برنامج هندسة المرافق والبنية التحتية

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أهداف البرنامج

هندسة المرافق و البنية التحتية هو مجال علمي ومهنى يختص بتصميم وتنفيذ و إدارة مشاريع البنية التحتية و المرافق والتى تشمل: الاحترافية في التصميم الهندسي و استيعاب الممارسة القانونية والمهنية ذات الصلة بالموافقات الحكومية بمشاريع المرافق و البنية التحتية وأساليب التنفيذ والمواد والأنظمة والمعدات والتخطيط والجدولة الزمنية والرفع المساحى والسلامة المهنية وتحليل ومراقبة التكاليف.

ونظرا لأن معظم برامج الهندسة المدنية التقليدية والموجودة حاليا لا تغطى في دراستها المعرفة المطلوبة للعمل في مشروعات المرافق والبنى التحتية بالصورة التي تمكنه من استغلال التقنيات الحديثة المتاحة، مما يخلق مشكلة في سوق العمل المحلي والعربي بعدم توافر مهندسين خريجين لديهم الدراية والمعرفة بهذه الأنظمة. لذا كان الهدف من هذا البرنامج هو تخريج مهندس قادر على تصميم وتنفيذ مشاريع المرافق والبنية التحتية وتوظيف التقنيات الحديثة في اعمال التصميم والتنفيذ لمشروعات المرافق و البنية التحتية.

ونظرا لأهمية هذا المجال وخاصة في ضوء نهضة المشاريع القومية التى تشهدها مصر في هذه العقود تسعى كلية الهندسة ببنها في انشاء برامج متخصصة في هذا المجال تعمل على تخريج مهندسين متخصصين في هذه الأعمال وتلبى حاجة سوق العمل لهذا التخصص ويكون لديهم القدرة على تصميم وإدارة مشاريع البنية التحتية و المرافق والتي تخلق الحياة والبيئة العملية مثل مشاريع الطرق و المياه و الصرف الصحى و شبكات وخطوط الكهرباء والطرق والجسور والمرافق ومشاريع الموارد المائية ومشاريع الهندسة الساحلية.

ومهندسى هذا البرنامج يمكنهم العمل في مشاريع المرافق و البنية التحتية بكافة أنواعها وأعمال الهندسة البيئية ومشروعات المنشآت المائية ومشاريع الحماية الساحلية. وفيما يلي بعض من فرص العمل التي يمكن استخدامها من قبل خريجي البرنامج:

- تقنيات الجيوفيزياء التطبيقية Applied Geophysical Techniques في أعمال الهندسة الجيوتقنية Geotechnical Engineering
- تقنيات الجيوفيزياء التطبيقية Applied Geophysical Techniques في أعمال مسح ما تحت الأرض ورسم خرائط البنية التحتية Underground Survey
- تقنيات تحديد الموقع بالأقمار الصناعية GNSS لإعداد الخرائط المساحية بأنواعها اللازمة لمشاريع المرافق والبنية التحتية
- أعمال الأنفاق Tunnel worksوالدراسات المتعلقة بها

- مشاريع الطرق والأعمال الخاصة بها.
- مشاريع المياه سواء شبكات التغذية أو شبكات الصرف والدراسات المرتبطة بها
- المشاريع الساحلية والشاطئية Coastal Engineering والدراسات المتصلة بها من اعمال مسح هيدروجرافي Hydrographic Survey
- أعمال التكريك وارتباطها بالمشاريع الشاطئية Dredging works وارتباطها الكلي بأعمال المسح الهيدروجرافيHydrographic Survey وخصائص تربة القاع
- الدراسات البيئية المرتبطة بتنفيذ المشروعات السابق ذكرها.

ويمكن تصنيف مهندسين هذا البرنامج و فقا لطبيعة العمل مكا يلى:

- **مهندس تصميم**: وضع أساسيات و تفاصيل العديد من مشاريع المرافق و البنية التحتية مثل الطرق والجسور و شبكات المياه والصرف الصحى والأعمال المساحية ومحطات المياه و الصرف الصحى والمنشآت المائية، المنشآت الساحلية، والمرافق، والسدود.
- **مهندس موقع (اشراف أو تنفيذ):** يطبق و ينسق عمليات التنفيذ لمشاريع المرافق والبنية التحتية المختلفة في الموقع.
- **مهندس مساحة**: القيام بعمليات الرفع المساحي لجميع أنواع مشاريع البنية التحتية و المرافق.
- **مهندس تقدير تكاليف**: تقدير تكاليف تفصيلية وميزانيات للتصميمات و عمليات التنفيذ على أساس المعرفة وعمليات ما قبل التصميم و تقدير المواد و متطلبات الموارد الأخرى.
- **مهندس تخطيط و جدولة زمنية**: التخطيط ومراقبة الخطة بالنسبة للتوقيت وتتابع عمليات و أنشطة تنفيذ مشاريع المرافق و البنية التحتية.
- **مهندس مراقبة الجودة / ضمان الجودة**: يضمن أن بنود مشروع البناء وعمليات البناء مطابقة للمواصفات والمعايير.
- **مهندس متابعة مشاريع**: يستعرض أداء التكلفة والوقت للمشروع أثناء عملية التنفيذ.
- **مهندس عقود**: يقوم بمراجعة بنود العقد للمشروع وإعداد / تغيير أوامر التغيير والمطالبات.
- **مهندس الصحة و السلامة و البيئة**: مراجعة و تنفيذ نظام الصحة والسلامة للمشروع لضمان معايير الصحة والسلامة في جميع مراحل المشروع.
- **مهندس المشروع:** يقوم بعمل تصاميم كل أو جزء من عمليات تنفيذ المشروع وينسق هندسة العمل لتحقيق الأهداف العامة لفريق التصميم.

سمات مهندس المرافق و البنية التحتية

الهدف الرئيسي للبرنامج هو إعداد مهندس قادر على العمل المهني في مجال هندسة المرافق و البنية التحتية من خلال اكساب الدارسين المهارات التقنية الضرورية والمهارات الشخصية والمعرفة في مجال هندسة المرافق و البنية التحتية.

بالإضافة إلى السمات العامة للمهندس، فأن المهندس خريج هذا البرنامج سوف يكون قادرا على:

- تطبيق التقنيات التحليلية و التجريبية و تصميم مفردات هندسة المرافق و البنية التحتية وإدارتها مع إجادة استخدام الأدوات الحديثة لذلك.
- فهم التطبيقات العلمية والأخلاقية والاجتماعية للمهنة في ما يخص قضايا السلامة العامة.
- تحصيل والاستفادة والتواصل وامتلاك مهارات القيادة الشخصية و قادر على العمل بشكل تعاوني في فريق متعدد التخصصات.
- مواصلة العمل المتميز و التعلم المستمر مدى الحياة.

المخرجات التعليمية للبرنامج:-

وفقا للهيئة القومية لضمان جودة التعليم والاعتماد، يجب أن يلبى برنامج هندسة المرافق والبنية التحتية مخرجات التعلم التالية:-

اولا: مخرجات المعرفة والفهم

يجب أن يكون خريج برنامج هندسة وإدارة التشييد قادر على إثبات المعرفة والفهم في:

1. المفاهيم والنظريات الرياضيات والعلوم الاساسية.
2. أساسيات تكنولوجيا المعلومات والاتصالات.
3. خصائص المواد الهندسية.
4. مبادئ التصميم بما في ذلك عناصر التصميم، لعملية و/أو لنظام.
5. منهجيات حل المشاكل الهندسية، وجمع البيانات وتفسيرها.
6. نظم ضمان الجودة و أكواد الممارسات والمعايير، ومتطلبات الصحة والسلامة والقضايا البيئية.
7. مبادئ إدارة الأعمال ذات الصلة بالهندسة.
8. التقنيات الهندسية الحالية.
9. مواضيع تتعلق بالاهتمامات الإنسانية والقضايا الأخلاقية.
10. اللغة الفنية وكتابة التقارير الفنية.
11. الأخلاق المهنية وتأثيرات الحلول الهندسية على المجتمع والبيئة.

12. الموضوعات الهندسية المعاصرة.
13. عمليات التشييد الأساسية والتقنيات المستخدمة في مجال هندسة المرافق و البنية التحتية.
14. مبادئ علوم هندسة المرافق و البنية التحتية وتطبيقها على مبادئ الهندسة المدنية.
15. خواص وسلوك وتصنيع مواد المرافق و البنية التحتية.
16. مبادئ التصميم الخاصة المرافق و البنية التحتية.
17. إدارة المشاريع بما في ذلك التخطيط والتمويل وتقديم العطاءات، وإجراءات العقد، و تقدير التكلفة وأنظمة الجودة.
18. الأساليب التحليلية وتطبيقات الكمبيوتر التي يمكن تطبيقها على مجالات المرافق و البنية التحتية.

ثانيا: مخرجات المهارات الفكرية

يجب أن يكون خريج برنامج هندسة المرافق و البنية التحتية قادر على إظهار المهارات الفكرية التالية:-

1. اختيار الطرق الرياضية والتي تعتمد على الكمبيوتر المناسبة للنموذجة وتحليل المشاكل.
2. اختيار الحلول المناسبة للمشاكل الهندسية القائمة على التفكير التحليلي.
3. التفكير بطريقة خلاقة ومبتكرة في حل و تصميم المشكلات.
4. جمع وتبادل وتقييم الأفكار المختلفة، وجهات النظر، والمعرفة من مجموعة من المصادر.
5. تقييم خصائص وأداء المكونات والنظم والعمليات.
6. فحص انهيار المكونات والنظم والعمليات.
7. حل المشاكل الهندسية، وغالبا على أساس معلومات محدودة وربما متناقضة.
8. اختيار وتقييم أدوات تكنولوجيا المعلومات والاتصالات المناسبة لمجموعة متنوعة من المشاكل الهندسية.
9. تحديد القرارات الهندسية المتعلقة بالتكاليف المتوازنة، والفوائد، والسلامة، والجودة، والموثوقية، والأثر البيئي.
10. دمج الأبعاد المجتمعية والاقتصادية والبيئية وإدارة المخاطر في التصميم.
11. تحليل نتائج النماذج العددية وتقييم حدودها.
12. خلق أساليب منظمة ومنهجية عند التعامل مع التكنولوجيا الجديدة والمتقدمة.
13. تعريف وحل مشاكل هندسية المرافق و البنية التحتية.
14. حل المشاكل البيئية والاجتماعية والاقتصادية.
15. تحديد مستويات وأنواع وأنظمة المرافق و البنية التحتية و تحديد مستويات وأنواع وأنظمة اساسات المرافق و البنية التحتية بناء على تقنيات الجيوتقنية أصول الهندسة.

16. تقييم ودمج المعلومات والعمليات من خلال العمل في المشروع فردياً وجماعياً.
17. حل مجموعة واسعة من المشاكل المرتبطة بتحليل وتصميم وتنفيذ المباني ومشاريع الهندسة المدنية.
18. تحليل وتفسير المعلومات التمويلية.
19. اقتراح حلول وتصاميم على المستوى الأساسي وفي التفاصيل بالنظر إلى الاستدامة وغيرها من القضايا ذات الأهمية

ثالثا: مخرجات عملية ومهنية

يجب أن يكون خريج برنامج هندسة المرافق و البنية التحتية قادر على إظهار المهارات العملية و المهنية التالية:-

1. تطبيق المعرفة في الرياضيات، والعلوم، وتكنولوجيا المعلومات والتصميم وسياق الأعمال والممارسات الهندسية مجمعة لحل للمشاكل الهندسية.
2. الدمج المهنى للمعرفة والفهم الهندسى، وردود الفعل لتحسين تصميم المنتجات و/أو الخدمات.
3. إنشاء و/أو إعادة تصميم عملية، مكون أو نظام، وتنفيذ التصاميم الهندسية المتخصصة.
4. التدريب على الدقة والجمالية في التصميم والنهج.
5. استخدام المرافق والتقنيات الحاسوبية، وأدوات القياس وورش العمل والمعدات المختبرية لتصميم التجارب، وذلك لجمع وتحليل وتفسير النتائج.
6. استخدام مجموعة واسعة من الأدوات التحليلية والتقنيات والمعدات، وحزم البرمجيات المتعلقة لتطوير برامج الكمبيوتر المطلوبة.
7. تطبيق أساليب النمذجة العددية للمشاكل الهندسية.
8. تطبيق أنظمة آمنة في العمل ومراقبة الخطوات المناسبة لإدارة المخاطر.
9. إظهار المهارات التنظيمية الأساسية ومهارات إدارة المشاريع.
10. تطبيق إجراءات ضمان الجودة واتباع القوانين والمعايير.
11. تبادل المعارف والمهارات مع المجتمع الهندسى والصناعى.
12. اعداد و عرض التقارير الفنية.
13. إعداد وتنفيذ مشاريع هندسة المرافق و البنية التحتية.
14. استخدام معدات الموقع و المعمل بكفاءة وأمان.
15. مراقبة وتسجيل وتحليل البيانات في المختبر و الموقع.
16. استخدام أدوات المساعدة القائمة على الحاسوب وحزم البرمجيات لحل المشكلات وتحليل النتائج.
17. إعداد مسودات فنية ورسومات نهائية يدويا وباستخدام الحاسب.

18. إعداد تقارير حصر الكميات و تقديرات التكلفة، وجداول التنفيذ.
19. إدارة العقود و التحكم في الوقت والتكلفة والجودة للمشاريع.
20. عمل جداول لتحقيق المواعيد النهائية في الأنشطة المعقدة.

رابعا: مخرجات عامة و قابلة للنقل

يجب أن يكون خريج برنامج هندسة المرافق و البنية التحتية قادر على إظهار المهارات العامة و القابلة للنقل التالية:-

1. التعاون بشكل فعال ضمن فريق متعدد التخصصات.
2. العمل في بيئة ضاغطة وضمن القيود.
3. التواصل الفعال.
4. إظهار قدرات تكنولوجيا المعلومات فعالة.
5. قيادة وتحفيز الأفراد.
6. إدارة فعالة للمهام والوقت والموارد.
7. البحث عن المعلومات والمشاركة في نظام التعلم الذاتي طويل المدى.
8. اكتساب مهارات تنظيم المشاريع والرجوع إلى الأدبيات ذات الصلة.

نسب المقررات الدراسية

يبين الجدول التالي نسب توزيع المقررات الدراسية للبرنامج ومقارناتها بمتطلبات الهيئة القومية لضمان جودة التعليم والاعتماد:

	Subject Area	CR	%	NARS Requirements
A	Humanities and Social Sciences (Univ. Req.)	18	10.11	9-12%
B	Mathematics and Basic Sciences	36	20.22	20-26%
C	Basic Engineering Sciences (Faculty/Spec. Req.)	40	22.47	20-23%
D	Applied Engineering and Design	39	21.91	20-22%
E	Computer Applications	18	10.11	9-11%
F	Projects and Practice	15	8.43	8-10%
G	Discretionary (Institution character-identifying) subjects	12	6.74	6-8%
Total		**178**	**100%**	

A. Humanities and Social Sciences (Univ. Req.) Courses

Code	Course Title	Credit Hours
HS101	English Language	2
HS102	Human Rights	2
HS201	Technical Writing	2
HS202	Engineering Economics	2
HS401	Legislation and Engineering Ethics	2
Humanity – Elective 1 (Student shall select one from)		2
HS302	Human Resource Management	
HS304	Strategic Management	
HS306	Computer and Society	
HS308	Accounting	
Humanity – Elective 2 (Student shall select one from)		2
HS402	Foundations of Marketing	
HS404	Introduction to Finance	
HS406	Human Computer Interaction	
UHS408	Sustainable Development	
Humanity – Elective 3 (Student shall select one from)		2
HS501	Specifications and feasibility studies	
HS503	Analytical Skills and Critical Thinking	
HS505	Communication Laws and Codes	
HS507	Construction Contracts and Law	
Humanity – Elective 4 (Student shall select one from)		2
HS502	Professional Communication Skills	
HS504	Principles of industrial health	
HS506	Social Risks and Security of Computer Systems	
HS508	Risk Management	
Total Hours		**18**

B. Mathematics and Basic Sciences Courses

Code	Course Name	Credit Hours
FRB101	Mathematics I	3
FRB102	Mathematics II	3
FRB201	Mathematics III	3
FRB202	Mathematics IV	3
FRB107	Physics I	3
FRB108	Physics II	3
FRB103	Mechanics I	3
FRB104	Mechanics II	3
FRB105	General Chemistry	3
FRE102	Computer Programming	3
FRB301	Numerical Method	3
FRB302	Probabilities & Statistics	3
TOTAL		**36**

C. Basic Engineering Sciences (Faculty/Spec. Req.) Courses

Code	Course Title	Credit Hours
FRM109	Engineering Graphics	4
FRM106	Production Engineering	3
UIC201	Structural Analysis I	3
UIC202	Engineering Geophysics I	3
UIC203	Properties of Engineering Materials	3
UIC205	Surveying for Engineers I	3
UIC206	Construction Materials	3
UIC208	Fluid Mechanics	3
UIC209	Engineering Geology	3
UIC303	Hydraulics	3
UIC305	Geotechnical Engineering	3
UIC308	Highway Engineering I	3
UIC309	Environmental Engineering	3
Total		**40**

D. Applied Engineering and Design Courses

Code	Course Title	Credit Hours
UIC204	Structural Analysis II	3
UIC210	Transportation Planning and Traffic Engineering	3
UIC306	Design of Reinforced Concrete Structures I	3
UIC310	Engineering Geophysics II	3
UIC401	Design of Reinforced Concrete Structures II	3
UIC405	Water Supply Engineering	3
UIC407	Soil Investigation for Highways	3
UIC410	Coastal Engineering	3
UIC402	Under Ground Utility Surveying	3
UIC404	Wastewater Engineering	3
UIC406	Design of Steel Structures	3

Code	Course Title	Credit Hours
UIC408	Highways Engineering II	3
UIC502	Design of Marin Structures	3
Total		**39**

E. Computer Applications Courses

Code	Course Title	Credit Hours
UIC207	CAD for Civil Engineering	3
UIC304	MATLAB for Civil Engineers	3
UIC307	Surveying for Engineers II	4
UIC311	Project Management	2
UIC403	Foundation Engineering	3
UIC409	Hydrographic Survey	3
Total		**18**

F. Projects and Practice Courses

Code	Course Title	Credit Hours
UIC501	Infrastructure Management	3
UIC504	Water distribution systems and sewer systems design	3
UIC503	Offshore Geo technology and Tunneling	3
UIC509	Project I	3
UIC510	Project II	3
Total		**15**

G. Elective Courses

Code	Course Title	Credit Hours
Elective Course 1		**3**
UIC507	Environmental Impact Assessment	
UIC508	Sustainable Environmental Engineering	

UIC509	Reuse of wastewater and solid wastes	
Elective Course 2		3
UIC510	Remote Sensing	
UIC511	Land Information Systems	
UIC512	Dredging Engineering	
Elective Course 3		3
UIC513	Sustainable Transportation and Highways Engineering	
UIC514	Railways Engineering	
UIC515	Airports Engineering	
Elective Course 4		3
UIC516	Retaining Structures and Underground Construction	
UIC517	Soil Dynamics and Foundations	
UIC518	Tunnels and Underground Structures	
Total Selected		**12**

- كما يجب ان يؤدى الطالب تدريب ميداني 240 ساعة على مرحلتين بواقع 120 ساعة (3 أسابيع) في كل مرحلة في فترة الصيف في أحد مشروعات المرافق والبنى التحتية في مجال التخصص حسب الجدول التالي:

Code	Course Title	Credit Hours	Prerequisites
EMM/E380	**Field Training I**	**1**	**120 Credit Hours**
EMM/E480	**Field Training II**	**1**	**120 Credit Hours**

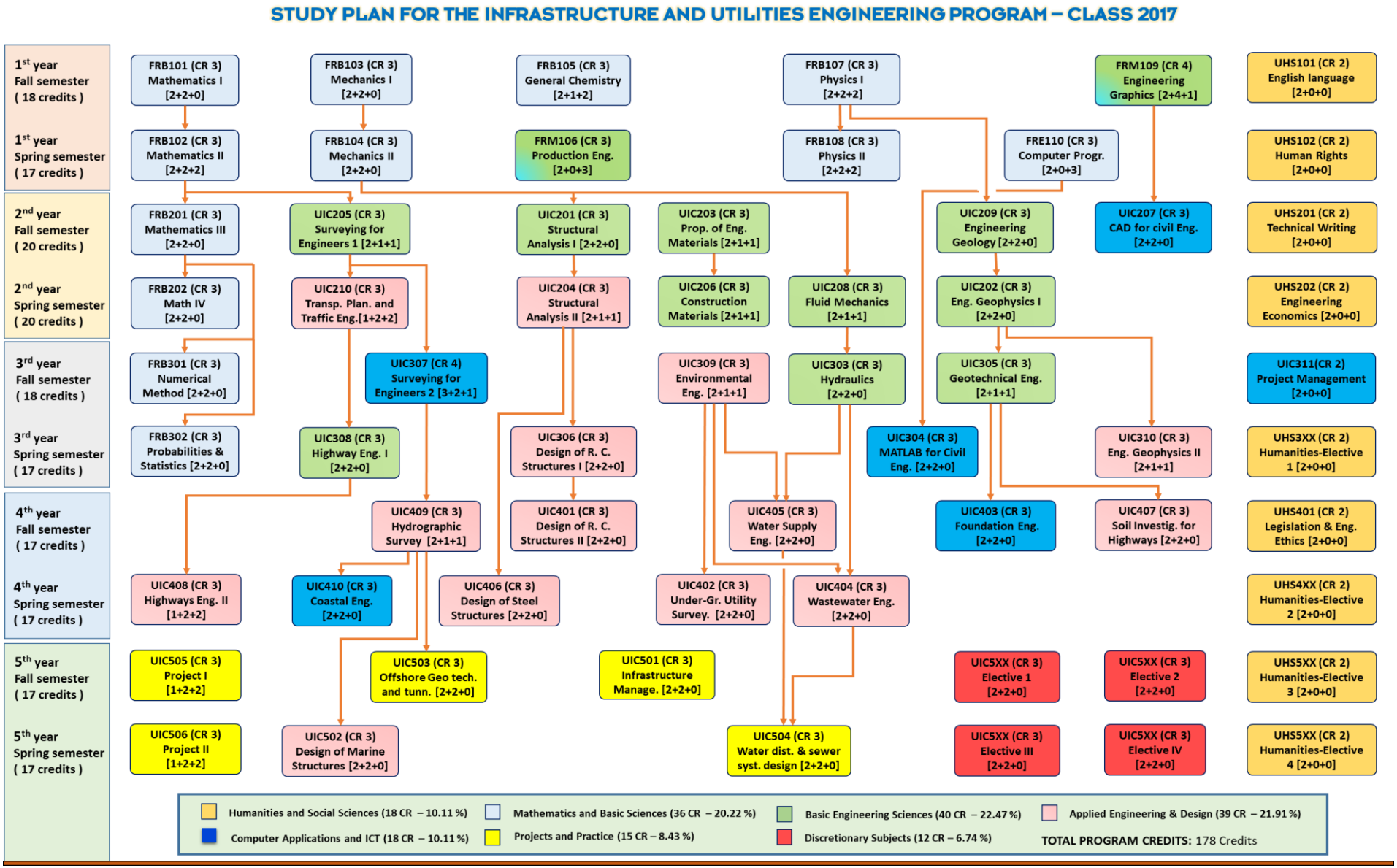
- ويجوز تدريب الطلاب خارج جمهورية مصر العربية ولا يحصل الطالب على شهادة البكالوريوس إلا بعد اجتياز التدريب بنجاح. حيث أن على الطالب تقديم تقرير حول التدريب الميداني الذي حصل عليه ويتم مناقشته فيه فور انتهائه من التدريب.

Program Courses Prerequisites

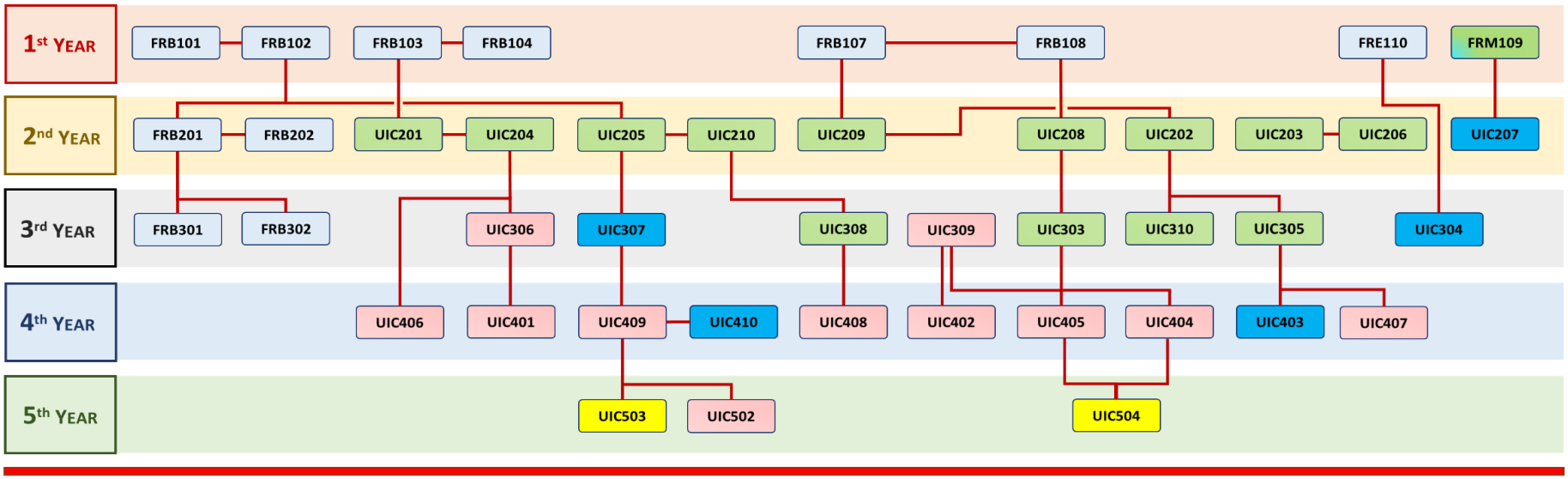
	Fall			Spring		
	Code	**Course Name**	**Prerequisites**	**Code**	**Course Name**	**Prerequisites**
First Year	FRB101	Mathematics I		FRB102	Mathematics II	FRB101
	FRB103	Mechanics I		FRB104	Mechanics II	FRB103
	FRB105	General Chemistry		FRM106	Production Engineering	
	FRB107	Physics I		FRB108	Physics II	FRB107
	FRM109	Engineering Graphics		FRE110	Computer Programming	
	HS101	English language		HS102	Human Rights	
Second Year	FRB201	Mathematics III	FRB102	FRB202	Mathematics IV	FRB101
	UIC201	Structural Analysis I	FRB104	UIC202	Engineering Geophysics I	UIC209
	UIC203	Properties of Engineering Materials		UIC204	Structural Analysis II	UIC201
	UIC205	Surveying for Engineers I	FRB202	UIC206	Construction Materials	UIC203
	UIC207	CAD for Civil Engineering	FRM109	UIC208	Fluid Mechanics	FRB104
	UIC209	Engineering Geology	FRB107	UIC210	Transportation Planning and Traffic Eng.	UIC205
	HS201	Technical Writing	HS101	HS202	Engineering Economics	
Third Year	FRB 301	Numerical Methods	FRB201	FRB302	Probabilities & Statistics	FRB201
	UIC303	Hydraulics	UIC208	UIC304	MATLAB for Civil Engineers	FRE110
	UIC305	Geotechnical Engineering	UIC202	UIC306	Design of R. C. Structures I	UIC204
	UIC307	Surveying for Engineers II	UIC202	UIC308	Highways Engineering I	UIC210
	UIC309	Environmental Engineering		UIC310	Engineering Geophysics II	UIC202
	HS301	Project Management		HS302	Humanities Elective 1	
Fourth Year	UIC401	Design of R. C. Structures II	UIC306	UIC402	Under-Ground Utility Surveying	UIC309
	UIC403	Foundation Engineering	UIC305	UIC404	Wastewater Engineering	UIC303 &UIC309
	UIC405	Water Supply Engineering	UIC303& UIC309	UIC406	Design of Steel Structures	UIC204
	UIC407	Soil Investigation for Highways	UIC305	UIC408	Highways Engineering II	UIC308
	UIC409	Hydrographic Survey	UIC307	UIC410	Coastal Engineering	UIC409
	HS401	Legislation & Engineering Ethics		HS4XX	Humanities Elective **2**	
Fifth Year	UIC501	Infrastructure Management		UIC502	Design of Marine Structures	UIC409
	UIC503	Offshore Geo technology and tunneling	UIC409	UIC504	Water distribution & sewer systems design	UIC404 & UIC405
	UIC5XX	Elective 1		UIC5XX	Elective III	
	UIC5XX	Elective 2		UIC5XX	Elective IV	
	HS5XX	Humanities Elective **3**		HS5XX	Humanities Elective **4**	
	UIC505	Project I		UIC506	Project II	

Elective Courses Prerequisites

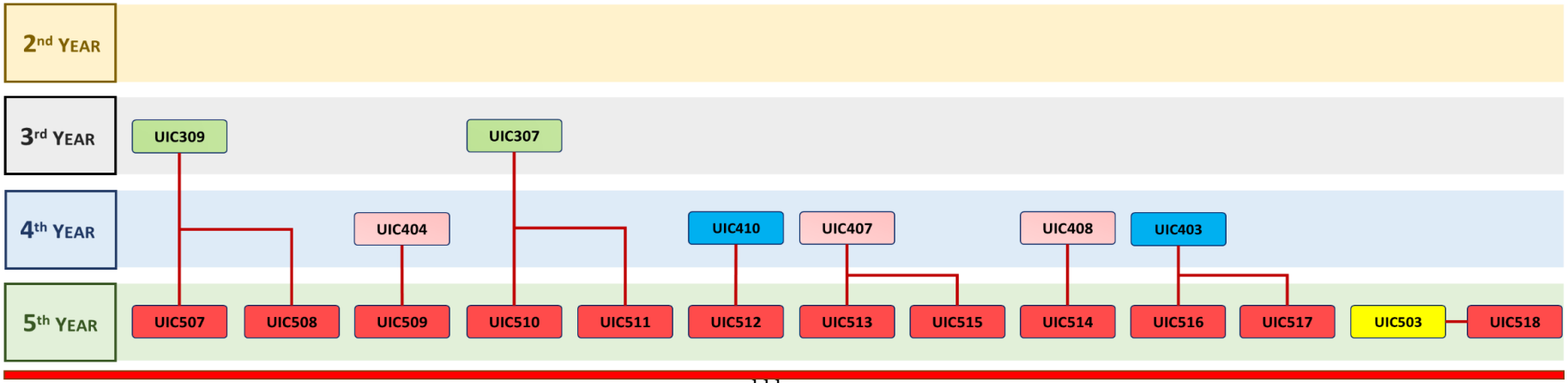
Code	Course Title	Prerequisites
Elective Course 1		
UIC507	Environmental Impact Assessment	UIC309
UIC508	Sustainable Environmental Engineering	UIC309
UIC509	Reuse of wastewater and solid wastes	UIC404
Elective Course 2		
UIC510	Remote Sensing	UIC307
UIC511	Land Information Systems	UIC307
UIC512	Dredging Engineering	UIC410
Elective Course 3		
UIC513	Sustainable Transportation and Highways Engineering	UIC407
UIC514	Railways Engineering	UIC408
UIC515	Airports Engineering	UIC407
Elective Course 4		
UIC516	Retaining Structures and Underground Construction	UIC403
UIC517	Soil Dynamics and Foundations	UIC403
UIC518	Tunnels and Underground Structures	UIC503


STUDY PLAN FOR THE INFRASTRUCTURE AND UTILITIES ENGINEERING PROGRAM – CLASS 2017
1st year Fall semester (18 credits)
1st year Spring semester (17 credits)
2nd year Fall semester (20 credits)
2nd year Spring semester (20 credits)
3rd year Fall semester (18 credits)
3rd year Spring semester (17 credits)
4th year Fall semester (17 credits)
4th year Spring semester (17 credits)
5th year Fall semester (17 credits)
5th year Spring semester (17 credits)
FRB101 (CR 3) Mathematics I [2+2+0]
FRB102 (CR 3) Mathematics II [2+2+2]
FRB103 (CR 3) Mechanics I [2+2+0]
FRB104 (CR 3) Mechanics II [2+2+0]
FRB105 (CR 3) General Chemistry [2+1+2]
FRM106 (CR 3) Production Eng. [2+0+3]
FRB107 (CR 3) Physics I [2+2+2]
FRB108 (CR 3) Physics II [2+2+2]
FRE110 (CR 3) Computer Progr. [2+0+3]
FRM109 (CR 4) Engineering Graphics [2+4+1]
UHS101 (CR 2) English language [2+0+0]
UHS102 (CR 2) Human Rights [2+0+0]
FRB201 (CR 3) Mathematics III [2+2+0]
FRB202 (CR 3) Math IV [2+2+0]
UIC205 (CR 3) Surveying for Engineers 1 [2+1+1]
UIC210 (CR 3) Transp. Plan. and Traffic Eng.[1+2+2]
UIC201 (CR 3) Structural Analysis I [2+2+0]
UIC204 (CR 3) Structural Analysis II [2+1+1]
UIC203 (CR 3) Prop. of Eng. Materials [2+1+1]
UIC206 (CR 3) Construction Materials [2+1+1]
UIC208 (CR 3) Fluid Mechanics [2+1+1]
UIC209 (CR 3) Engineering Geology [2+2+0]
UIC202 (CR 3) Eng. Geophysics I [2+2+0]
UIC207 (CR 3) CAD for civil Eng. [2+2+0]
UHS201 (CR 2) Technical Writing [2+0+0]
UHS202 (CR 2) Engineering Economics [2+0+0]
FRB301 (CR 3) Numerical Method [2+2+0]
FRB302 (CR 3) Probabilities & Statistics [2+2+0]
UIC307 (CR 4) Surveying for Engineers 2 [3+2+1]
UIC308 (CR 3) Highway Eng. I [2+2+0]
UIC306 (CR 3) Design of R. C. Structures I [2+2+0]
UIC401 (CR 3) Design of R. C. Structures II [2+2+0]
UIC309 (CR 3) Environmental Eng. [2+1+1]
UIC303 (CR 3) Hydraulics [2+2+0]
UIC304 (CR 3) MATLAB for Civil Eng. [2+2+0]
UIC305 (CR 3) Geotechnical Eng. [2+1+1]
UIC310 (CR 3) Eng. Geophysics II [2+1+1]
UIC311(CR 2) Project Management [2+0+0]
UHS3XX (CR 2) Humanities-Elective 1 [2+0+0]
UIC409 (CR 3) Hydrographic Survey [2+1+1]
UIC405 (CR 3) Water Supply Eng. [2+2+0]
UIC403 (CR 3) Foundation Eng. [2+2+0]
UIC407 (CR 3) Soil Investig. for Highways [2+2+0]
UHS401 (CR 2) Legislation & Eng. Ethics [2+0+0]
UIC408 (CR 3) Highways Eng. II [1+2+2]
UIC410 (CR 3) Coastal Eng. [2+2+0]
UIC406 (CR 3) Design of Steel Structures [2+2+0]
UIC402 (CR 3) Under-Gr. Utility Survey. [2+2+0]
UIC404 (CR 3) Wastewater Eng. [2+2+0]
UHS4XX (CR 2) Humanities-Elective 2 [2+0+0]
UIC505 (CR 3) Project I [1+2+2]
UIC503 (CR 3) Offshore Geo tech. and tunn. [2+2+0]
UIC501 (CR 3) Infrastructure Manage. [2+2+0]
UIC5XX (CR 3) Elective 1 [2+2+0]
UIC5XX (CR 3) Elective 2 [2+2+0]
UHS5XX (CR 2) Humanities-Elective 3 [2+0+0]
UIC506 (CR 3) Project II [1+2+2]
UIC502 (CR 3) Design of Marine Structures [2+2+0]
UIC504 (CR 3) Water dist. & sewer syst. design [2+2+0]
UIC5XX (CR 3) Elective III [2+2+0]
UIC5XX (CR 3) Elective IV [2+2+0]
UHS5XX (CR 2) Humanities-Elective 4 [2+0+0]
Humanities and Social Sciences (18 CR – 10.11 %)
Mathematics and Basic Sciences (36 CR – 20.22 %)
Basic Engineering Sciences (40 CR – 22.47 %)
Applied Engineering & Design (39 CR – 21.91 %)
Computer Applications and ICT (18 CR – 10.11 %)
Projects and Practice (15 CR – 8.43 %)
Discretionary Subjects (12 CR – 6.74 %)
TOTAL PROGRAM CREDITS: 178 Credits

PREREQUISITES PLAN FOR THE INFRASTRUCTURE AND UTILITIES ENGINEERING PROGRAM



ELECTIVES PREREQUISITES



COURSE DESCRIPTION

UIC201 Structural Analysis I **3 (2, 2, 0)**

Prerequisites: FRB 104

Definition of a structure, its support condition and its various structural forms in addition various loading conditions that a structure must support. Study the stability and determinacy of structures. Basic concepts of structural analysis. Calculation of reaction forces. Calculation of the internal forces (normal forces, shear forces and bending moments) and its distribution on statically determinate beams, frames and arches. Member forces in trusses. Influence lines and its use to calculate the maximum response functions in structures.

Text Book

Theory of structures, Part I by El-Dakhakhni, W. M., Dar Al-Maaref, 1989. Cairo. ISBN: 9770255634. 624

UIC202 Engineering Geophysics I **3 (2, 1, 1)**

Prerequisites: UIC 209

Ground Penetrated Radar

Introduction, Principles of operation, Propagation of radio-waves, Theory, Energy loss and attenuation, Horizontal and vertical resolution, Dielectric properties of earth materials, Modes of data acquisition, Interpretation techniques

Geomagnetic Methods

Introduction, Basic concepts and units of geomagnetism, Magnetic properties of rocks, The Earth's magnetic field, Magnetic instruments, Magnetic Survey, Quantitative and Qualitative interpretation, Applications include Regional aeromagnetic investigations, Mineral exploration, Detection of underground pipes, Detection of buried containers, Landfill investigations, Unexploded Ordnance (UXO).

Electrical Resistivity Methods

Introduction, Basic principles, Electrode configurations and geometric factors, Modes of deployment, Interpretation Methods, ERT applications include Site investigations, Groundwater and landfill surveys, Groundwater flow.

Application of GPR, Geomagnetic & Electric Resistivity in shallow soil investigation

Text Book

Environmental and Engineering Geophysics by Sharma P., Cambridge University Press 1997, ISBN: 0521572401

UIC203 Properties of Engineering Materials **3 (2, 1, 1)**

Prerequisites: FRB 107

Mechanical, physical and chemical properties of engineering materials. Stress-strain behavior, strength, ductility, toughness, and resilience - Testing machines - Calibration devices - Strain gauges - Mechanical properties in tension, compression, bending, shear and torsion. Impact – Fatigue - Hardness.

Text Book

Building Materials, Third Edition by S.K. Duggal, ISBN 8122423922, 9788122423921

UIC204 Structural Analysis II **3 (2, 2, 1)**

Prerequisites: UIC201

Properties of Areas. Normal stresses. Axial stress thermal stress and bending stresses. Shear stress and direct shear stress. Transverse loading and tensional stresses. Principal stresses and

strains. Elastic deflection of beams. Buckling of columns. Introduction to statically indeterminate structures. Methods of structural analysis of statically indeterminate structures. Method of consistent deformation. Method of three-moment equation for continuous beams. Virtual work method. Moment distribution method. Stiffness method. Computer validation.

Text Book

Static and Dynamic Analysis of Structures: with An Emphasis on Mechanics and Computer Matrix Methods by James F. Doyle, Springer Netherlands, ISBN: 978-0-7923-1208-6, 978-94-011-3420-0

UIC205/CMC207 Surveying for Engineers I 3 (2, 1,1)

Prerequisites: FRB 202

Measurement systems and equipment- Handling, adjustment, and regular maintenance of Survey equipment. Theodolites and level instruments- principles of measurements; angular measurements; traverse computations and adjustments. Distance measurements, optical (tacheometric, substance bar), EDM; area computations and subdivision of plots; spirit and trigonometrical levelling; introduction to triangulation, trilateration, resection, intersection and radiation as methods for provision of controls. Coordinate systems for engineering works: Setting out of engineering works. Areas of irregular objects, Longitudinal sections and cross sections- formation level, calculation of cross-sectional areas- Volumes- the end areas method, the prismoidal method, volumes of large earthworks. Balance of cut and fill, volumes from contours. Mass haul diagrams cumulative volumes bulking and shrinkage factor correction.

Text Book

Elementary surveying. An introduction to geomatics by Ghilani C.D., Wolf P.R., PH 2011, ISBN 0132554348

UIC206 Construction materials 3 (2, 1, 1)

Prerequisites: UIC203

Mineral binding materials {Lime, Gypsum & Cement} - Concrete aggregates - Building Rocks - Steel reinforcement – Steel reinforcement - Bricks - Fiber – timber. Introduction to concrete as a structural material - Mixing water - Concrete manufacture - Properties of fresh concrete - Properties of hardened concrete - Durability of concrete - Mix design methods - Non-destructive testing - Concrete admixtures - Special concretes.

Text Book

Fundamentals of Building Construction: Materials and Methods by Edward Allen, Joseph Iano, Wiley 2008, ISBN: 047007468X, 9780470074688

UIC207 CAD for Civil Engineering 3 (2, 2, 0)

Prerequisites: FRM105

Irrigation structures: Earth works, retaining walls, bridges, culverts, syphons, regulators, and weirs. Utilities structures: Valve chambers, manholes, settling tanks, filter house, roads intersections. Reinforced concrete structures: footings, column slabs and beams. Steel structures: columns and beams. Drawings of civil and environmental engineering projects, which include: residential and industrial buildings, water resources projects, urban transportation systems, coastal development projects, and environmental protection projects.

Text Book

AutoCAD 2013 for Dummies, by: David Byrnes and Bill Fane, John Wiley and Sons 2013

UIC208 Fluid Mechanics 3 (2, 1, 1)

Prerequisites: FRB 104

Review of fluid properties and hydrostatics: Manometry, Forces on plane and curved surfaces, Buoyancy, Fluid masses subject to acceleration (forced vortex). Kinematics of fluid motion: Fluid flow, Types of flow, Classification of flow, Continuity equation. Flow of Incompressible fluid, Applications of Bernoulli's. Pipe flow: Laminar and turbulent flow, Reynolds number, Shear stress distribution, Velocity distribution, Main losses, Secondary losses, Single pipe, Pipe connections (parallel and series), Pipe branching, Three tank problems. The Impulse-Momentum principle: Development of the principle, Pipe bends, Enlargements and contractions.

Text Book

A Brief Introduction to Fluid Mechanics, Fifth Edition by Donald F. Young, Bruce R. Munson, Theodore H. Okiishi, Wade W. Huebsch, Wiley 2010, ISBN: 0470596791, 9780470596791

UIC209 Engineering Geology 3 (2, 1, 1)

Prerequisites: FRB 107

Composition and constitution of the earth. rock and mineral types, soil properties, rock mechanics. Structural geology. Interpretation of geological maps. Weathering, erosion and denudation. Superficial movements. Physical processes in different environments. Sedimentation. Igneous activity. Metamorphism. Groundwater, slope stability and landslides, rivers and flood hazards Earth movements and plate tectonics. Earthquakes and earthquake engineering. Rock types and their engineering properties. Geology of Egypt. Geological aspects of foundations, Geological site investigation.

Text Book

Basic Environmental and Engineering Geology by Bell, F.G., SPON, ISBN: 978-0-8155-1761-0, 978-0-8155-1340-7, 1-904445-02-0, 978-1-904445-02-9, 978-1-4200-4470-6

UIC210 Transportation Planning and Traffic Engineering 3 (2, 2, 0)

Prerequisites: UIC207

Transportation Planning: Introduction to transportation planning – transportation problem definition and defining study area – Data collection – (origin and destination study)- Travel Forecast – (Trip Generation- Trip Distribution – modal split – traffic assignment)- Transportation Evaluation.

Traffic Engineering: Introduction (Human characteristic and vehicle characteristics) – Traffic volume- traffic speed – traffic density – Travel time and delay studies – traffic flow characteristics – Highway Capacity (Two Lane highway) – Parking studies – Traffic control devices – Intersections control (Conflict point at intersections, types intersection control) – Traffic signals design – Weaving for intersections, freeways and expressways.

Text Book

Traffic Engineering Handbook, 7th Edition by ITE.; Pande, Anurag; Wolshon, Brian, John Wiley & Sons 2016, ISBN: 9781118762301, 1118762304

UIC303 Hydraulics 3 (2, 2, 0)

Prerequisites: UIC208

Open channel flow: Introduction, Types of open channel flow, States of open channel flow, Properties of open channels flow, Uniform steady flow, Design of open channels cross sections, Velocity Distribution, Energy equation, gradually varied flow, rapidly varied flow. Hydraulic machines: Introduction, Pumps: Types of pumps, Pump characteristics and

performance, Operation of pumps, Pumps selection, Cavitation phenomena, Principles of hydraulic similarity, Classification of hydraulic models, Dimensional analysis, Dynamic Similarity Applications. Turbines, Types of turbines, Cavitation phenomena.

Text Book

Fundamentals of Hydraulic Engineering, by Prasuhn, Alan L., Oxford University Press 1992, ISBN 978-1-61344-141-1, 978-0-19-510732-6

UIC304 MATLAB for Engineers **3 (1, 2, 2)**

Prerequisites: FRB110

Introduction to MATLAB and prepare students for subsequent courses requiring computation with MATLAB in engineering. It covers basics of MATLAB including simple commands, variables, vector, matrix, plotting, solving equations, differentiation, integration, differential equations and fundamentals of programming in the MATLAB environment. Engineering and scientific computations, numerical techniques for linear equations, overview of the Symbolic math toolbox, and application development.

Text Book

An Introduction to MATLAB® Programming and Numerical Methods for Engineers, by Timmy Siauw and Alexandre Bayen, Academic Press 2015, ISBN: 978-0-12-420228-3

UIC305 Geotechnical Engineering **3 (2, 2, 1)**

Prerequisites: UIC202

Introduction: Soils in civil engineering, evaluation procedure; Formation of soils: Weathering - physical and chemical weathering; sedimentary and residual soils; Index Properties, Atterberg Limits, Soil Classification Systems, Phase Relations: Definitions - water content, void ratio, dry density, degree of saturation, and calculations; Soil Compaction, Compaction Specification: types of specifications, compaction equipment, compaction control testing; Mohr Circle of Stress: Principal stresses, Mohr's circle of stress, calculation of magnitude and direction, Mohr-Coulomb failure criterion; Shear Strength; Effective stress; Stress Analysis in Rocks: Mechanical properties of rocks, uniaxial compressive strength, tensile strength, shear strength (unconfined & triaxial); Rock Mass: stress strain relations; rock mass properties, joint analysis and classification, effects of joints.

Text Book

Geotechnical Engineering: Principles and Practices of Soil Mechanics and Foundation Engineering (Civil and Environmental Engineering), by V.N.S. Murthy, CRC Press 2002, ISBN: 9780824708733, 9780824743406, 0824708733

UIC306 Design of Reinforced Concrete Structures I **3 (2, 2, 0)**

Prerequisites: UIC204

Introduction to reinforced Concrete. Materials used in reinforced concrete. Mechanical properties of hardened concrete and reinforcing steel. Methods of design. Load factors and material factors. Behavior of reinforced concrete sections subjected to flexure for: untracked stage, working stress stage, and ultimate limit state. Design of sections subjected to flexure using both ultimate strength limit state method and working stress method. Design of sections for shear, bond, development length, and reinforcement splices. Design of sections subjected to axial loads. Design of sections under combined flexure and axial compression. Serviceability limit states (deflection and cracking limit states). Floor systems. Design of solid reinforced concrete one-way and two-way slabs. Design of floor beams. One-way and two-way hollow block slabs.

Text Book

Behavior, Analysis and Design of Structural Steel Elements, by El-Sayed Bahaa Machaly, Faculty of Engineering Cairo University 2005, ISBN: 9771966294

UIC307/CMC306 Surveying for Engineers **// 4 (2, 2, 2)**

Prerequisites: UIC205

Operations in geodesy; spherical excess and Legendre's formula; shape of the earth - ellipsoid geoid, vertical deflection, selection of spheroid; coordinate systems, change of coordinate systems, computations on the spheroid,; Map projections – distortion, conformal mapping, Gaussian fundamental quantities, isometric co-ordinates, transverse Mercator, UTM

Space-based positioning systems (such as GPS and GLONASS) used in conjunction with sophisticated mathematical modeling to solve the problems of determining 3-D position on and near the surface of the earth. GPS system concepts and characteristics, signal structure, receivers and antennae; GPS measurements, GPS time, error sources and measurement accuracy,; position determination techniques - single point and differential positioning, static and kinematic GPS, post mission and Real time processing, DGPS concepts; using GPS for height determination; reference datum and datum transformation.

Text Book

Elementary surveying. An introduction to geomatics by Ghilani C.D., Wolf P.R., PH 2011, ISBN: 0132554348.

UIC308 Highway Engineering I **3 (2, 1, 1)**

Prerequisites: UIC305

Geometric design: Determine appropriate design controls (design vehicle, speed, volume, etc.)Highway classification – Traffic volume – Study and analysis of highways capacity – Design of cross section – sight distances – Vertical alignment of highway – Horizontal alignment of highway – Intersections (at grade and grade separation) Highways - Road Safety studies and environmental (noise – pollution).

Structural design: Soil classification for highways – Soil compaction. Evaluation of soil strength for design of pavements –Design of flexible pavements and methods of soil stabilization .

Text Book

Highway Design and Construction, by R. J. Salter, Macmillan Education UK (1988), ISBN: 978-0-333-45998-0, 978-1-349-10067-5

UIC309 Environmental Engineering 3 (2, 1, 1)

Introduction to environmental engineering, pollution problems, types of pollution, degrees of Pollution, sources of pollution, surface water pollution, groundwater Pollution, rain Water Pollution, sea & ocean water pollution, air pollution. Soil pollution, pollution control, pollution prevention. Samples conditions, chemical pollutions measuring in water, microbiological & biological pollution measuring in water, chemical pollutions measuring in air, chemical pollutions measuring in soil, microbiological & biological pollution measuring in soil, field pollution monitoring, environmental protection laboratory. Water supply, wastewater systems, solid waste management, air pollution. Solid waste management: collection, handling, separation and treatment, disposal, recycling and reuse. Monitoring and control, noise, air pollution, environmental laws and its applications

Text Book

Introduction to Environmental Engineering, Third Edition, by P. Aarne Vesilind, Susan M. Morgan, Lauren G. Heine, CL-Engineering (2009), ISBN: 0495295833, 9780495295839

UIC310 Engineering Geophysics II **3 (2, 1, 1)**

Prerequisites: UIC202

Applied Seismology: Introduction and Principles

Introduction, Seismic waves, Raypath geometry in layered ground, Loss of seismic energy, Detection and recording of seismic waves

Seismic Refraction Surveying

Introduction, General principles of refraction surveying, Geometry of refracted raypaths, Interpretational methods, Applications include Shear wave methods, Ground stiffness profiling, Multichannel Analysis of Shear Waves (MASW), Earthquake hazard studies

Seismic Reflection Surveying

Introduction, Reflection surveys, Reflection data processing, correlating seismic data with borehole logs and cones, Interpretation, Applications include High-resolution seismic profiling on

Application of Seismic Methods in Extracting soil properties

Text Book

An Introduction to Applied and Environmental Geophysics, by John M. Reynolds, Wiley 2011, ISBN: 0471485357, 9780471485353

UIC 311 Project Management

Project Planning, Scheduling, and control, Project activities and network construction, Critical path method, PERT, Introduction to Resource scheduling, Project Economy. Applications in Infrastructure and utilities projects and case studies

Text Book

A Guide to Project Management Body of Knowledge: PMBOK, by Project Management Institute, 2016

UIC401 Design of Reinforced Concrete Structures II **3 (2, 2, 0)**

Prerequisites: UIC306

Paneled beams. Design of slender columns (braced and untraced. Design of simple reinforced concrete frames. Design of slab-type and cantilever-type stairs. Design of reinforced concrete beams subjected to combined shear and torsion. Design of frames, brackets, windbags. Structural systems for tall buildings. Design of multistory frames. Design of concrete water tanks.

Text Book

Design of reinforced concrete structures, by Subramanian, Narayanan, Oxford University Press 2013, ISBN: 0-19-808694-6, 978-0-19-808694-9

UIC402 Underground Utility Survey **3 (2, 1, 1)**

Prerequisites: UIC309

Utility Location: Geophysical Methods oriented for Utility detection like GPR, Geomagnetic Methods Ground detectors, methods, Micro Gravity and Seismic Refraction Methods as mentioned in Geophysical Engineering Courses

Utility Mapping: Terrestrial Techniques (Total Stations) & GNSS. Feeding GIS with utility attributes.

Utility Mapping at appropriate ASCE "American Society of Civil Engineering" Quality Levels, Utility Coordination, Utility relocation and adjustment through conflict matrix resolution, Utility relocation design and cost estimates, Communication of utility data to concerned parties, Implementation of Utility Accommodation Policies and utility design

Text Book

Belowground Pipeline Networks for Utility Cables, by Lawrence M. Slavin, American Society of Civil Engineers (2009), ISBN: 0784410550, 978-0-7844-1055-4

UIC403 Foundations Engineering 3 (2, 3, 0)

Prerequisites: UIC307

Slope stability analysis. Retaining structures. Walls for excavation. Slurry trenches and braced-cut systems. Types of foundation and design criteria. Design of shallow foundations and deep foundations, Construction methods. Pile load test. Dewatering and seepage control. Soil stabilization for foundation support.

Text Book

Principles of Foundation Engineering, by Braja M. Das, Cengage Learning 2010, ISBN: 0495668125, 9780495668121

UIC404 Wastewater Engineering **3 (2, 2, 0)**

Prerequisites: UIC309 & UIC303

Sewer systems, Wastewater characteristics, Wastewater treatment works, Wastewater disposal works, Treated wastewater reuse, Industrial wastes. Preliminary studies for wastewater projects. Wastewater collection systems: flow rate, types, hydraulic design. Types of sewage pipes, fittings, pump station, force main. Physical, Chemical, and Biological processes for wastewater treatment. Sludge treatment.

Text Book

Wastewater Engineering - Treatment and Reuse (4th edition), by Metcalf & Eddy 2004, ISBN: 0070495394, 9780070495395

UIC405 Water Supply Engineering **3 (2, 2, 0)**

Prerequisites: UIC309 & UIC303

Hydrology cycles, rainfall measurements, computation of evapo-transpiration and infiltration values. Hydrology of Nile basin. Preliminary studies for water supply works, sources of water, water quality of each source, drinking water standards. Rate of water consumption. Introduction to aquatic chemistry as a basis for evaluation of water quality related to treatment and use of water. and wastewater. Important types of chemical reactions. Quantitative acid-base calculation. Buffer-intensity. The carbonate system. Mineral solubility. Introduction about important of water microbiological, microbiological tastes. Physical, chemical and biological processes for water purification: selection, advanced methods, applications of coagulation, flocculation and sedimentation processes. Slow and rapid filtration. Disinfection. Iron and manganese removal, water desalination, water softening.

Text Book

Water reuse: issues, technologies, and applications, by Metcalf & Eddy, Inc. an AECOM Company, Takashi Asano, Franklin Burton, Harold Leverenz, Ryujiro Tsuchihashi, George Tchobanoglous 2007, ISBN: 0-07-145927-8, 978-0-07-145927-3

UIC406 Design of Steel Structures 3 (2, 2, 0)

Prerequisites: UIC303

Design loads of steel structures. Allowable stresses. Design of tension members. Stability of steel structures against lateral loads. Bracing systems. Column buckling. Design of axially compressed members. Design of bracing members. Design of laterally unsupported beams. Design of beam-columns. Frames and trusses. Design of bolted and welded connections. Column bases. Industrial buildings. Tall buildings. Long span structures. Introduction to load and resistance factor design and ultimate design.

Text Book

Design of Steel Structures, by Elias G. Abu-Saba, Springer US (1995), ISBN: 978-1-4613-5864-0, 978-1-4615-2079-5

UIC407 Soil Investigation for Highways 3 (2, 2, 0)

Prerequisites: UIC305

Problems and phases of foundation investigations; Methods of exploration, geophysical and conventional methods; Sounding, drilling and boring technique; Ground water table determination; Application of Remote sensing in subsoil classification. Field tests – penetration tests, vane shear tests, pressure-meter test, plate load test, field permeability test, critical evaluation of different tests; Preservation and transportation of samples; Selection of type of laboratory tests, analysis and interpretation of results, Site evaluation and reporting.
Highway embankments; Design and construction of embankments, Stage construction, Reinforced Earth design and construction,

Text Book

Geotechnical Engineering: Principles and Practices of Soil Mechanics and Foundation Engineering (Civil and Environmental Engineering) by V.N.S. Murthy, CRC Press (2002), ISBN: 9780824708733, 9780824743406, 0824708733

UIC408 Highway Engineering II 3(2, 1,1)

Prerequisites: UIC308

Highway Engineering: Testing and specifications of road aggregates – Testing and specifications of bituminous materials characteristics and tests– Mineral aggregates (Calculations – Gradations – Tests)– Hot mix asphalt concrete characteristics and design- Surface treatments and seal coats – Asphalt Concrete mix planet – Pavement layers' construction - Design procedures for rigid pavement. Distresses of flexible pavement and rigid pavement-Pavement maintenance – Drainage of roads.

Text Book

Road engineering for development, by Robinson, Richard; Thagesen, Bent, SPON 2004, ISBN: 9780203301982, 0-203-30198-6, 9781482288209, 1482288206, 63-2003-625-7, 0-203-34045-0

UIC409 Hydrographic Survey 3 (2, 1, 1)

Prerequisites: UIC307

IHO specifications and requirements. Vertical datum and related Chart datum. Sea depths Measurements. Introduction to Sonars, Echosounder physical principal, Errors, calibrations. Motion Sensors: Heave compensators, types, advantages & disadvantages. Hydrographic Positioning. Tides: Theory and Practice. Depth measurements and corrections. Hydrographic Information systems. Introduction to Hydrographic Survey Software Modules. Connecting different equipment to the PC. Data acquisition and processing include tide correction, squat. RTK GNSS as a tide and heave compensator.

Text Book

Manual of Offshore Surveying for Geoscientists and Engineers, by R. P. Loweth, Springer Netherlands (1997), ISBN: 978-94-010-6461-3, 978-94-011-5826-8

UIC410 Coastal Engineering 3 (2, 1,1)

Prerequisites: UIC409

Waves and current movements- stability of shore line- erosion and sedimentation in unstable shoreline- movement of sediment particles- shore protection structures- groins- retaining walls and blocks- submerged, floating and detached parallel break water- modifying the wave property - Revetments of shore line- theoretical and empirical equations representing sediments movements in marine structure zones- sand nourishment. Coastal water level fluctuations. Mechanics of wave motion. Coastal processes: beach sediment properties and analysis. Beach profiles. Surf dynamics and sediment transport. Beach stability. Design wave characteristics: breaking and non-breaking waves, extreme waves. Wave forces on cylinders. Morison equation. Wave forces on vertical walls. Effects of approach angle and non- verticality, Breakwater design.

Text Book

Basic coastal engineering, by Sorensen R.M., Springer (2006), ISBN: 0387233326, 9780387233321

UIC501 Infrastructure Management 3 (2, 2, 0)

Prerequisites: UIC409

The processes for the planning and development of new infrastructure, and on maintaining and operating mature infrastructure for sustainability. A wide variety of management topics are covered, such as infrastructure planning, infrastructure economics, infrastructure management systems, optimal maintenance management, reliability of infrastructure systems, asset valuation and utilization, and infrastructure planning under risk and uncertainty.

Text Book

Information Systems for Engineering and Infrastructure Asset Management, by Abrar Haider, Gabler Verlag 2013, ISBN: 978-3-8349-4233-3, 978-3-8349-4234-0

UIC502 Design of Marine Structures 3 (2, 2, 0)

Prerequisites: UIC409

Design of offshore platforms: Introduction, fixed and floating platforms. case studies and general features-elements of hydrodynamics and wave theory-fluid structure interaction, Steel, concrete and hybrid platforms. Design criteria. Environmental loading, Wind, wave and current loads after installation. Stability during towing. Foundations: Site investigations. Piled foundation. Foundations for gravity structures. Behavior under dynamic loading. Static and dynamic analysis of platforms and components. Dynamic response in deterministic and in-deterministic environment, codes of practice, analysis of fixed platform and semisubmersible related topics.

Text Book

Analysis and Design of Marine Structures, by Carlos Guedes Soares, P.K. Das, CRC Press 2009, ISBN: 0415549345, 9780415549349

UIC503 Offshore Geo technology and Tunneling 3 (2, 2, 0)

Prerequisites: UIC403

Elements of physical oceanography related to coast and offshore including tides, currents, waves and littoral drift; Hydraulic and geo technical design of coastal structures. Offshore site investigations, properties of marine soils; Soil behavior under cyclic loading, design storm loading; Gravity structures; Dynamic response and cyclic displacements; Pile foundations for offshore structures, axial lateral and cyclic loads, types of foundation anchorage; Jack-up platforms; Rig foundations. Underground openings, structural geology in rock tunneling, Rock slopes, Rock foundations; Bearing Capacity of Rocks; Drilling and blasting of rocks; Grouting; Instrumentation and measurements in tunneling.

Text Book

-Handbook of Tunnel Engineering, Volume I: Structures and Methods, 9783433030486, 9783433603505, 9783433603512, 9783433603529, 9783433603499

-Handbook of Tunnel Engineering II: Basics and Additional Services for Design and Construction, by Bernhard Maidl, Markus Thewes, Ulrich Maidl, David S. Sturge, Ernst & Sohn 2013, ISBN: 9783433030493, 9783433603543, 9783433603550, 9783433603567, 9783433603536

UIC504 Water distribution systems and sewer systems design 3(2, 2, 0)

Prerequisites: UIC404 & UIC405

Water distribution systems: Introduction of water network, Classification of Water Distribution System, Requirements of a Good Water Distribution System, Basic Principles of Hydraulics Applicable to Water Distribution Systems, Design of Water Distribution System, Minor Head Losses, Optimization of Pipe Diameter, Hydraulic Computation of Water Distribution System Fire Flow Tests, Water Quality in Water Distribution Systems.

Sewer systems: introduction, types of sewer system (sanitary sewer system, combined sewer system, storm water system and patterns of sewer system), planning of sewer system, sewer pipes (shapes of sewer pipes sewer materials, strength and bedding of sewers), sewer appurtenances (manholes, drop manholes, inlets, inverted siphons, sewage pumping), design of sewer system (design sewage flow of sewer, hydraulic formulas for sewer design, maximum and minimum velocities, minimum slopes, minimum size of sewers and depth of flow)

Text Book

Water and Wastewater Calculations Manual by Shun Lin, C. Lee, McGraw-Hill Professional, 2 Edition, 2007

UIC505 Project I 3 (1, 2, 2)

UIC506 Project II 3 (0,6,0)

The student is assigned, among a team of students. The project simulates the real working condition to which the student will be exposed after graduation. The project should be comprehensive, sustainable and includes all the necessary preliminary field studies, visibility studies, final design drawings. The graduation project will continue for two semesters. At the end of each semester, there will be a seminar held for the working team of students to present the details of the completed part of the project. The working team will be orally examined and evaluated based on the presentation as well as the oral discussion.

Elective Courses

Elective 1: Students shall select one course from the following three alternatives

UIC507 Environmental Impact Assessment **3 (2, 2, 0)**

Prerequisites: UIC309

Main parameters of environment impacts on the projects. Environmental Impact of the project on the human. Environmental Impact of the project on animals and plants. Environmental impact of the project on the rest of components of the environment. Environmental impact of the project during and after the construction. Environmental impact assessment in Egypt and different countries. Steps for performing environmental impact assessment. Case studies and applications.

Text Book

-Environmental impact assessment: a guide to procedures, by DETR & The National Assembly for Wales, Thomas Telford Publishing 2000, ISBN: 2016-05-22 07:20:00

-Environmental Impact Assessment and Strategic Environmental Assessment: Towards an Integrated Approach, by Hussein Abaza, Ronald Bisset, Barry Sadler, ISBN: 9280724290, 9789280724295

UIC508 Sustainable Environmental Engineering **3 (2, 2, 0)**

Prerequisites: UIC309

Sustainability. Sustainable water supply. Sustainable sanitation. Sustainable solid waste management. Life cycle analysis. Sustainable cities. Sustainable communities. Sustainable living. Leadership in Energy and Environmental Design (LEED) accreditation for buildings. Greenhouse gas emissions. Biodiversity. Sustainable water supply. Case studies and applications.

Text Book

Environmental Engineering: Designing a Sustainable Future (Green Technology), by Anne E. Maczulak, Facts on File 2009, ISBN: 9780816072002, 0816072000, 9781438127477

UIC509 Reuse of wastewater and solid wastes **3 (2, 2, 0)**

Prerequisite: UIC404

Methods for minimization of liquid and solid wastes, especially in Egypt. Waste water treatment plants, gray water networks and uses, Reuse and recycle municipal solid wastes, landfill, solid waste collection, sorting, energy content, with focus on Egypt. Reuse and recycle industrial solid wastes, agro – industrial waste treatment, with focus on Egypt. Environmental impact assessment for reuse and recycle of wastes, minimization, reuse and recycle of constructions wastes, treatment, sludge treatment, reuse and disposal of sludge.

Text Book

Wastewater Engineering - Treatment and Reuse (4th edition), by Metcalf & Eddy 2004, ISBN: 0070495394, 9780070495395

Elective 2: Students shall select one course from the following three alternatives

UIC510 Remote Sensing **3 (2, 2, 0)**

Prerequisite: UIC307

Basics and principles of remote sensing, Definitions, Energy sources. Advantages of remote sensing technique. Photo and image interpretation. Control points and ground truth observations. Field work steps. The use of remote sensing in GIS applications. Remote

sensing application in civil and environmental engineering. Hardware and software required for image processing and interpretations. Case studies.

Text Book

Remote Sensing Digital Image Analysis: An Introduction, by John A. Richards, Xiuping Jia, Springer 2005, ISBN 9783540251286, 3-540-25128-6

UIC511 Land Information Systems **3 (2, 2, 0)**

Prerequisite: UIC402 & UIC307

Information systems (features- administration- decision) - Geoinformation systems (GIS) - Processing (classification - transformation- programming) - Data input and data output format and management (traditional filing systems- architectural of data base systems- standard and non-standard approaches) - Distributed systems (computer networks - data communication technology) - Projects selection - Design and implementation.

Text Book

An Introduction to Geographical Information Systems, by Ian Heywood, Sarah Cornelius, Steve Carver, Prentice Hall 2006, ISBN: 0-13-129317-6, 978-0-13-129317-5, 9781405898447

UIC512 Dredging Engineering **3 (2, 2, 0)**

Prerequisite: UIC410 & UIC307

Planning of inland navigation projects, Design of navigation channels cross section, Master plan of inland ports, Berthing facilities, repairing facilities, Dredging and maintenance of navigation channels, Environmental impact of inland navigation. Environmental Studies & Approvals, Preliminary Surveys, Subsurface Investigations, Disposal of Spoil & Environmental Considerations, understanding of dredging and related environmental issues in ports and harbors. Fluid Mechanics of Dredging, utilize a systems approach to dredging as a part of port and harbor engineering. Dredging Contracts, Types of Dredgers, Mobilization of Dredges, Survey Control for Dredging and Problems in Maintenance Dredging.

Text Book

Fundamentals of hydraulic dredging, by Turner, Thomas M, ASCE Press (1996), ISBN: 0-7844-0147-0, 9780784401477

Elective3: Students shall select one course from the following three alternatives

UIC513 Sustainable Transportation and Highways Engineering **3 (2, 2, 0)**

Prerequisites: UIC407

Traffic management and delay computations in relation to unfinalized intersections and roundabouts. Principles of land use and transport integration. Transport and Environment. Air quality, noise and energy impacts. Fuel options for transport. Intelligent transport Systems. Transport costs, pricing and financing urban transport projects. Highways maintenance, highways evaluation, type of highways maintenance and rehabilitation, treatment of highways pavement, pavement recycling techniques, sustainable and economical evaluation of highways maintenance.

Text Book

An Introduction to Sustainable Transportation: Policy, Planning and Implementation, by Preston L. Schiller, Eric Bruun, Jeffrey R. Kenworthy, Earthscan 2010, ISBN: 1844076652, 9781844076659, 1844076644, 9781844076642

UIC514 Railways Engineering **3 (2, 2, 0)**

Prerequisite: UIC408

Introduction to Railways Engineering, Urban and Sub-urban design of railways, Vertical and horizontal curves- rails design- wood and concrete sleepers design- stresses in gravels section – railways intersections- signs and design of control stations; Economical and environmental effect of railways

Text Book

Practical railway engineering, by Clifford F. Bonnett, Imperial College Press; Distributed by World Scientific Pub 2005, ISBN: 1860945155, 9781860945151

UIC515 Airports Engineering **3 (2, 2, 0)**

Prerequisite: UIC408

Types of airports – Airport planning and configuration – Geometric design of the landing area and runway direction – Safety areas – Instrument landing system – Marking and signing of airport – Airport lighting – Soil classification for airports - Structural design methods for flexible **and rigid pavements of airports.**

Text Book

Planning and Design of Airports, by Robert Horonjeff, Francis McKelvey, William Sproule, Seth Young, McGraw-Hill Professional 2010, ISBN: 0071446419, 9780071446419

Elective3: Students shall select one course from the following three alternatives

UIC516 Retaining Structures and Underground Construction **3 (2, 2, 0)**

Prerequisite: UIC403

Stability analysis of Slopes, Embankments and Dams (Cr = 03) Landslide phenomenon: Types and causes of slope failures, Practical applications ; Stability analysis of infinite slopes with or without water pressures; Stability analysis of finite and Infinite slopes: concept of factor of safety, pore pressure coefficients, Mass analysis, Wedge methods, friction circle method; Method of slices, Bishop's method, Janbu's method ; Effect of seepage, submerged and sudden draw down conditions; Design of slopes in cutting, Embankments and Earth dams; Site Investigation, Investigation for foundations; Advances in stability analysis of slopes.

Earth pressure theories, conditions of applicability, arching effect; Retaining walls, different types and their stability, design considerations, drainage provisions; Cantilever sheet pile wall; Anchored bulk head, Free and fixed earth support methods, types of sheet piles and construction aspects; cellular coffer dams, design procedures, interlock, piling rise and overturning; Braced excavation, types, earth pressure, effect of wall rigidity and sequence of construction, Design of wall and wall supports; tunnels and shafts, pressure distribution, design of tunnel lining, methods of tunneling, ground loss.

Text Book

Civil Engineering: Foundations and Retaining Structures, by Alan Williams, Kaplan AEC Education 2003, ISBN: 0793185076, 9780793185078

UIC517 Soil Dynamics and Foundations **3 (2, 2, 0)**

Prerequisite: UIC403

Behavior of dynamically loaded soil - Dynamic properties of soil - Laboratory and field investigations to determine dynamic properties of soil - Dynamic response of soil media to

earthquake motions - Soil instabilities due to earthquakes; Vibration of foundation - Soil-structure interaction and its influence on dynamic response of buildings.

Text Book

An Introduction to Soil Dynamics, Arnold Verruijt, Springer Netherlands 2010, ISBN: 9048134404, 9789048134403

UIC518 Tunnels and Underground Structures 3 (2, 2, 0)

Prerequisite: UIC403

History of tunnels – Using of tunnels – Hydraulic tunnels classification - Tunneling methods in soft ground – Tunneling in rock – Rock mass evaluation systems – Technology of tunnels in soil and rock – Design of tunnel supporting systems – Planning and design of site investigation – Instrumentation, monitoring and evaluation of engineering behavior of underground structures – Numerical analysis of tunnels.

Text Book

-Underground Structures: Design and Instrumentation, by R.S. Sinha, Academic Press, Elsevier 1989, ISBN: 978-0-444-87462-7

-Handbook of Tunnel Engineering, Volume I: Structures and Methods, by Bernhard Maidl, Markus Thewes, Ulrich Maidl, David S. Sturge, Ernst & Sohn 2013, ISBN: 9783433030486, 9783433603505, 9783433603512, 9783433603529, 9783433603499