ecologically responsible, environmental conservation and rehabilitation designs; through understanding of structural design, construction, technology, and engineering problems associated with building designs.
	B4	Transform design concepts into buildings and integrate plans into overall planning within the constraints of project financing, project management, cost control and

		methods of project delivery; while having adequate knowledge of industries, organizations, regulations, and procedures involved.
	B5	Prepare design project briefs and documents and understand the context of the architect in the construction industry, including the architect's role in the processes of bidding, procurement of architectural services and building production.

3- Housing & Design for Communities Engineering ARS		
Level C (ARS)	**C1**	Recognize and demonstrate the technical design and construction aspects of houses, infrastructure, and Solve conflicts between the engineering systems that serve residential context and its urban values (Technical Installations, Urban Infrastructure, Architecture Installations).
	C2	Apply theories and concepts to identify key housing and urban development needs, problems and solutions that satisfy both aesthetic and technical requirements, with due consideration of their contexts on both regional and local levels.
	C3	Explain critical contemporary issues that face the society and built areas and apply best practices with specific reference to social, economic and environmental development towards sustainable integrated housing and urban development
	C4	Define, design, compare and evaluate models of policy and strategy formulation, programs, and projects for housing through efficient resources management towards sustainable housing provision, informal upgrading and urban development.
	C5	Apply digital technologies and software as design aiding tools to generate and analyze spatial data and to produce integrated architecture documents and Land Mapping.

For determination the compatibility of program objectives with its competencies, the following matrix can be used:

Program Competencies	**Program Objectives**																			
	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	B1	B2	B3	B4	B5	C1	C2	C3	C4	C5	C6
Objective #1	√				√				√		√					√					
Objective #2				√		√						√			√			√			√
Objective #3			√							√			√	√						√	
Objective #4		√					√										√		√		
Objective #5								√					√							√	

MATRIX RELATING THE PROGRAM COURSES WITH COMPETENCIES

Course Code	Course Name	Engineering Competencies NARS (2018)										Architecture Engineering Competencies (NARS)					"Discipline" Housing & Design for Communities Engineering Competencies (ARS)				
		A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	B1	B2	B3	B4	B5	C1	C2	C3	C4	C5
GEN000	English Language (A remedy course)							√	√												
GEN201	Information Technology	√	√								√										
GEN301	Current Social Issues in Egypt			√				√	√												
GEN401	Professional Ethics			√	√																
GEN101	English Language							√	√												
GEN102	German Language							√	√												
GEN202	Communication & Presentation Skills							√	√												
GEN407	Entrepreneurship						√			√											
GEN105	History of Arts & Architecture					√			√			√									
BAS101	Differential Calculus and Algebra	√		√																	
BAS103	Physics of Materials	√	√																		
BAS104	General Chemistry	√	√																		
BAS105	Statics & Dynamics (1)	√		√		√															
BAS106	Physics of Electricity & Magnetism	√	√		√																
BAS107	Statics & Dynamics (2)	√		√		√															

Course Code	Course Name	Engineering Competencies NARS (2018)										Architecture Engineering Competencies (NARS)					"Discipline" Housing & Design for Communities Engineering Competencies (ARS)				
		A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	B1	B2	B3	B4	B5	C1	C2	C3	C4	C5
ENG104	Computer Programming with MATLAB				√						√	√									
BAS201	Probability and Statistical Methods	√	√									√									
ENG101	Production Engineering		√	√			√														
ENG102	Engineering Graphics			√							√										
HDC211	Field Training-1						√	√	√		√										
HDC335	Field Training-2						√	√	√		√		√		√						
HDC405	Graduation Project-1													√		√	√	√	√	√	√
HDC433	Graduation Project-2													√		√	√	√	√	√	√
HDC201	Architectural Design-1										√	√									
HDC202	Introduction to Building Materials & Technology				√									√							
HDC203	Introduction to CAD Systems				√						√	√									
HDC204	Environmental Psychology			√									√								
HDC205	Introduction to Housing & Urban Design							√				√	√								
HDC206	Architectural Design-2							√			√	√									
HDC207	Building Construction & Structural Systems				√	√								√							
HDC208	Housing-1												√					√			

Course Code	Course Name	Engineering Competencies NARS (2018)										Architecture Engineering Competencies (NARS)					"Discipline" Housing & Design for Communities Engineering Competencies (ARS)				
		A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	B1	B2	B3	B4	B5	C1	C2	C3	C4	C5
HDC209	Urban Design-1											√	√				√				
HDC210	History & Theory of Architecture-1								√			√									
HDC301	Housing-2												√					√			
HDC302	Urban Design-2											√	√				√				
HDC303	Urban Design & Landscape Architecture-1												√							√	
HDC304	Computer Application-1													√							√
HDC305	Urban Ecology-1											√					√	√			
HDC318	Housing-3												√					√			
HDC319	Sustainable Urban Design and Development											√	√				√				
HDC320	Community Design and Development												√					√	√		
HDC321	Introduction to Town Planning													√	√					√	
HDC401	Urban Sociology and Management														√					√	
HDC402	Housing Project Management														√					√	
HDC403	Urban Ecology-2											√					√	√			
HDC404	Urban Design & Landscape Architecture-2												√							√	
HDC418	Housing Project Design Studio															√					√

Course Code	Course Name	Engineering Competencies NARS (2018)										Architecture Engineering Competencies (NARS)					"Discipline" Housing & Design for Communities Engineering Competencies (ARS)				
		A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	B1	B2	B3	B4	B5	C1	C2	C3	C4	C5
HDC419	Urban Design Project Design Studio															√					√
HDC420	Surveying Methods in Urban Design															√					√
HDC306	Housing Design & Needs												√					√			
HDC307	Housing in Developing Countries												√					√			
HDC308	Design of Rural Communities													√					√		
HDC309	Housing & Exterior Effects														√						√
HDC322	Introduction to Space making in Housing Projects												√				√				
HDC323	Designing Housing for Future												√								√
HDC324	Housing & Urbanization in Global Cities															√		√			
HDC325	Housing Management														√					√	
HDC406	Tools for Sustainable Cities												√						√		
HDC407	Smart & Intelligent Cities											√					√				
HDC408	Structuring Housing Projects in Developing Countries													√			√				
HDC409	Cities, Infrastructure & Polices													√				√			
HDC421	Housing & livable Communities													√					√		
HDC422	The Future Urbanization of Cities															√					√

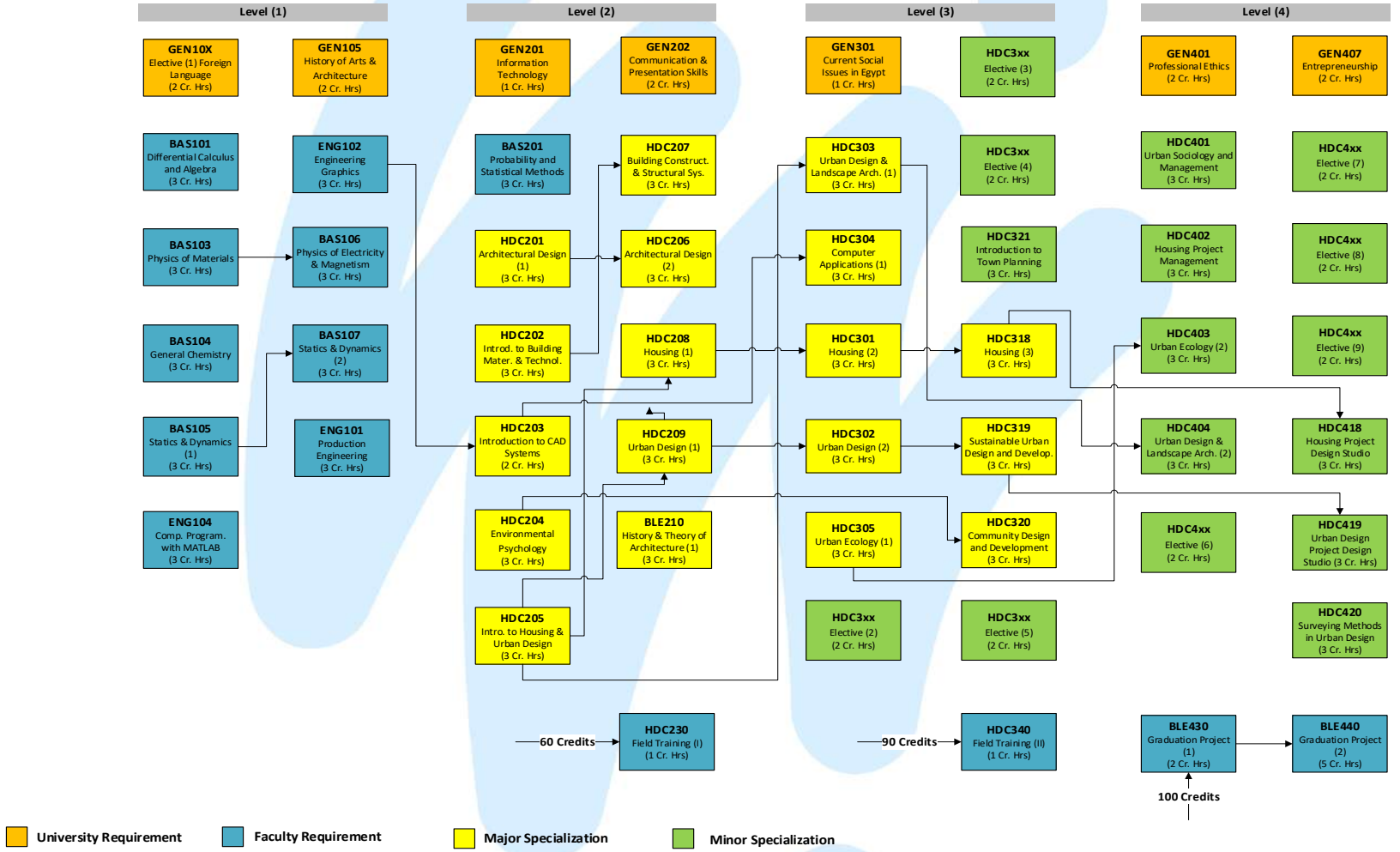
Course Code	Course Name	Engineering Competencies NARS (2018)										Architecture Engineering Competencies (NARS)					"Discipline" Housing & Design for Communities Engineering Competencies (ARS)				
		A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	B1	B2	B3	B4	B5	C1	C2	C3	C4	C5
HDC423	Introduction to Geographical Information Systems															√					√
HDC424	Sustainable Housing, Community and Technology												√					√			
HDC310	The Urban Form											√							√		
HDC311	Urban Economic and Resilience														√				√		
HDC312	Heritage of Urban Culture											√								√	
HDC313	Introduction to Urban Conservation													√						√	
HDC326	Selected Topics in Urban Design												√								√
HDC327	Computer Application-2													√							√
HDC328	Urban Preservation											√						√			
HDC329	Histories & Theories of Urban Interventions											√					√				
HDC410	Urban Transportation Planning													√					√		
HDC411	Cities & Urban Life												√					√			
HDC412	History & Conservation of Greenery															√				√	
HDC413	Site Design											√					√				
HDC425	Parametric Design											√					√				
HDC426	Introduction to Landscape Management														√					√	

Course Code	Course Name	Engineering Competencies NARS (2018)										Architecture Engineering Competencies (NARS)					"Discipline" Housing & Design for Communities Engineering Competencies (ARS)				
		A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	B1	B2	B3	B4	B5	C1	C2	C3	C4	C5
HDC427	Urban Economics														√					√	
HDC428	Introduction to Urban & Environmental Law																		√		
HDC314	Human Behavior & Built Environment												√						√		
HDC315	Human Dimensions of Conservation													√				√			
HDC316	Community Finance														√					√	
HDC330	Emotional Ethics of the Community														√			√			
HDC331	Social Legislation & Social Policy														√			√			
HDC332	Walkability & Urban Form											√					√				
HDC333	Psychology & Sustainability														√				√		
HDC334	Community Planning & Social Policy																				
HDC414	Healthy Community Design and Development													√				√			
HDC415	Economic Development for Rural Communities														√					√	
HDC416	Community Development & Revitalization Technique													√				√			
HDC417	Planning for Healthy Communities															√		√			
HDC429	Community Economic Development														√					√	
HDC430	Resilience & Community Development													√				√			

Course Code	Course Name	Engineering Competencies NARS (2018)										Architecture Engineering Competencies (NARS)					"Discipline" Housing & Design for Communities Engineering Competencies (ARS)				
		A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	B1	B2	B3	B4	B5	C1	C2	C3	C4	C5
HDC431	Building Community Resilience													√					√	√	
HDC432	Community Participation in Design												√							√	

جامعة بنها الأهلية
Benha National University
BNU

FLOWCHART FOR HOUSING & DESIGN FOR COMMUNITIES (HDC) PROGRAM COURSES



HOUSING & DESIGN FOR COMMUNITIES (HDC) PROGRAM
COURSES CLASSIFICATION AND PERCENTAGES

#	Subject Area	CR	%	Min. Percentage according to reference framework (%)
1	University Requirements	12	8.33	8
2	Faculty Requirements	39	27.08	20
3	Major Specialization Subjects	53	36.81	35
4	Minor Specialization Subjects	40	27.78	Maximum 30
		144	**100**	**100**

HOUSING & DESIGN FOR COMMUNITIES (HDC) PROGRAM
LIST OF COURSES

Code	Course	CR	Lec	Tut	Lab	Pre-Req.
(A) University Requirements (12 Credits)						
GEN000	English Language (A remedy course)	0	0	0	0	---
GEN201	Information Technology	1	1	0	0	---
GEN301	Current Social Issues in Egypt	1	1	0	0	---
GEN401	Professional Ethics	2	2	0	0	---
GEN10X	Elective (1) From Language Courses List	2	1	2	0	---
GEN202	Communication & Presentation Skills	2	1	2	0	---
GEN407	Entrepreneurship	2	1	2	0	---
GEN105	History of Arts & Architecture	2	2	0	0	---
(B) Faculty Requirements (39 Credits)						
BAS101	Differential Calculus and Algebra	3	2	2	0	-
BAS201	Probability and Statistical Methods	3	2	2	0	-
BAS103	Physics of Materials	3	2	0	3	-
BAS104	General Chemistry	3	2	0	2	-
BAS105	Statics & Dynamics (1)	3	2	2	0	-
BAS106	Physics of Electricity & Magnetism	3	2	0	3	BAS103
BAS107	Statics & Dynamics (2)	3	2	2	0	BAS105
ENG101	Production Engineering	3	2	0	3	-
ENG102	Engineering Graphics	3	1	0	4	-
ENG104	Computer Programming with MATLAB	3	2	0	3	---
HDC230	Field Training (I)	1	0	0	3	60 Credits
HDC340	Field Training (II)	1	0	0	3	90 Credits
HDC430	Graduation Project (1)	3	1	2	2	100 Credits
HDC440	Graduation Project (2)	4	2	2	2	HDC430
(C) Major Specialization Subjects (53 Credits)						
HDC201	Architectural Design-1	3	1	4	0	-
HDC202	Introduction to Building Materials & Technology	3	2	0	2	-
HDC203	Introduction to CAD Systems	2	1	0	3	ENG102
HDC204	Environmental Psychology	3	2	2	0	-
HDC205	Introduction to Housing & Urban Design	3	2	2	0	-
HDC206	Architectural Design-2	3	1	4	0	HDC201
HDC207	Building Construction & Structural Systems	3	2	2	0	HDC202
HDC208	Housing-1	3	1	4	0	HDC205
HDC209	Urban Design-1	3	1	3	0	HDC205
HDC210	History & Theory of Architecture-1	3	2	2	0	-
HDC301	Housing-2	3	1	4	0	HDC208
HDC302	Urban Design-2	3	1	4	0	HDC209
HDC303	Urban Design & Landscape Architecture-1	3	2	2	0	HDC205

Code	Course	CR	Lec	Tut	Lab	Pre-Req.
HDC304	Computer Applications-1	3	2	0	3	HDC203
HDC305	Urban Ecology-1	3	2	2	0	-
HDC318	Housing-3	3	1	4	0	HDC301
HDC319	Sustainable Urban Design and Development	3	2	2	0	HDC302
HDC320	Community Design and Development	3	2	2	0	HDC204
(D) Minor Specialization Subjects (40 Credits)						
HDC3XX	Elective-2 (Housing or Urban Design or Community Development List)	2	X	X	X	-
HDC3XX	Elective-3 (Housing or Urban Design or Community Development List)	2	X	X	X	-
HDC321	Introduction to Town Planning	3	2	0	3	-
HDC3XX	Elective-4 (Housing or Urban Design or Community Development List)	2	X	X	X	-
HDC3XX	Elective-5 (Housing or Urban Design or Community Development List)	2	X	X	X	-
HDC401	Urban Sociology and Management	3	2	2	0	-
HDC402	Housing Project Management	3	2	2	0	-
HDC403	Urban Ecology-2	3	2	2	0	HDC305
HDC404	Urban Design & Landscape Architecture-2	3	2	0	3	HDC303
HDC4XX	Elective-6 (Housing or Urban Design or Community Development List)	2	X	X	X	-
HDC4XX	Elective-7 (Housing or Urban Design or Community Development List)	2	X	X	X	-
HDC418	Housing Project Design Studio	3	2	0	3	HDC318
HDC419	Urban Project Design Studio	3	2	0	3	HDC319
HDC420	Surveying Methods in Urban Design	3	2	0	3	-
HDC4XX	Elective-8 (Housing or Urban Design or Community Development List)	2	X	X	X	-
HDC4XX	Elective-9 (Housing or Urban Design or Community Development List)	2	X	X	X	-
Elective Courses for Housing– List 1						
HDC306	Housing Design & Needs	2	1	2	0	HDC204, HDC206
HDC307	Housing in Developing Countries	2	1	2	0	-
HDC308	Design of Rural Communities	2	1	2	0	-
HDC309	Housing & Exterior Effects	2	1	2	0	HDC207, HDC208
HDC322	Introduction to Spacemaking in Housing Projects	2	1	2	0	HDC208
HDC323	Designing Housing for Future	2	1	2	0	HDC201
HDC324	Housing & Urbanization in Global Cities	2	1	2	0	-
HDC325	Housing Management	2	1	2	0	-
HDC406	Tools for Sustainable Cities	2	1	2	0	HDC319
HDC407	Smart & Intelligent Cities	2	1	2	0	-
HDC408	Structuring Housing Projects in Developing Countries	2	1	2	0	-
HDC409	Cities, Infrastructure & Polices	2	1	2	0	-
HDC421	Housing & Livable Communities	2	1	2	0	-
HDC422	The Future Urbanization of Cities	2	1	2	0	-
HDC423	Introduction to Geographical Information Systems	2	1	2	0	HDC304
HDC424	Sustainable Housing, Community and Technology	2	1	2	0	HDC319

Code	Course	CR	Lec	Tut	Lab	Pre-Req.
Elective Courses for Urban Design – List 2						
HDC310	The Urban Form	2	1	2	0	-
HDC311	Urban Economic and Resilience	2	1	2	0	-
HDC312	Heritage of Urban Culture	2	1	2	0	-
HDC313	Introduction to Urban Conservation	2	1	2	0	-
HDC326	Selected Topics in Urban Design	2	1	2	0	-
HDC327	Computer Application-2	2	1	0	3	HDC203, HDC302
HDC328	Urban Preservation	2	1	2	0	-
HDC329	Histories & Theories of Urban Interventions	2	1	2	0	-
HDC410	Urban Transportation Planning	2	1	2	0	HDC321
HDC411	Cities & Urban Life	2	1	2	0	-
HDC412	History & Conservation of Greenery	2	1	2	0	-
HDC413	Site Design	2	1	2	0	HDC321
HDC425	Parametric Design	2	1	2	0	-
HDC426	Introduction to Landscape Management	2	1	2	0	HDC404
HDC427	Urban Economics	2	1	2	0	-
HDC428	Introduction to Urban & Environmental Law	2	1	2	0	-
Elective Courses for Community Development – List 3						
HDC314	Human Behavior & Built Environment	2	1	2	0	HDC204
HDC315	Human Dimensions of Conservation	2	1	2	0	-
HDC316	Community Finance	2	1	2	0	-
HDC330	Emotional Ethics of the Community	2	1	2	0	-
HDC331	Social Legislation & Social Policy	2	1	2	0	-
HDC332	Walkability & Urban Form	2	1	2	0	-
HDC333	Psychology & Sustainability	2	1	2	0	HDC305
HDC334	Community Planning & Social Policy	2	1	2	0	HDC320
HDC414	Healthy Community Design and Development	2	1	2	0	-
HDC415	Economic Development for Rural Communities	2	1	2	0	-
HDC416	Community Development & Revitalization Technique	2	1	2	0	-
HDC417	Planning for Healthy Communities	2	1	2	0	-
HDC429	Community Economic Development	2	1	2	0	-
HDC405	Resilience & Community Development	2	1	2	0	HDC319
HDC431	Building Community Resilience	2	1	2	0	HDC319
HDC432	Community Participation in Design	2	1	2	0	-
Basic Science& Mathematics Courses						
BAS101	Differential Calculus and Algebra	3	2	2	0	-
BAS103	Physics of Materials	3	2	0	3	-
BAS104	General Chemistry	3	2	0	2	-
BAS105	Statics & Dynamics (1)	3	2	0	2	-
BAS106	Physics of Electricity & Magnetism	3	2	0	3	BAS103

Code	Course	CR	Lec	Tut	Lab	Pre-Req.
BAS107	Statics & Dynamics (2)	3	2	0	2	BAS105
HDC204	Environmental Psychology	3	2	2	0	-
BAS201	Probability and Statistical Methods	3	2	2	0	-
HDC202	Introduction to Building Materials & Technology	3	2	0	3	-
HDC304	Computer Application-1	3	2	0	3	HDC203

HOUSING & DESIGN FOR COMMUNITIES (HDC) PROGRAM
STUDY PLAN

STUDY PLAN FOR HOUSING & DESIGN FOR COMMUNITIES PROGRAM

1st Level

FIRST SEMESTER

Code	Subject	Credits	Contact Hours			Prerequisites
			Lec.	Tut.	Lab.	
GEN10X	Elective (1) From Language Courses List	2	1	2	0	---
BAS101	Differential Calculus and Algebra	3	2	2	0	---
BAS103	Physics of Materials	3	2	0	3	---
BAS104	General Chemistry	3	2	0	2	---
BAS105	Statics & Dynamics (1)	3	2	2	0	---
ENG101	Production Engineering	3	2	0	3	-
		17	**11**	**6**	**8**	

SECOND SEMESTER

Code	Subject	Credits	Contact Hours			Prerequisites
			Lec.	Tut.	Lab.	
GEN105	History of Arts & Architecture	2	2	0	0	---
ENG102	Engineering Graphics	3	1	0	4	-
BAS106	Physics of Electricity & Magnetism	3	2	0	3	BAS103
BAS107	Statics & Dynamics (2)	3	2	2	0	BAS105
BAS201	Probability and Statistical Methods	3	2	2	0	-
ENG104	Computer Programming with MATLAB	3	2	0	3	---
		17	**11**	**4**	**10**	

STUDY PLAN FOR HOUSING & DESIGN FOR COMMUNITIES PROGRAM

2nd Level

FIRST SEMESTER

Code	Subject	Credits	Contact Hours			Prerequisites
			Lec.	Tut.	Lab.	
HDC201	Architectural Design-1	3	1	4	0	-
HDC202	Introd. to Building Materials & Technology	3	2	0	2	-
HDC203	Introduction to CAD Systems	2	1	0	3	ENG102
HDC204	Environmental Psychology	3	2	2	0	-
HDC205	Introduction to Housing & Urban Design	3	2	2	0	-
GEN202	Communication & Presentation Skills	2	1	2	0	---
GEN201	Information Technology	1	1	0	0	---
		17	**10**	**10**	**5**	

SECOND SEMESTER

Code	Subject	Credits	Contact Hours			Prerequisites
			Lec.	Tut.	Lab.	
HDC206	Architectural Design-2	3	1	4	0	HDC201
HDC207	Building Construction & Structural Sys.	3	2	2	0	HDC202
HDC208	Housing-1	3	1	4	0	HDC205
HDC209	Urban Design-1	3	1	3	0	HDC205
HDC210	History & Theory of Architecture-1	3	2	2	0	-
GEN301	Current Social Issues in Egypt	1	1	0	0	---
GEN401	Professional Ethics	2	2	0	0	---
		18	**10**	**15**	**0**	

SUMMER SEMESTER

Code	Subject	Credits	Contact Hours			Prerequisites
			Lec.	Tut.	Lab.	
HDC230	Field Training (I)	1	0	0	3	60 Credits

STUDY PLAN FOR HOUSING & DESIGN FOR COMMUNITIES PROGRAM

3rd Level

FIRST SEMESTER

Code	Subject	Credits	Contact Hours			Prerequisites
			Lec.	Tut.	Lab.	
HDC301	Housing-2	3	1	4	0	HDC208
HDC302	Urban Design-2	3	1	4	0	HDC209
HDC303	Urban Design & Landscape Architecture-1	3	2	2	0	HDC205
HDC304	Computer Applications-1	3	2	0	3	HDC203
HDC305	Urban Ecology-1	3	2	2	0	-
HDC3XX	Elective-2 (Housing or Urban Design or Community Development List)	2	X	X	X	XXX
HDC3XX	Elective-3 (Housing or Urban Design or Community Development List)	2	X	X	X	XXX
		19	**X**	**X**	**X**	

SECOND SEMESTER

Code	Subject	Credits	Contact Hours			Prerequisites
			Lec.	Tut.	Lab.	
HDC318	Housing-3	3	1	4	0	HDC301
HDC319	Sustainable Urban Design and Develop.	3	2	2	0	HDC302
HDC320	Community Design and Development	3	2	2	0	HDC204
HDC321	Introduction to Town Planning	3	2	0	3	-
HDC3XX	Elective-4 (Housing or Urban Design or Community Development List)	2	X	X	X	XXX
GEN407	Entrepreneurship	2	1	2	0	---
HDC3XX	Elective-5 (Housing or Urban Design or Community Development List)	2	X	X	X	XXX
		18	**X**	**X**	**X**	

SUMMER SEMESTER

Code	Subject	Credits	Contact Hours			Prerequisites
			Lec.	Tut.	Lab.	
HDC340	Field Training (II)	1	0	0	3	90 Credits

STUDY PLAN FOR HOUSING & DESIGN FOR COMMUNITIES PROGRAM

4th Level

FIRST SEMESTER

Code	Subject	Credits	Contact Hours			Prerequisites
			Lec.	Tut.	Lab.	
HDC401	Urban Sociology and Management	3	2	2	0	-
HDC402	Housing Project Management	3	2	2	0	-
HDC403	Urban Ecology-2	3	2	2	0	HDC305
HDC404	Urban Design & Landscape Architecture-2	3	2	0	3	HDC303
HDC430	Graduation Project-1	2	0	4	0	100 Credits
HDC4XX	Elective-6 (Housing or Urban Design or Community Development List)	2	X	X	X	XXX
HDC4XX	Elective-7 (Housing or Urban Design or Community Development List)	2	X	X	X	XXX
		18	**X**	**X**	**X**	

SECOND SEMESTER

Code	Subject	Credits	Contact Hours			Prerequisites
			Lec.	Tut.	Lab.	
HDC418	Housing Project Design Studio	3	2	0	3	HDC318
HDC419	Urban Design Project Design Studio	3	2	0	3	HDC319
HDC420	Surveying Methods in Urban Design	3	2	0	3	-
HDC440	Graduation Project-2	5	2	6	0	HDC430
HDC4XX	Elective-8 (Housing or Urban Design or Community Development List)	2	X	X	X	XXX
HDC4XX	Elective-9 (Housing or Urban Design or Community Development List)	2	X	X	X	XXX
		18	**X**	**X**	**X**	

HOUSING & DESIGN FOR COMMUNITIES (HDC) PROGRAM
COURSE DISCERPTIONS

HOUSING & DESIGN FOR COMMUNITIES PROGRAM
COURSE DESCRIPTIONS

HDC201	Architectural Design-1	3 (1,4,0)
The students are desired to understand the basics of architectural design and principles. The course introduces the different aspects that influence the form of architectural buildings. It focuses on elements such as: design method and representation, human scale, space, form and light, functional relations, circulation patterns, place and time. Design is understood as a method of inquiry, through hands-on exercises which enhance architectural skills and thinking by 2-dimensional and 3- dimensional weekly assignments. The studio concludes by a design assignment for a simple structure for small scale buildings placed in a selected context they learn during the studio in a process-based project.		

Prerequisites: none.

References:

1. Ching, Francis D.K., ''Architecture: Form, Space and order'' , 1979. Van Nostrand Reinhold Co., NY, USA.
2. Ernst and Peter Neufert, Architects Data, Recommended books.
3. Time Saver Standards for Architectural Design Data.
4. Alan Jefferis , David A. Madsen, "Architectural Drafting and Design", 2004 Cengage Learning.
5. Wiley, Ramsey Sleeper, (2007) , "Architectural Graphic Standards",11th Edition, American.
6. E. L. Koller Light, Shade & Shadow 2008 Dover Publications
7. MARTIN, LESLIE. Architectural Graphics. 2002Mac Milan Publishers London Chiu-Shui Chan. 'Style and Creativity in Design' 2015

HDC202	Introduction to Building Materials & Technology	3 (2,0,2)
General introduction about drawing techniques - understanding types of structures - wall bearing & skeleton types - Traditional construction - masonry - raw bricks & brick masonry – detailing - Introduction to foundation design - construction buildings types & techniques. The crucial link between an Architectural Project and the building technology and materials. Classification of types of materials - Concrete and asphalt concrete; constituent materials and their properties, mix design, manufacture, properties, and standard and quality control testing.		

Prerequisites: none.

References:

1. Fundamental Building Technology, by Andrew J. Charlett and Craig Maybery-Thomas, Routledge, 2013, ISBN 9780415692595.
2. Egyptian code, third appendix, Laboratory testing of concrete materials
3. Egyptian code for design and construction of reinforced concrete buildings
4. خواص المواد واختباراتها الجزء الأول أ.د/ محمود إمام 2007
5. David Roylance 'MECHANICAL PROPERTIES OF MATERIALS' 2008.
6. Illston, J.M, and Domone, P.L.J."Construction Materials, Their nature and behavior", ISBN 0-419-25860
7. Somayaji, S. "Civil Engineering Materials", ISBN 0-13-177643-6

HDC203	Introduction to CAD Systems	2 (1,0,3)
This course is investigates current CAD technologies and helps students in the utilization of expert CAD programming to deliver 2D and 3D plan determinations, to change CAD software into photograph reasonable virtual items and to acquire a consciousness of CAD data and how such data can be changed to designing drawings. Toward the end of the course, the students will comprehend an assortment of terms and phrasing as applied to CAD technology; show the utilization of an industry standard working framework to make standard CAD packages for 2D and 3D design drawings.		

Prerequisites: ENG102.

References:

1- A Textbook of Engineering Drawing: Along with an Introduction to AutoCAD 2015 by Roop Lal, I K International Publishing House, 2015.

2- A Textbook of Engineering Drawing: with AutoCAD 4th ed. by K Venkata Reddy, BS Publications, 2016, ISBN-13 : 978-9352300440

HDC204	Environmental Psychology	3 (2,2,0)
This course basically inspects the field of environmental psychology. The students will find out about the interrelationships among ourselves and the natural frameworks where we reside and work. The attention is on both hypothesis and application. Explicit themes tended to include: the set of experiences and extent of ecological brain science; speculations of climate and conduct; natural pressure; indigenous habitats; constructed conditions; planning for people; specific living and work spaces and social change according to contemporary worldwide natural issues and issues of manageability.		

Prerequisites: none.

1- Environmental Psychology: An Introduction 1st Edition, by Linda Steg, Agnes E. van den Berg, Judith I. M. de Groot (Editors), Wiley-Blackwell; 1st edition (2012), ISBN-13 : 978-0470976388

HDC205	Introduction to Housing & Urban Design	3 (2,2,0)
The course presents the fundamental standards of urban design and the essential standards associated with housing layouts. Before the finish of the course the students produce plan proposition for plan basic housing layouts utilizing fundamental standards of urban design.		

Prerequisites: none.

References:

1- Donald Watson, Alan Plattus& Rebort Shibley, Time Saver Standard for Urban Design, McGraw-Hill.

2- Introduction to Urban Housing Design: At Home in the City 1st Edition, by Graham Towers, Architectural Press; 1st edition (2005), ISBN-13 : 978-0750659024

3- Baruch Givoni," Climatic Consideration in Building and Urban Design" Van Nostrand Reinhold, 1998.

HDC206	Architectural Design-2	3 (1,4,0)

This course intends to direct the students through the cycle of design beginning from determining the idea and reasonable speculation dependent on human behavioral inputs; and finally coming to a complete multi-layered design. The students will start to comprehend the various aspects incorporated with the design process covering simply: Socio-cultural, Utilitarian, Structural, Environmental and Economic aspects.

The students will investigate the subjective parts of the structure work relationship and their collaboration with ecological viewpoints. The student learns how to coordinate functional requirements with basic environmental considerations in his design inception and form generation.

Prerequisites: HDC201.

References:

1. Ching, Francis D.K., ''Architecture: Form, Space and order'', 1979Van Nostrand Reinhold Co., NY, USA.
2. Joseph de Chiare and John Hancock Callender,(1990) ,"Time Saver Standards for Building Types".
3. Time Saver Standards for Architectural Design Data.
4. Alan Jefferis , David A. Madsen, "Architectural Drafting and Design", 2004 Cengage Learning
5. Ernst and Peter Neufert, Architects Data,Recommended books
6. MARTIN, LESLIE. Architectural Graphics 2002. Mac Milan Publishers London
   Chiu-Shui Chan. 'Style and Creativity in Design' 2015

HDC207	Building Construction & Structural Systems	3 (2,2,0)

This is a basic course to introduce the students:

The components of architectural structure systems. Roofing systems, Wooden construction, light steel detailing, stair types and construction, introduction to technical Installations. It includes also exterior and interior finishing materials and particulars.

Prerequisites: HDC202.

References:

1. Osama Al Nahas , "Building construction" 2015
2. W.B. McKay, M.Sc.Tech.,M.I.Struct.E. , "McKay's Building Construction, William Barr McKay ,2013"
3. Mitchel, "Building construction" 2002.
4. Medan Mehta, Scarborough , Armrest ,"Building Construction ",Prentice Hall, 2012
5. Building Design and Construction Handbook, Sixth Edition, 2001, McGraw-Hill: New York, San Francisco, Washington, D.C., Auckland, Bogotá, Caracas, Lisbon.
6. محمد عبدالله , "الانشاء المعمارى" , دار الكتب المصرية 1980
7. فاروق عباس حيدر , "تشييد المبانى" , دار الكتب المصرية

HDC208	Housing-1	3 (1,4,0)

Survey of housing and redevelopment problems, theories, standards, and practice. Development of public policies, finance, technological considerations, social factors, and priorities.

Prerequisites: HDC205.

References:

1. Introduction to Housing 2nd Edition, by Housing Education Research Association, Katrin B. Anacker (Editor), Andrew T. Carswell (Editor), Sarah D. Kirby (Editor, Contributor), et. al., University of Georgia Press; (2018), ISBN-13 : 978-0820349688
2. The Housing Design Handbook: A Guide to Good Practice By David Levitt and Jo McCafferty, 2nd Edition (2019), Routledge, ISBN 9781138568952

HDC209	Urban Design-1	3 (1,3,0)
Prologue to the concepts, methods, and manifestations of urban design and city-building. Zero in on both traditional and contemporary city conditions. Students will acquire an essential comprehension of design structure, order, function, and character of cities and towns and assess various qualitative aspects of these conditions. Relationships between processes of architecture, landscape architecture, site planning, preservation and other relevant acts of city-building will be considered as referential points-of-view in assessing certain complexities of urban morphology.		

Prerequisites: HDC205.

References:

1. Urban Design by William S. Saunders (Editor), University of Minnesota Press, (2009), ISBN-13 : 978-0816656394
2. The Image of the City (Harvard-MIT Joint Center for Urban Studies Series) by Kevin Lynch, MIT Press; Illustrated edition (1964), ISBN-13 : 978-0262620017
3. Cities for People by Jan Gehl, Island Press (2010), ISBN-13 : 978-1597265737

HDC210	History & Theory of Architecture-1	3 (2,2,0)
The course discusses a layout of the set of experiences and hypothesis of engineering and urbanism from Ancient Egypt to the nineteenth century. It investigates structures as the result of culture and comparable to the unique issues of building plan.		

Prerequisites: none.

References:

1. Fletcher.B, 1996, A History of Architecture
2. Riseberro, B. Massachusetts 2012,The Story of Western Architecture The MIT Press, Cambridge
3. Mills, E.D. 1985 planning the architects handbook
4. Neufert, E. 1980 architects data
5. Dechiara, J, 1990 , Time -saver standards for buildings types
6. Architecture: Form, Space and Order 2007 John Wiley & Son Francis D.K. Ching

7. شكري،محمد انور،1986،العماره المصرية القديمة
8. سامي،عرفان،1967،نظريات عمارة
9. عبد الجواد،توفيق احمد،2008،تاريخ العمارة والفنون في العصور الاولي
10. محمد انور شكرى, 1986 "العمارة فى مصر القديمة" , الهيئة المصرية العامة للكتاب

HDC301	Housing-2	3 (1,4,0)
Housing is more than “protection from the elements”. Housing has social, financial, and mental ramifications. Points to be tended to during this course include: an introduction to housing		

studies, architectural styles and preferences, construction methods and components, social and psychological aspects, policies and regulations impacting individuals and families.

Prerequisites: HDC208.

References:

1- Introduction to Housing 2nd Edition, by Housing Education Research Association, Katrin B. Anacker (Editor), Andrew T. Carswell (Editor), Sarah D. Kirby (Editor, Contributor), et. al., University of Georgia Press; (2018), ISBN-13 : 978-0820349688
2- Housing Design: A Manual , by Bernard Leupen and Harald Mooij, nai010 publishers; 2nd edition (2012), ISBN-13 : 978-9056628260

HDC302	Urban Design-2	3 (1,4,0)

This course prepares the students to consider engineering inside an urban setting and features urban design and various degrees of preparation and plan. The course manages metropolitan plan in both existing and new zones, including models of urban analysis, contemporary theories of urban design and implementation strategies, supplemented by the illustration of methods of urban design practice, as well as field trips. The course includes different urban analysis exercises and small-scale projects, which could deal with the design of a specific public space or the design of a “building gap” amid an existing urban fabric.

Prerequisites: HDC209.

References:

1. The People's City: One City Trust by Nadine Aisha Jassat (Author), Anne Hamilton, Alexander McCall Smith, Ian Rankin, Sara Sheridan, Birlinn Ltd, (2022), ISBN-13 : 978-1846976018
2. Cities for People, Not for Profit: Critical Urban Theory and the Right to the City by Neil Brenner, Peter Marcuse and Margit Mayer, Routledge, (2011), ISBN-13 : 978-0415601788

HDC303	Urban Design & Landscape Architecture-1	3 (2,2,0)

This course presents the standards of landscape architecture, including site examination, practical ideas, preliminary plan and expert arranging. It covers both knowledge and skills for the students to be able to present a final plan. It covers both hard-scape and soft-scape components of landscape projects. In addition, the course applies the basics of environmental design and building technologies in the field of landscape design.

Prerequisites: HDC205.

References:

1. Simonds, John Ormsbee, “Landscape Architecture,” MC Graw-Hill Book Company.
2. W.Reid, Grant, “Landscape Graphics,” Whitney Library of Design, New York.
3. د. محمد حماد، م. محمد فتحي سالم، " التشجير المعماري، في زراعة انواع نباتات الزينة لتنسيق الحدائق،" 1971
4. د. مصطفى بدر، "تنسيق وتجميل المدن والقرى،" منشأة المعارف، الاسكندرية، 1992

HDC304	Computer Applications-1	3 (2,0,3)

Creating Ideas with Computers. The objective of the course is to encourage insightful, basic and integrative deduction to help students commence, arrange, execute and introduce exploration proposals. The students will inspect, examine, question and discuss issues of registering and data innovation in planning, and to imagine better plan instruments for what's to come.

Prerequisites: HDC203.

References:

1. Linda Holtzschue , Edward Noriega , "Design Fundamentals for the Digital Age", Wiley, 1997 - Benjamin ,
2. Wucius Wong, "Visual Design on the Computer", W. W. Norton & Company, 2001
3. Hashimoto , Clayton, "Visual Design Fundamentals", Course Technology PTR, 2009

HDC305	Urban Ecology-1	3 (2,2,0)

Introducing basic concepts of integrated design taking into account basic functional relations between the facility under design and the environment.
The goal is to create skills in making plans considering their effect on the climate. It additionally expects to show the natural conditions of expert morals, social competencies: understanding the role of sustainable development in architecture and the role of integrated design, ability to perform critical analysis of projects and architectural implementation for sustainable development.

Prerequisites: none.

References:

1- Daniel E. Williams, 2007, Sustainable Design: Ecology, Architecture, and Planning, John Wiley & Sons, Inc.
2- Moore, F., Environmental control systems, Heating Cooling – Lighting, McGraw-Hill Inc., 1993 .
3- Olgyae V, Design with Climate – Bioclimatic Approach to Architecture Regionalism, Princeton University press, 1973
4- Lechner, N., Heating, Cooling, Lighting- Design Methods for Architects, John Wiley &Sons, 1991
5- دليل العمارة والطاقة " العمارة الخضراء والطاقة" جهاز تخطيط الطاقة – يوليو 1998م.
6- شفق العوضى الوكيل، د.م محمد عبد الله سراج " المناخ وعمارة المناطق الحارة" القاهرة 1989.
7- خالد الفجال "العمارة والبيئة فى المناطق الصحراوية" الدار الثقافية للنشر والتوزيع - 2002

HDC318	Housing-3	3 (1,4,0)

Application of critical thinking abilities to selection of neighborhood locations. Investigation of social and natural conditions in the site. Lectures connect configuration tasks to contemporary hypotheses and practices.

Prerequisites: HDC301.

References:

1- Introduction to Housing 2nd Edition, by Housing Education Research Association, Katrin B. Anacker (Editor), Andrew T. Carswell (Editor), Sarah D. Kirby (Editor, Contributor), et. al., University of Georgia Press; (2018), ISBN-13 : 978-0820349688
2- Manual of Tropical Housing and Building: Climate Design by O H Koenigsberger, T G Ingersoll , Alan Mayhew, Orient Blackswan (January 1, 1975), ISBN-13 : 978-8173716973

HDC319	Sustainable Urban Design and Development	3 (2,2,0)

The course equips students with the ability required to build within contemporary cities and the new approaches to urban design. It analyzes the green city idea and its methodologies, standards, measure, rating frameworks, files and techniques. The course will investigate the metropolitan

personal satisfaction. Students dissect a current climate and propose arrangements that encourage connection between planning and the bigger metropolitan domain and rethink the metropolitan climate.

Prerequisites: HDC302.

References:

1. Margaret Robertson, Sustainability Principles and Practice, Routledge, 2014, eBook: 978-0-203-76874-7
2. David Adams and Steve Tiesdell, Shaping Places: Urban Planning, Design and Development, Routledge, 2012, eBook: 978-0-203-10566-5

HDC320	Community Design and Development	3 (2,2,0)

This course introduces the student to community development concepts, and techniques, providing students an opportunity to obtain "a theoretical and practical field" experience. This is done through: In depth exploration of social aspects of various urban contexts, Debating the various roles and responsibilities of the architect in the design/planning process, Conducting and utilizing social research in designing/ planning.

Prerequisites: HDC204.

References:

1. Edited by Rhonda Phillips and Robert Pittman, An Introduction to Community Development, Routledge, 2014, eBook: 978-0-203-76263-9
2. Design First: Design-based Planning for Communities, by David Walters, Linda Brown, Architectural Press, 1st Edition, (2004)

HDC321	Introduction to Town Planning	3 (2,2,0)

This course will provide planning students a foundational understanding of the spatial arrangement of cities. It will examine the history of spatial planning from the early 19th century to today, the processes that shape growth and development, and the major socio-politico-economic factors that influence the social and built environments within cities. This course will introduce the major theories, models, and methodological approaches that planners use to explain the function and structure of urban areas. This course also takes a critical urban planning approach that examines institutional and structural racism that planning has played in shaping the physical and social structure in the cities.

Prerequisites: none.

References:

1- Avi Friedman, Planning Small and Mid-Sized Towns: Designing and Retrofitting for Sustainability, Routledge, 2014, eBook: 978-0-203-10781-2

HDC401	Urban Sociology and Management	3 (2,2,0)

The functions for this course are two-fold. First, it serves as an introduction to some of the substantive issues, and to a lesser extent, the methods, that have animated debates in urban sociology. The course will cover topics like succession, mutual surveillance, inequality, poverty, segregation, and gentrification. These substantive topics are, of course, tied up in particular frameworks for understanding urban space. These topics will be situated within the broader framework of the development of urban sociology as a field of knowledge. In doing so, it will

explore how the sub-field of urban sociology consists of a number of narratives and frameworks in discourse with each other.

Prerequisites: none.

References:

1. Edited by Loretta Lees, Tom Slater, and Elvin Wyly, The Gentrification Reader, Routledge, 2010, ISBN 978-0-415-54840-3
2. Edited by Fritz Wagner and Roger Caves, Community Livability: Issues and Approaches to Sustaining the Well-Being of People and Communities, Routledge, 2012, eBook: 978-0-203-14820-4

HDC402	Housing Project Management	3 (2,2,0)
Ventures are an undeniably significant part of present-day business. The course underlines the significance of understanding the connection among projects and the essential objectives. The course likewise examines the specialized, social, and relational skills important to effectively oversee projects from beginning to end. It underscores that project needs its own instruments, collection of information, and skills. Ideas are fortified by contextual investigations covering a wide assortment of contract types.		

Prerequisites: none.

References:

1- Harold R. Kerzner, (2013), “Project Management: A Systems Approach to Planning, Scheduling, andControlling", Wiley; 11 edition .
2- Terry Schmidt, (2009), “Strategic Project Management Made Simple: Practical Tools for Leaders andTeams”, Wiley; 1 edition .
3- Project Management Institute, (2013), "A Guide to the Project Management Body of Knowledge", Project Management Institute; 5 edition .
4- Meredith, R. Jack and Mantel, Jr., Samuel J., (2008), "Project Management: A Managerial Approach ,"Wiley, 7th edition.
5- Project Management Institute, (2013), "A Guide to the Project Management Body of Knowledge", Project Management Institute; 5th edition

HDC403	Urban Ecology-2	3 (2,2,0)
The course will inspect how both nature and people have reacted environmentally and developmentally to urbanization. The course will analyze physical and organic factors that drive the nature of urban regions. A focal objective will be to see how communications among people and the climate drive and are driven by the fabricated climate particularly with regards to the physical and natural. The course will analyze both theoretical underpinnings and the use of hypothesis to practice to improve government assistance and ecological quality.		

Prerequisites: HDC305.

References:

1- Daniel E. Williams, 2007, Sustainable Design: Ecology, Architecture, and Planning, John Wiley & Sons, Inc.
2- Moore, F., Environmental control systems, Heating Cooling – Lighting, McGraw-Hill Inc., 1993 .

3- Olgyae V, Design with Climate – Bioclimatic Approach to Architecture Regionalism, Princeton University press, 1973
4- Lechner, N., Heating, Cooling, Lighting- Design Methods for Architects, John Wiley &Sons, 1991
5- دليل العمارة والطاقة " العمارة الخضراء والطاقة" جهاز تخطيط الطاقة – يوليو 1998م.
6- شفق العوضى الوكيل، د.م محمد عبد الله سراج " المناخ وعمارة المناطق الحارة" القاهرة 1989.
7- 4- خالد الفجال "العمارة والبيئة فى المناطق الصحراوية" الدار الثقافية للنشر والتوزيع - 2002

HDC404	Urban Design & Landscape Architecture-2	3 (2,0,3)
Students analyze an existing environment and design a built structure that fosters relationships between its intended activities and the larger urban territory and redefines the urban environment. The course also Introduces skills needed to build within a landscape establishing continuities between the built and natural world. Students learn to build appropriately through analysis of landscape and climate for a chosen site and conceptualize design decisions through drawings and models.		

Prerequisites: HDC303.
References:

1. Harris ,Charles. Time-Saver Standards for Landscape Architecture, McGraw Hill. New York., 2nd Ed. 1998
2. Austin, R. Designing with Plants, Van nostrand Reinhold Fishman, R. 19 Urban Utopias of the Twentieth Century.
3. Lyall, Sutherland, (1991), Designing the New Landscape, Thames and Hudson
4. Tate, Alan (2003), Great City Parks, Spon Press, 2nd edition
5. Walter Rogers, 1996, The Professionals Practice of Landscape Architecture, John Wiley & Sons.
6. Tim Waterman, 2015, The Fundamentals of Landscape Architecture
7. Steven L. Cantor, 1996, Contemporary Trends in Landscape Architecture, John Wiley & Sons

HDC418	Housing Project Design Studio	3 (2,0,3)
Focuses on understanding complex social, economic, and environmental factors, developing sustainability priorities and strategies, and applying them through housing design projects and policy.		

Prerequisites: HDC318.
References:

1. Edited by Elizabeth Mueller and Rosie Tighe, The Affordable Housing Reader, Routledge, 2012, eBook: 978-0-203-72267-1.
2. Residential Design Studio, by Robert Philip Gordon, 1st Edition, (2022), ISBN-13: 978-1563678417

HDC419	Urban Design Project Design Studio	3 (2,0,3)
Focuses on understanding complex social, economic, and environmental factors, developing sustainability priorities and strategies, and applying them through urban design and policy.		

Prerequisites: HDC319.
References:

1. Robert Mantho, The Urban Section: An analytical tool for cities and streets, Routledge, 2014, eBook: 978-0-203-07990-4
2. Ron Kasprisin, Urban Design: The Composition of Complexity, Routledge, 2011, eBook: 978-0-203-83376-6

HDC420	Research Methods in Urban Design	3 (2,0,3)
Qualitative and Quantitative research methods covering both the theoretical foundations and practical methodologies of traditional and contemporary approaches, including cognitive mapping, open-ended interviews, ethnographic observation, hermeneutics, phenomenology, critical theory and communicative action.		

Prerequisites: none.

References:

1- Research Methodology and Scientific Writing, by C. George Thomas, Ane Books Pvt. Ltd., 2016
2- Williamson, Antony Ford, Understanding Scientific Research ,Taylor & Francis, 2013
3- Garnier J. Principles and Practice of research , Presses univ. de Louvain, 2011
4- بدر احمد ، أصول البحث العلمى ومناهجه ، المكتبة الاكاديمية 1996
5- مبارك محمود الصاوى ، البحث العلمى ، اسسه وطريقة كتابته ، المكتبة الاكاديمية 1992

HDC306	Housing Design & Needs	2 (1,2,0)
This course expects students to comprehend the significance of essential physical and emotional human requirements, what these necessities can mean for housing needs and what a person's qualities can mean for the impression of housing. The course expects to value the modernization of lodging and to show how it developed to address human issues utilizing accessible materials. During the course the students ought to recognize the components, for example, environment, security, characteristic assets, authentic impacts, way of life, and design styles that impact the kind of haven that is given by lodging.		

Prerequisites: HDC204, HDC206.

References

1- Housing Design for an Increasingly Older Population: Redefining Assisted Living for the Mentally and Physically Frail by Victor Regnier, (2018), ISBN: 978-1-119-18003-6
2- Radical Housing: Designing multi-generational and co-living housing for all by Caroline Dove, RIBA Publishing (2020), ISBN 9781859468913
3- Designing for Privacy and Related Needs by Julie Stewart-Pollack, Rosemary M. Menconi, Fairchild Publications (2005), ISBN-13 : 978-1563673405
4- Ethnicity and Housing : Accommodating the Differences by Frederick w. Boal, Ashgate Publishing, The Limited (2000), ISBN-13 : 9781859725962
5- Inclusive Housing: A Pattern Book: Design for Diversity and Equality by Edward Steinfeld and Jonathan White, Norton Architecture, ISBN: 978-0-393-73316-7.

HDC307	Housing in Developing Countries	2 (1,2,0)
Assessment of urban housing and vagrancy from a political economy viewpoint, inside the setting of more extensive monetary powers at work.		

Prerequisites: none.

References :

1- غريب محمد أحمد "مجتمع القرية-دراسات وبحوث" -دار المعرفة الجامعية-الإسكندرية - ١٩٨٧ م
2- ماجد، صبيح "مدخل إلى التخطيط والتنمية الاجتماعية- الشركة المتحدة للتوريد والتسويق – القاهرة- 2014م.
3- Gehl.Jan –"Life Between Building –Using Public Spaces" V.N.R ,New York-1987.
4- Rapoport ,A- "The meaning of the built environment-"California: Sage publications, Inc-1982.
5- ZUCHELLI ALBERTO: INTRODUCTION A LURBANISME OPERATIONNEL A LA COMPOSITION URBAINE VOLUME, OPU ALGERE 1983.

HDC308	Design of Rural Communities	2 (1,2,0)
Introduction to rural extension including history and philosophy, learning and motivation, the rural setting, adoption/technology transfer process, marketing, planning, extension teaching/communication methods and technology and evaluation		

Prerequisites: none.

References:

1- Hassan Fathy, "Architecture for the poor", An experiment in rural Egypt, University of Chicago Press,1973.
2- Paul Oliver, Dwellings - The House across the World, Phaidon Press Limited.
3- Willi Weber & Simos Yannas, 2013, Lessons from Vernacular Architecture, Routledge
4- Henry Glassie, 2000, Vernacular Architecture, Indiana University Press

HDC309	Housing & Exterior Effects	2 (1,2,0)
Understanding the nature of exterior design materials, how they are created, evaluated, and refined to meet human needs. This is achieved through: . Examining ways in which the elements and principles of design apply to the exterior appearance of a building. . Considering materials used for housing exterior. . Examining window styles and their contribution to the overall exterior appearance of the home.		

Prerequisites: HDC207, HDC208.

References

1- What Not To Build: Do's and Don'ts of Exterior Home Design by Sandra Edelman, Creative Homeowner, 2006, ASIN : B0028N738Y
2- Exterior Design in Architecture by Ashihara, Yoshinobu, Van Nostrand Reinhold, 1981, ISBN-13 : 978-0442212032

HDC322	Introduction to Space making in Housing Projects	2 (1,2,0)
Introduction to basic principles of design for the creation of space in housing projects. Introduction to design methodologies and skills necessary to define, manipulate, and represent the built environment. Workshops in 2D computer graphic techniques and 3D physical modeling making will reinforce design principles.		

Prerequisites: HDC208.

References

Time-Saver Standards for Interior Design and Space Planning by Joseph DeChiara, Julius Panero, Martin Zelnik, Second Edition (2001), McGraw Hill LLC, ISBN: 9780071704656

HDC323	Designing Housing for Future	2 (1,2,0)
Develop students understanding of how housing knowledge is created, evaluated, refined and changed with changing social conditions and the introduction of new technology. Through promoting both imaginative thought and the ability to evaluate ideas, processes, and experiences related to housing.		

Prerequisites: HDC201.

References:

1- Joanna Williams, Zero-carbon Homes, A Road Map, Routledge, 2011, eBook: 978-0-203-15352-9
2- Future Home Design: A Home That Adapts To Different Phases Of Your Life by Farinah Husodo, 514 Publishing (2021), ISBN-13 : 978-0645189421
3- Future Homes: Sustainable Innovative Designs by Avi Friedman and Charles Gregoire, Images Publishing Dist Ac (2022), ISBN-13 : 978-1864709155

HDC324	Housing & Urbanization in Global Cities	2 (1,2,0)
This course analyzes housing policy and planning in developing urban societies around the world and especially in the Global South. To understand the effects of different national and cultural environments, the course examines the ways private developers, planners, designers, non-government organization officers, and government officials work within local systems of land use, law, and finance to produce homes for people. This will prepare students for courses in international housing, social policy, planning, and design. This will also interest students who would like to apply social engagement and diverse methods of producing low-income housing in global cities.		

Prerequisites: none.

References

1. Lawrence Herzog, Global Suburbs, Routledge, 2014, eBook: 978-1-315-79463-1
2. Hugh Barton, Marcus Grant and Richard Guise, Shaping Neighbourhoods For Local Health and Global Sustainability, Routledge, 2010, ISBN 978-0-415-49549-3
3. Global Urbanization (The City in the Twenty-First Century) by Eugenie L. Birch (Editor), Susan M. Wachter (Editor), University of Pennsylvania Press (2011), ISBN-13 : 978-0812242843

HDC325	Housing Management	2 (1,2,0)
This course focuses on development and management issues in multifamily housing. The subjects of study include: multifamily housing development planning and financing, management approaches, with specific residential populations such as elderly persons and families with children, and affordable housing issues such as government supported housing, cooperatives, and community land trusts.		

Prerequisites: none.

References

1. Housing and Housing Management: Balancing the Two Key Contracts (Policy and Practice in Health and Social Care), by Nigel Sprigings, (2017), ISBN-13 : 978-1780460611
2. Housing Management, Principles and Practices (Classic Reprint) by Beatrice Greenfield Rosahn, Forgotten Books (2018), ISBN-13 : 978-0364769027

3. Introduction to Social Housing by Paul Reeves, Routledge (2005), ISBN 9780750663939

HDC406	Tools for Sustainable Cities	2 (1,2,0)
The course examines specific tools used for planning sustainable cities, including hands-on learning, case studies, and site tours to enrich students' knowledge and experience.		

Prerequisites: HDC319.

References

1. Paul Chatterton, Low Impact Living: A Field Guide to Ecological, Affordable Community Building, Routledge, 2014, eBook: 978-1-315-76592-1
2. Jonathan Barnett, City Design: Modernist, Traditional, Green and Systems Perspectives, Routledge, 2011, ISBN 978-0-415-77541-0: $

HDC407	Smart & Intelligent Cities	2 (1,2,0)
In this course, the students learn about the influence of urban networks, smart city urban planning, energy as a catalyst of sustainable development, smart city infrastructure, sustainable transportation, flow of information and communications, smart grids, digital infrastructure and the role of data and information technology. It will discuss criteria for measuring the smartness of a city, including quality of life, citizen governance, and discuss issues that go towards the making of a future smart city. Several case studies will be presented on critical thinking and practices in smart city development.		

Prerequisites: none.

References

1. From Intelligent to Smart Cities Edited By Mark Deakin and Husam Al Waer, Routledge (2014), ISBN 9780415754897
2. The Age of Intelligent Cities: Smart Environments and Innovation-for-all Strategies by Nicos Komninos, Routledge (2018), ISBN 9781138329058
3. Developing and Monitoring Smart Environments for Intelligent Cities by Zaigham Mahmood, IGI Global, 1st Edition (2020), ISBN-13 : 978-1799850625

HDC408	Structuring Housing Projects in Developing Countries	2 (1,2,0)
The course is intended as an introduction and understanding of current issues in Third World housing policies and projects and targeted toward those interested in a practical understanding of how projects are prepared by development agencies. The course prepares students to participate in development projects and stresses hands-on real life issues, that challenge professionals.		

Prerequisites: none.

References

1. Affordable Housing in the Urban Global South: Seeking Sustainable Solutions. Jan Bredenoord, Paul Van Lindert and Peer Smets (eds). Routledge, (2014), ISBN-13 : 978-0415622424
2. Trading Places: Accessing Land in African Cities. Stephen Berrisford, Caroline Wanjiku Kihato, Rob McGaffin, Mark Napier and Lauren Royston. African Minds Publishers, (2013), ISBN-13 : 978-1920489991

3. Housing the urban poor : policy andpractice in developing countries / edited by Brian C. Aldrich and Ranvinder S. Sandhu, Zed Books (1995), ISBN 1856493601

HDC409	Cities, Infrastructure & Polices	2 (1,2,0)
From Renaissance to Smart Technologies, infrastructures play a decisive role in urban development and in the life of cities. This course will envisage this role from a historical perspective. History proves especially useful when dealing with the political dimension of urban infrastructures. From fortifications to smart technologies, infrastructures are inseparable from political intentions and consequences.		

Prerequisites: none.

References

1. Alexander Cuthbert, Understanding Cities: Method in Urban Design, Routledge, 2011, eBook: 978-0-203-81793-3
2. Vicki Elmer, Infrastructure Planning and Finance: A Smart and Sustainable Guide, Routledge, 2013, eBook: 978-0-203-55239-1
3. Edited by Stephen Graham and Colin McFarlane, Infrastructural Lives: Urban Infrastructure in Context, Routledge, 2014, eBook: 978-1-315-77509-8

HDC421	Housing & Livable Communities	2 (1,2,0)
The course introduces the principles and aspects of quality of life, home modification, livable and convivial communities, and assistive technology to support individuals/families. Specially the course emphasizes will be on the housing needs of older adults and persons with disabilities and the ways in which housing and community planning facilitates or inhibits the quality of life for persons with special needs.		

Prerequisites: none.

References:

Edited by Fritz Wagner and Roger Caves, Community Livability Issues and Approaches to Sustaining the Well-Being of People and Communities, Routledge, 2012, eBook: 978-0-203-14820-4

HDC422	The Future Urbanization of Cities	2 (1,2,0)
The course begins with exploring the concept of the 'city' in housing studies literature by examining what urbanization means to the governments, businesses and people whose lives are affected by changes to the built environment of cities and to the ecosystems that support them. It moves on to consider urban contestations over policy, planning and development among a wide range of stakeholders, from real estate developers to social movements.		

Prerequisites: none.

References

1. Tony Fry, City Futures in the Age of a Changing Climate, Routledge, 2014, eBook: 978-1-315-76596-9
2. Lucy Bullivant, Masterplanning Futures, Routledge, 2012, eBook: 978-0-203-72068-4
3. John Ratcliffe, Michael Stubbs and Miles Keeping, Urban Planning and Real Estate Development, , Routledge, 2009, eBook: 978-0-203-93572-9

HDC423	Introduction to Geographical Information Systems	2 (1,2,0)
Basic concepts, principles, and methods of GIS are presented. Data structures, database design, GIS data creation, GPS, and spatial analysis.		

Prerequisites: HDC304.

1- Paul Bolstad, GIS Fundamentals: A First Text on Geographic Information Systems, ISBN: 978-1-59399-552-2, 2022

2- Peter A. Burrough, Rachael A. McDonnell, Christopher D. Lloyd, Principles of Geographical Information Systems, ISBN-13 : 978-0198742845, 2015

HDC424	Sustainable Housing, Community and Technology	2 (1,2,0)
This course is for students interested in sustainable housing, green buildings and the technology required for high performance structures. The course begins with a section on society and housing, exploring how sustainable housing practices can build communities. The second phase of this course focuses on the relationship between society and the environment. Students explore how community growth has impacted the environment and how natural events impact our communities. Finally, the course concludes with a section on building science: how houses work as a system. In this section, students explore the science and technology required to build high performance houses.		

Prerequisites: HDC204, HDC319.

References:

Edited by Alan Bond, Angus Morrison-Saunders, Murdoch and Richard Howitt, Sustainability Assessment, Pluralism, practice and progress, Routledge, 2012, eBook: 978-0-203-11262-5

HDC310	The Urban Form	2(1,2,0)
Elements, patterns, and evolution of urban form. The forces that shaped cities in history. Contemporary trends. Methods of urban morphological analysis as related to urban design and planning practices.		

Prerequisites: none.

References:

1. David Adams and Steve Tiesdell, Shaping Places: Urban Planning, Design and Development, Routledge, 2012, eBook: 978-0-203-10566-5
2. Edited by Rodolphe El-Khoury and Edwards Robbins, Shaping the City: Studies in History, Theory and Urban Design, Routledge, 2013, ISBN 978-0-415-58462-3:

HDC311	Urban Economic and Resilience	2 (1,2,0)
The aim of the course is to gain insight into the fundamental urban and regional economic processes that explain economic competitiveness, resilience and policy effectiveness, and to develop the ability to analyze and govern these processes in practice.		

Prerequisites: none.

References

Graham Squires, Urban and Environmental Economics: An Introduction, Routledge, 2012, eBook: 978-0-203-82599-0

HDC312	Heritage of Urban Culture	2 (1,2,0)
The course introduces students to the importance of culture and heritage in urban design and development process. It develops students' analytical and descriptive skills in order to understand the meaning and significance of human heritage as a product of culture and civilization, with		

special reference to Egyptian Architectural Heritage. It also enhances the students design skills to deploy the layers of concepts, beliefs, values and urban products in the different Egyptian historic periods while addressing contemporary architectural and urban design problems.

Prerequisites: none.

Harold Kalman, Heritage Planning: Principles and Process. Routledge, 2014, eBook: 978-1-315-77985-0

HDC313	Introduction to Urban Conservation	2 (1,2,0)
The course acquaints students with scientific, theoretical, legislative, organizational and practical bases for conservation, designing and revaluation programs, as well as administration in the area of protection of various architectural objects and urban complexes.		

Prerequisites: none.

References

1. Introduction to Urban Conservation by Ayman Abdel Tawab, LAP LAMBERT Academic Publishing (2013), ISBN-13 : 978-3659417955
2. Historic Cities: Issues in Urban Conservation by Jeff Cody and Francesco Siravo, Getty Publications, (2019), ISBN 9781606065938

HDC326	Selected Topics in Urban Design	2 (1,2,0)
A studio-based course that focuses on different topics in urban design through project-based learning. These topics include the study and analysis of relationships between place and space, and urban realms. The course discusses how landscape architecture, and urban design have explored those issues and how the design process relates to urban design through hands-on projects involving interactive design process.		

Prerequisites: none.

References

1. Urban Playground: How child-friendly planning and design can save cities by Tim Gill, Riba Publishing (2021), ISBN 978 1859469293
2. Restorative Cities: Urban Design for Mental Health and Wellbeing by Jenny Roe and Layla McCa, Bloomsbury Visual Arts (2021), ISBN 978 1350112889
3. Estate Regeneration by Brendan Kilpatrick and Manisha Patel, Routledge (2020), ISBN 978 0367271282
4. The Urban Block: A Guide for Urban Designers, Architects and Town Planners by Jonathan Tarbatt and Chloe Street Tarbatt, RIBA (2020), ISBN 978 1859468764.

HDC327	Computer Applications -2	2 (1,0,3)
Uses digital technologies for mapping, drafting, modeling, and communication. Includes real-world case study projects that focus on urban design and planning issues.		

Prerequisites: HDC203, HDC302

References:

1- Linda Holtzschue , Edward Noriega , "Design Fundamentals for the Digital Age", Wiley, 1997- Benjamin,

2- Wucius Wong, "Visual Design on the Computer", W. W. Norton & Company, 2001

3- Hashimoto , Clayton, "Visual Design Fundamentals", Course Technology PTR, 2009

HDC328	Urban Preservation	2 (1,2,0)
The course introduces the different concepts and principles of urban preservation, legislation, economic and frameworks of urban preservation.		

Prerequisites: none.

References

1- Alison Henry ,(2015)"Stone Conservation: Principles and Practice Kindle", Routledge (November 30, 2015) Edition
2- Norman Tyler(2009)," "Historic Preservation: An Introduction to Its History, Principles, and Practice" W. W. Norton & Company; 2nd edition (Second Edition)
3- المجلس الاعلي للاثار-القاهرة مهندس عبد المعز شاهين , (2008) " ترميم و صيانة المبانى الاثرية و التاريخية
4- اسامة النحاس، " معايير صيانة وترميم الاثار", بحث منشور (2010)

HDC329	Histories and Theories of Urban Interventions	2 (1,2,0)
This course provides an introduction to the critical histories and theories of urban intervention and formation, and to the disciplinary practices of urban planning and urban design and the technological, institutional, and political contexts in which they operate over time and across cultures and geographies.		

Prerequisites: none.

References

1. Transforming Cities: Urban Interventions in Public Space by Kristin Feireiss (Editor), Oliver Hamm (Editor), JOVIS (2015), ISBN-13 : 978-3868593372
2. Urban Theory: New critical perspectives Edited By Mark Jayne and Kevin Ward, Routledge (2017), ISBN 9781138793385
3. Shaping the City: Studies in History, Theory and Urban Design Edited By Rodolphe El-Khoury and Edwards Robbins, Routledge (2013), ISBN 9780415584623

HDC410	Urban Transportation Planning	2 (1,2,0)
This course prepares students to be effective practitioners and informed citizens at a time when rapid advances in technology are swiftly changing the transport field. The course will focus on three aspects: - Understanding the Transport System: How does transportation work? - Challenges: What are the key issues in the transport field? Focusing on understanding current travel patterns as well as identifying key challenges and opportunities for the transport field. - Planning: A broad introduction to the institutional structure and technical tools of transportation planning.		

Prerequisites: HDC321.

References:

Eric Christian Bruun, Better Public Transit Systems: Analyzing Investments and Performance, Routledge, 2013, eBook: 978-1-315-88291-8

HDC411	Cities and Urban Life	2 (1,2,0)
This course will introduce students to aspects cities and urban life. Studying cities and urban life is important to understanding how human societies developed, how households live and		

function, how economies grow and innovate, how culture develops and influences, and an array of other topics including social opportunity, inequality, and political movements.

Prerequisites: none.

References

1. Cities and Urban Life by John Macionis (Author), Vincent Parrillo , 7th Edition (2016), Pearson, ISBN-13 : 978-0133869804
2. The City: A Dictionary of Quotable Thoughts on Cities and Urban Life By *James A. Clapp*, Routledge (2014), ISBN 9781412848350

HDC412	History & Conservation of Greenery	2 (1,2,0)
This course will introduce students to the theoretical knowledge of principles of composing historic gardens, component elements of historic gardens natural, architectural-structural and technical. The principles of conservation and revaluation of historic green areas will be discussed.		

Prerequisites: none.

References

1. Conservation Science: Balancing the Needs of People and Nature by Peter Kareiva (Author), Michelle Marvier, W. H. Freeman (2017), ISBN-13 : 978-1319146719
2. Urban Nature Conservation: Landscape Management in the Urban Countryside 1st Edition by Stephen Forbes, Taylor & Francis; 1st edition (2013), ISBN-13 : 978-1138437418
3. The Management and Maintenance of Historic Parks, Gardens and Landscapes: The English Heritage Handbook by John Watkins and Thomas Wright Frances Lincoln (2007), ISBN-13 : 978-0711224391

HDC413	Site Design	2 (1,2,0)
Introduction to site design and planning, how it is regulated; why it is important to know; and how to carry out its key tasks, including residential subdivision and mixed-use development layout; basic topographical and hydrological analysis and manipulation; roadways, parking and hierarchies of circulation, and site design detail.		

Prerequisites: HDC321.

References

1. Site Planning and Design Handbook, by Thomas Russ, McGraw Hill, 2nd Edition(2009), ISBN-13 : 978-0071605588
2. Site Planning: International Practice by Gary Hack, MIT Press (2018), ISBN: 9780262534857

HDC425	Parametric Design	2 (1,2,0)
This course aims to prepare students to modeling geometry through scripted development of parametric schemes for architecture applications — that is, to introduce students to basic scripting with a focus on algorithms relating to form making and to reinforce and extend basic concepts of parametric modeling.		

Prerequisites: none.

References

Elements of Parametric Design by Robert Woodbury, Routledge1st Edition(2010), ISBN-13 : 978-0415779876

HDC426	Introduction to Landscape Management	2 (1,2,0)
Students will be exposed to the range of issues and opportunities in the field of landscape management. Reviewing historic and contemporary practices, students will explore the benefits of a scientific and multidisciplinary approach to addressing the environmental, social and cultural imperatives of open space and natural resources in urban areas.		

Prerequisites: HDC404.

References

Edited by Nicola Dempsey, Harry Smith, and Mel Burton, Place-Keeping: Open Space Management in Practice, Routledge, 2014, eBook: 978-0-203-72531-3

HDC427	Urban Economics	2 (1,2,0)
As an introduction to the field of housing and economic Development, the course aims to: - Develop student's understanding of how public policy and private markets affect urban, economic development, the local economy, and neighborhood institutions. - Provide an overview of techniques for framing public and private interventions to meet community and urban development agendas, broadly defined, of low-income neighborhoods. - Review and critique specific programs, policies and strategies that are (and have been) directed at local development and neighborhood regeneration issues; Give students an opportunity to reflect on their personal sense of the "urban, community, and economic development" process and the various roles that planners play in implementing the elements of that agenda.		

Prerequisites: none.

References

1. ISE Urban Economics by Arthur O'Sullivan, McGraw-Hill Interamericana de España S.L, 9th Edition(2021), ISBN-13: 978-1260084498
2. Lectures on Urban Economics by Jan K. Brueckner , The MIT Press (2011), ISBN-13 : 978-0262016360
3. Urban and Environmental Economics: An Introduction by Graham Squires, Routledge, 2013, ISBN 9780415619912

HDC428	Introduction to Urban & Environmental Law	2 (1,2,0)
The aim of the course is to introduce the students to the principles and process that govern the management of urban spaces and the protection of the environment. This will be done through an examination of the key legislation and regulations applied to urban spaces and the environment.		

Prerequisites: none.

References:

1. Fundamentals of Environmental Law and Compliance by Daniel T. Rogers, CRC Press (2022), ISBN 9781032006789
2. Advanced Introduction to International Environmental Law by Ellen Hey, Elgar Advanced Introductions series (2016), ISBN: 978 1 78195 457 7.

HDC314	Human Behavior & Built Environment	2 (1,2,0)

Introduction to environmental psychology that examines human-environment interactions and human relation to the natural and physical environment. This will be done through exploring the human behavior, the settings human prefer to live and function in.

Prerequisites: HDC204.

References

1. Environmental Psychology and Human Well-Being: Effects of Built and Natural Settings by Ann Sloan Devlin, Academic Press; 1st edition (September 8, 2018), ISBN-13 : 978-0128114810
2. Environmental Psychology for Design: Bundle Book + Studio Access Card by Dak Kopec, Fairchild Books (2018), ISBN-13 : 978-1501321801

HDC315	Human Dimensions of Conservation	2 (1,2,0)
This course is premised on the idea that conservation will only be achieved through change in how people choose to act toward the environment. It takes as self-evident the principle that that natural systems and human systems are integrally linked to one another. The goal of conservation psychology is to promote conservation through the scientific study of cognitive, affective and behavioral processes. On completion of this course, it is expected that students will be conversant in the basic constructs of conservation psychology and understand how to use this framework in conservation recommendations, and to effectively criticize conservation strategies.		

Prerequisites: none.

References

1. Human Dimensions of Wildlife Management, Edited By Daniel J. Decker, Shawn J. Riley, And William F. Siemer , John Jopkins University Press, second edition (2012)
2. Natural Resource Management: The Human Dimension by Alan W Ewert, Routledge (2021), ISBN 9780429039706

HDC316	Community Finance	2 (1,2,0)
The course examines the history and practice of community development finance. Low-income communities face particular challenges in meeting their credit needs through the traditional financial sector. The course explores strategies for developing assets for low-income families and low-income communities. Different types of community development finance projects are discussed, including affordable housing, charter schools, community facility, small business lending, and nonprofit real estate projects. The course concludes with an examination of continuing challenges to meet the depository and credit needs of low-income communities.		

Prerequisites: none.

References

1. Democratizing Finance: Origins of the Community Development Financial Institutions Movement by Clifford N. Rosenthal, FriesenPress (2018), ISBN-13 : 978-1525536625
2. Financial Strategy for Public Managers by Sharon Kioko and Justin Marlowe, open access, https://press.rebus.community/financialstrategy/

HDC330	Emotional Ethics of the Community	2 (1,2,0)
This course will attempt to answer some of the questions about ethics and to conceptualize central notions in community ethics. It will focus on defining what it means to have moral standing		

or to be a (moral) person. Is this concept coextensive with the set of human beings? How far can/should we extend the borders of our moral community?

Prerequisites: none.

Reference

1. The Ethics of Community by Frank G. Kirkpatrick, Wiley-Blackwell1st Edition(2011), ISBN-13 : 978-0631216834
2. Situating the Self: Gender, Community and Postmodernism in Contemporary Ethics by Seyla Benhabib, Wiley (1992), ISBN: 978-0-745-61059-7

HDC331	Social Legislation & Social Policy	2 (1,2,0)
This course is designed to provide students with an understanding of: - The key demographic and economic trends underway with particular attention placed on the changing perception of the poor, the elderly and our increasingly diverse population. - The history and evolution of social policies as well as the structure of programs and responsibilities among levels of government and the private sector. - An assessment of key social programs and future challenges.		

Prerequisites: none.

References

1. Social Work and Social Policy: An Introduction, by Jonathan Dickens, Routledge (2016), ISBN 9781138017573
2. Social Policy: An Introduction byKen Blakemore, Louise Warwick-Booth, McGraw-Hill Education (UK), 2013, ISBN 9780335246632
3. Social Protection Policies in Egypt by Dr. Abdo Al Ashry, https://www.sis.gov.eg/UP/SIS%20English%20Publications/Social%20Protection%20Policies%20in%20Egypt%206.pdf

HDC332	Walkability & Urban Form	2 (1,2,0)
This course concentrates on walking as a mode of transportation in cities and city-regions, including social, cognitive, and perceptual dimensions of pedestrian movement and behavior theory.		

Prerequisites: none.

References

1. Carmen Hass-Klau, The Pedestrian and the City, Routledge, 2015, eBook: 978-0-203-06739-0
The Walkable City: Dimensions of Walking and Overlapping Walks of Life by Jennie Middleton, Routledge (2022)
2. Walkable City Rules: 101 Steps to Making Better Places by Jeff Speck , Island Press (2018), ISBN-13 : 978-1610918985

HDC333	Psychology & Sustainability	2 (1,2,0)
This course examines human behavior and human nature in the context of ecological factors. The focus of the course will be on how psychology might help contribute to solve, or to mitigate, ecological problems that are likely to occur in this century, including depletion of natural resources (especially fossil fuels), human population overshoot of the planetary carrying capacity, climate change, species extinction, etc.		

Prerequisites: HDC305.

References:

1. Psychology for Sustainability by Britain A. Scott, Elise L. Amel, Susan M. Koger and Christie M. Manning, Routledge (2021),ISBN 9780367480691
2. Peter F. Smith," Building for A Changing Climate-The Challenge for Construction, Planning and Energy" Earthscan in the UK and USA in 2010.
3. HocineBougdah and Stephen Sharpies, "Environment, Technology and Sustainability" Taylor & Francis, London and New York.2010.
4. Robert D. Brown, "Design with Microclimate- the Secret to Comfortable Outdoor Space" Island press, 2010 .
5. Peter F. Smith," Architecture in a Climate of Change- A guide to sustainable design "An imprint of Elsevier Linacre House, Jordan Hill, Oxford Second edition 2005.
6. Baruch Givoni, "Climatic Consideration in Building and Urban Design" Van Nostrand Reinhold, 1998.

HDC334	Community Planning & Social Policy	2 (1,2,0)
Critical analysis of approaches to social policies, particularly as they affect issues of poverty and community development. Review of major debates in selected areas, including welfare reform, employment, housing, education and crime. Emphasis on innovative approaches that communities are taking in partnership with public and private sectors to address contemporary social problems.		

Prerequisites: HDC320.

References

1. Judith E. Innes and David E. Booher, Planning with Complexity: An Introduction to Collaborative Rationality for Public Policy, Routledge, 2010, eBook: 978-0-203-86430-2
2. Basic Social Policy and Planning: Strategies and Practice Methods by Hobart A Burch, Routledge 1st Edition (1997), ISBN-13 : 978-0789002181

HDC414	Healthy Community Design and Development	2 (1,2,0)
This course seeks to bridge the gap between planning and public health, providing an interdisciplinary approach to address the health implications of the built environment. Students will understand public health and planning history, evolution and significant movements to the present, and historical and current theories on the relationship between the built environment and public health.		

Prerequisites: none.

References

1. Designing Healthy Communities by Richard J. Jackson (Author), Stacy Sinclair, Jossey-Bass 1st Edition (2011), ISBN-13 : 978-1118033661
2. Edited by Rhonda Phillips and Robert Pittman, An Introduction to Community Development, Routledge, 2014, eBook: 978-0-203-76263-9
3. Edited by Fritz Wagner and Roger Caves, Community Livability: Issues and Approaches to Sustaining the Well-Being of People and Communities, Routledge, 2012, eBook: 978-0-203-14820-4

HDC415	Economic Development for Rural Communities	2 (1,2,0)
This course addresses the variety of challenges facing rural communities relating it livelihood creation and maintenance, employment, investment and enhanced the associated strategies for urban development and management. The course addresses selected methods of analysis and outlines the process of urban design for mapping, economic development at the local level.		

Prerequisites: none.

References

1. Nick Gallent, Introduction to Rural Planning: Economies, Communities and Landscapes, Routledge, 2015, eBook: 978-1-315-74928-0
2. Building Rural Community Resilience Through Innovation and Entrepreneurship Edited By Charlie French, 1st Edition (2022), ISBN 9781032014203

HDC416	Community Development & Revitalization Techniques	2 (1,2,0)
This course is designed to give students a background on the history of urban redevelopment programs, and their impact on individuals and communities. The students will learn about early progressive era reforms, programs of the New Deal, Urban Renewal, Model Cities, and the Great Society. It will also cover the development of community development corporations, and their role in revitalizing cities.		

Prerequisites: none.

References:

1. Andrew Scott and Eran Ben-Joseph, ReNew Town: Adaptive Urbanism and the Low Carbon Community, Routledge, 2011, eBook: 978-0-203-15534-9
2. Michael A. Burayidi, Resilient Downtowns, A New Approach to Revitalizing Small- and Medium-City Downtowns, Routledge, 2013, eBook: 978-0-203-52219-6

HDC417	Planning for Healthy Communities	2 (1,2,0)
The course examines how the design of communities, spaces and transportation decisions have positive impacts on health. Also, students must consider the built environment impacts on physical activity, air quality, mental health, social capital, and explores interventions to promote healthy community design.		

Prerequisites: none.

References

1. Allan B. Jacobs, The Good City: Reflections and Imaginations, Routledge, 2011, eBook: 978-0-203-83596-8
2. Nick Wates, The Community Planning Handbook, How people can shape their cities, towns & villages in any part of the world, Routledge, 2014, eBook: 978-1-315-84871-6

HDC429	Community Economic Development	2 (1,2,0)
This course will provide students with an overview of the theories, practices and resources within community and economic development. This course aims to provide examples of culture and economic development practice that students can apply in their future work involving cultural sustainability.		

Prerequisites: none.

References

1. Community Owned Businesses: International Entrepreneurship, Finance, and Economic Development Edited By Norman Walzer, Routledge (2021) , ISBN 9780367485450
2. Theory, Practice, and Community Development Edited By Mark Brennan, Jeffrey Birdger, Theodore R. Alter. 1st Edition Routledge (2013), ISBN 9780415694148

HDC430	Resilience & Community Development	2 (1,2,0)
The course provides an overview of the connection between communities and their local environments. The first part of the course discuss resilience and interlinked social and social-ecological systems. The second part will examine the tools of social-ecological system management, exploring the basic social, regulatory, and political systems in which social-ecological interactions take place. In the last part of the course, it will discuss how to manage across scale, as well as how it can work within social and institutional boundaries for resilient, sustainable community development.		

Prerequisites: HDC319.

References

1. Michael A. Burayidi, Resilient Downtowns: A New Approach to Revitalizing Small- and Medium-City Downtowns, Routledge, 2013, eBook: 978-0-203-52219-6
2. Building Rural Community Resilience Through Innovation and Entrepreneurship Edited By Charlie French, 1st Edition, Routledge (2022), ISBN 9781032014203

HDC431	Building Community Resilience	2 (1,2,0)
In this course, the following topics will be covered: public health, environment, community development, concepts of resilience of communities, etc. and the health and equity implications of such elements. The aim of the course is to identify elements of the social fabric that can hold communities through rough times, including diversity in knowledge, skills and networks; as well as interventions and grassroots social movements that build capacity and resilience at the community level.		

Prerequisites: HDC319.

References

Edited by Leonie Pearson, Peter Newton and Peter Roberts, Resilient Sustainable Cities: A Future, Routledge, 2013, eBook: 978-0-203-59306-6

HDC432	Community Participation in Design	2 (1,2,0)
In this course, the students learn about community participation in design. The following topics will be studied such as: integrated social and cultural factors, public and community processes, theories and practices related to human-environment behavior; community involvement in design, social analysis, community engagement and accessibility.		

Prerequisites: none.

References:

Nick Wates, The Community Planning Handbook: How people can shape their cities, towns & villages in any part of the world, Routledge, 2014, eBook: 978-1-315-84871-6

جامعة بنها الاهلية (برامج كلية الهندسة)

ملخص عدد الساعات المعتمدة والاتصال والحمل التدريسي

Benha National University (BNU)

Faculty of Engineering Programs

Summary of Total credit Hours, Contact Hours, Student Working Load (SWL) and ECTS

Summary of Total credit Hours, Contact Hours, Student Working Load (SWL) and ECTS

#	Engineering Program	Code	NC	Credits and SWL			Total Contact Hours				Requirements %				BS %
				CH	ECTS	SWL	Lec	Tut	Lab	TT	UR	FR	DR	PR	
1	Materials and Manufacturing	MME	54	144	259.2	6480	92	36	78	206	8.33	27.08	36.81	27.78	27.08
2	Mechatronics and Automation	MAE	53	144	259.2	6480	92	36	78	206	8.33	27.08	36.81	27.78	27.08
3	Communication Systems	CSE	53	144	259.2	6480	93	49	64	206	8.33	27.08	36.81	27.78	27.08
4	Medical	MDE	53	144	259.2	6480	93	52	61	206	8.33	27.08	36.81	27.78	27.08
5	Building	BLE	54	144	259.2	6480	93	52	61	206	8.33	27.08	36.81	27.78	27.08
6	Housing & Design for Communities	HDC	55	144	259.2	6480	89	52	61	206	8.33	27.08	36.81	27.78	20.83

Where:

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