Architecture & Green Urbanism Program

General Knowledge

1-Main Data

Item	Data
Faculty	Faculty of Engineering-at Mataria
Program Name	GREEN ARCHITECTURE & URBANISM
Start date	2017/2018
Program finder	Professor/ Noha Ahmed Nabil
Coordinator & Leader	Professor/ Dalia Wagih Abd Elhalim
Affiliation	Professor in Landscape- Architectural Department
Email	Dalia_said@m-eng.helwan.edu.eg Dalia.wagih123@gmail.com
Mobile	01005016606
Date of appointment decision	2/11/2024

2- The types of provided certificates:

Courses type	Theoretical and Practical	
Certificate types	Diploma of science in green architecture and urbanism	Master of science in green architecture and urbanism

3- Number of credit hours and semesters for graduation:

Number of Credit hours	42
Number of semesters for graduation	2 semesters (12 hours/each) +18 hours for the master thesis

The Aim of the Program

This program aims to develop research capabilities, scientific thinking and enhance research skills for architectural engineers. It seeks to enable them to work with high technical efficiency and gain scientific experience in the fields of Architecture & Green Urbanism.

The curriculum for the program includes specialized course in the following research areas within the field of Architecture & Green Urbanism, with the assistance of academic theme:

1- Architectural Studies
2- Urban Studies
3- Environmental Studies
4- Technological Studies

1. Master of Science (MSc) Program in AGU Engineering

The Master's program (Architecture and Green Urbanism) aims to prepare distinguished professionals to face future challenges and contribute to developing the field of construction

fundamentally and innovatively, in addition to qualifying its graduates to assume leadership of projects.

1.1. Graduate attributes of Master of Science (MSc) Program in AGU Engineering

The graduate of the "Program Title" Master of Science Program should be able to:

1) Proficiency in applying the basics and methodologies of scientific research and writing reports.
2) Apply specialized knowledge to provide effective solutions to sustainable architecture challenges.
3) Accurately identifying professional problems, analyzing their aspects related to architecture and sustainability, and arriving at the best solutions.
4) Use technological tools and digital analysis techniques, such as environmental modelling and energy performance analysis to improve project design.
5) Must have the ability to make sustainability decisions that take into account environmental, economic and social factors.
6) The graduate must have the ability to communicate clearly and effectively with team members and other interested parties, whether they are customers, engineers or members of the community.
7) To be aware of the environmental and social challenges facing society and how the field of architecture and urbanism can help to improve the quality of the environment and society through designing buildings in a sustainable manner.
8) Has an awareness of the concept of sustainability and the ability to include these concepts in using resources.
9) Adheres to ethical standards related to the profession and displays a deep understanding of ethical responsibilities in the field of architecture and urbanism.
10) Ready to constantly develop his/her skills to design projects in a way that makes the graduate capable of resisting challenges related to climate changes.
11) Apply an analytical approach and use it in architecture and engineering design.
12) Able to integrate environment control technology into building design to achieve maximum energy efficiency.

1.2. Learning outcomes of Master of Science (MSc) Program in AGU Engineering

By the completion of "Architecture and Green Urbanism" program, the graduate is expected to know and be able to fulfil the following competencies:

1) Acquisition and application of new knowledge about the principles of green architecture, self-directed learning and other learning strategies.
2) Encouraging students to develop a strong desire for continuous learning and keeping up with the latest developments in the field of green architecture and urban planning.

3) Thinking sustainably in all aspects of design and implementation with a focus on energy efficiency and resource sustainability.
4) Developing oral and written communication skills to interact effectively with colleagues, clients, and the target audience.
5) The ability to make sustainable decisions that consider environmental, economic, and social factors.
6) Effective communication with team members and other stakeholders, whether they are clients, engineers, or members of the community.
7) Enhancing effective decision-making skills based on the analysis of multiple information and knowledge-based conclusions.
8) Raising awareness of the importance of social and environmental responsibility in the field of architecture and urban planning and forming a sustainable and ethical vision.
9) Conducting research and effectively utilizing to achieve scientifically based designs and projects.
10) Evaluating the environmental impact of projects and improving their environmental performance.

1.3. Construction of Master of Science (MSc) Program in AGU Engineering

First: Basic diploma in Architecture and Green Urbanism

The candidate who successfully pass the admission exam with the required level should study 12 credit hours (2 courses) of the compulsory courses shown in Table 1. And (2 courses) from the available elective courses listed below in Table 2. The selected courses should be related to the research area selected by the candidate.

Table 1 Compulsory courses for Postgraduate Basic diploma in Architecture and Green Urbanism

No.	Code	Pre-requisite	Course Name	Credit Hrs.	Class Work	Prac/Oral Grade	Final Grade	Total	Exam Time
1	GAU501		Sustainable Development and Green Architecture	3	40	20	40	100	3
2	GAU502		Scientific Research Methods & Writing Reports	3	40	20	40	100	3

Table 2 Elective courses for Postgraduate Basic diploma in Architecture and Green Urbanism

No.	Code	Pre-requisite	Course Name	Credit Hrs.	Class Work	Prac/Oral Grade	Final Grade	Total	Exam Time
1	GAU503		The Computer Simulation in Environmental Design	3	40	20	40	100	3
2	GAU504		Materials and Techniques of Green Building and Kinetic Energy	3	40	20	40	100	3
3	GAU505		Rationalization of Energy Consumption and Improving its Efficiency in Budlings and Urbanism	3	40	20	40	100	3
4	GAU506		Alternative and Renewable Energies	3	40	20	40	100	3

Second: Advanced Engineering diploma in Architecture and Green Urbanism

The candidate who successfully pass the admission exam with the required level should study 12 credit hours (2 courses) of the compulsory course shown in Table 3. And (2 courses) from the available elective courses listed below in Table 4. The selected courses should be related to the research area selected by the candidate.

Table 3 Compulsory courses for Advanced Engineering diploma in Architecture and Green Urbanism

No.	Code	Pre-requisite	Course Name	Credit Hrs.	Class Work	Prac/Oral Grade	Final Grade	Total	Exam Time
1	GAU601		Evaluation Systems of Green Buildings	3	40	20	40	100	3
2	GAU602		Assessment of Environmental Impact for Urban Project	3	40	20	40	100	3

Table 4 Elective courses for Advanced Engineering diploma in Architecture and Green Urbanism

No.	Code	Pre-requisite	Course Name	Credit Hrs.	Class Work	Prac/Oral Grade	Final Grade	Total	Exam Time
1	GAU603		Retrofitting and Use of Old Buildings	3	40	20	40	100	3
2	GAU604		Sustainable Cities	3	40	20	40	100	3
3	GAU605		Green Building Life Cycle	3	40	20	40	100	3
4	GAU606		Sustainable Landscaping	3	40	20	40	100	3
5	GAU607		Climate Change Adaptation in Cities	3	40	20	40	100	3
6	GAU608		Sustainable Neighborhood Planning	3	40	20	40	100	3
7	GAU609		Instruments and Systems of Sustainable and Smart Transport	3	40	20	40	100	3

Third: Master of Science (MSc)

In the case of a student achieving a cumulative grade point average of (3.0) with a minimum requirement of (2.7) in all courses of the advanced diploma in Green Architecture and Urbanism studied in Table 3 and Table 4. After that, the candidate was ready for preparing a master thesis that present his/her ability to analysis and oresent scientific information in a proper level under full supervision of the main supervisor (supervision committee). The competencies matrix of each course in the Master of Science program is shown in Table 5.

Table 5 The competencies matrix of each course in the Master of Science program

No.	Code	Course Name	Learning Outcomes (Competencies)									
			1	2	3	4	5	6	7	8	9	10
1	GAU501	Sustainable Development and Green Architecture	*				*	*		*		
2	GAU502	Scientific Research Methods & Writing Reports				*			*		*	
3	GAU503	The Computer Simulation in Environmental Design		*	*		*				*	
4	GAU504	Materials and Techniques of Green Building and Kinetic Energy	*		*			*				
5	GAU505	Rationalization of Energy Consumption and Improving its			*						*	

		Efficiency in Buildings and Urbanism										
6	**GAU506**	Alternative and Renewable Energies			*						*	
7	**GAU601**	Evaluation Systems of Green Buildings			*			*	*	*		*
8	**GAU602**	Assessment of Environmental Impact for Urban Project			*		*				*	
9	**GAU603**	Retrofitting and Use of Old Buildings			*		*					*
10	**GAU604**	Sustainable Cities	*		*		*	*		*		
11	**GAU605**	Green Building Life Cycle			*	*		*	*	*		
12	**GAU606**	Sustainable Landscaping					*			*		
13	**GAU607**	Climate Change Adaptation in Cities			*		*			*		*
14	**GAU608**	Sustainable Neighborhood Planning			*					*		*
15	**GAU609**	Instruments and Systems of Sustainable and Smart Transport			*		*	*		*		*

1.4. Courses Contents of Master of Science (MSc) Program in AGU Engineering

The course content of the above listed course for the postgraduate Basic diploma in "Architecture and Green Urbanism" are listed below:

Course Title:	**Sustainable Development and Green Architecture**				
Course Code:	**Pre-requisite**	**Credit hrs.**	**Contact hrs.**		
			Lec.	**Tut.**	**Lab.**
GAU501		**3**	**2**	**2**	**0**
Course Grades	**Class Works**	**Prac/Oral**	**Final Exam**	**Total**	**Exam Time hr.**
	40	**20**	**40**	**100**	**3**
Course Content					
The syllabus includes the current debates about the sustainable development in which it shows the development of concept, discussion of goals, challenges and principles of sustainability, knowing the relationship between Economics, Ecology, applying principles of Green Architecture and analysing the best practices of available projects in the world to go out with these lessons and identify the theoretical challenges and the methodology for the development of cities and suggest ways to deal with it and identify the role of Green Architecture in sustainable development.					
References:					
• Yeang, K. (2015). EcoDesign: A Manual for Ecological Design. Wiley. • Edwards, B. & Edwards, D. (2013). Green Architecture: A Guide to Sustainable Design. Laurence King Publishing.					

- يس، عادل. (٢٠١٦). العمارة الخضراء. المجلس الأعلى للثقافة.

Course Title:	Scientific Research Methods & Writing Reports				
Course Code:	Pre-requisite	Credit hrs.	Contact hrs.		
			Lec.	Tut.	Lab.
GAU502		3	2	2	0
Course Grades	Class Works	Prac/Oral	Final Exam	Total	Exam Time hr.
	40	20	40	100	3

Course Content

The syllabus includes the approaches and foundations of scientific research, quantitative and qualitative, as well as the methods of application of various research on which how to develop research structure and components and to develop hypothesis, formulation and testing methods. An introduction to reports' objectives, kinds, basics and methods of writing, means of setting report objectives and components. The importance of components' independency and systemization and the means of achieving that, means of setting the sequence of contents, organizing and writing results with clarity, setting up schedules, graphs and statistics, organizing demonstrative figures in terms of dimensions and distribution throughout the report presentation.

References:

- Creswell, J. W. (2014). Research Design: Qualitative, Quantitative, and Mixed Methods Approaches (4th ed.). Sage Publications.
- Day, R.A., & Gastel, B. (2012). How to Write and Publish a Scientific Paper (7th ed.). Cambridge University Press.
- سرحان، محمد. (٢٠١٩). مناهج البحث العلمي. مركز النيل للنشر والتوزيع.

Course Title:	The Computer Simulation in Environmental Design				
Course Code:	Pre-requisite	Credit hrs.	Contact hrs.		
			Lec.	Tut.	Lab.
GAU503		3	2	0	2
Course Grades	Class Works	Prac/Oral	Final Exam	Total	Exam Time hr.
	40	20	40	100	3

Course Content

The syllabus deals with studying the simulation software of energy, climate analysis and environmental design using the computer. Commencing the importance of these software programs and their classification such as CLIMATE CONSULTANT, SOLAR5-7 and VISUAL-DOE BIM, Revit, Envi-Met, Design Builder, programs for the integration of the use of simulation tools of Energy and Environmental Design during various stages of design process.

References:

- Holzbecher, E. (2007). Environmental Modeling Using MATLAB. Springer.
- Luh, P.B., Liu, J., Freihaut, J., & Saber, E.M. (2016). Simulation for Designing

Sustainable Budlings and Cities. Springer.

- Menges, A., & Ahlquist, S. (2018). Computational Design Thinking: Computation Design Thinking and Machine Intelligence. Springer.

Course Title:	Materials and Techniques of Green Building and Kinetic Energy				
Course Code:	Pre-requisite	Credit hrs.	Contact hrs.		
			Lec.	Tut.	Lab.
GAU504		3	2	2	0
Course Grades	Class Works	Prac/Oral	Final Exam	Total	Exam Time hr.
	40	20	40	100	3

Course Content

The course aims to study Green Building, overview of sustainable building practices. Green building materials, eco-friendly and recycled materials overview. Sustainable sourcing and life cycle analysis. Energy-efficient building design. Study the properties and manufacturing-handling-operating-dismantling (and methods of operation of modern building materials and construction techniques and modern methods of construction. The study of the extent to which these materials, techniques, and strategies coop with the principles of green architecture, as well as manufactured materials by nanotechnology. Codes of energy efficiency in buildings.

References:

- Dissanayake, P., & Jayasinghe, C. (2016). Green Building: Guidebook for Sustainable Architecture. Springer.
- Kibert, C.J. (2016). Sustainable Construction: Green Building Design and Delivery. John Wiley & Sons.
- Baird. G., & Harrison, C. (2018). Materials for Sustainable Sites: A Complete Guide to the Evaluation, Selection, and Use of Sustainable Construction Materials. Wiley.

Course Title:	Rationalization of Energy Consumption and Improving its Efficiency in Buildings and Urbanism				
Course Code:	Pre-requisite	Credit hrs.	Contact hrs.		
			Lec.	Tut.	Lab.
GAU505		3	2	2	0
Course Grades	Class Works	Prac/Oral	Final Exam	Total	Exam Time hr.
	40	20	40	100	3

Course Content

The syllabus includes an introduction to Environmental Design, the principles of Green and Sustainable Architecture and their role in energy conservation and the use of solar energy in the passive design. Identify the passive environmental design techniques for cooling and heat gain with practical examples, the development of integrating passive and active methods that reduce energy consumption in the design of buildings to achieve maximum efficiency in energy saving.

References:

- CIBSE. (2006). Guide F: Energy Efficiency in Buildings. Chartered Institution of Building Services Engineers.
- Roulet, C.A., & Marchal, R. (2013). Energy Efficiency in Buildings. Springer.
- Meckler, M. J. (2018). Energy Efficiency: Concepts and Calculations. CRC Press.

Course Title:	**Alternative and Renewable Energies**				
Course Code:	**Pre-requisite**	**Credit hrs.**	**Contact hrs.**		
			Lec.	**Tut.**	**Lab.**
GAU506		**3**	**2**	**2**	**0**
Course Grades	**Class Works**	**Prac/Oral**	**Final Exam**	**Total**	**Exam Time hr.**
	40	**20**	**40**	**100**	**3**
Course Content					
The syllabus includes the basic terms and concepts of renewable energy and the technological changes used. How to convert to various electrical systems learning about the different electronics for new energy. Reviewing the features of renewable energy, integrating new energy systems into their design to shape architecture and urban areas, and reviewing the control and technologies that can be used to create components. New Sustainability.					
References:					
• Boyle, G. (2012). Renewable Energy: Power for a sustainable Future. Oxford University Press. • Twidell, J., & Weir, T. (2015). Renewable Energy Resources. Routledge. • Zhang. X, & Lin, Y. (2016). Introduction to Renewable Energy. CRC Press.					

Course Title:	**Evaluation Systems of Green Buildings**				
Course Code:	**Pre-requisite**	**Credit hrs.**	**Contact hrs.**		
			Lec.	**Tut.**	**Lab.**
GAU601		**3**	**2**	**2**	**0**
Course Grades	**Class Works**	**Prac/Oral**	**Final Exam**	**Total**	**Exam Time hr.**
	40	**20**	**40**	**100**	**3**
Course Content					
The course includes studying programs and systems that assess the sustainability of the environment, analyze them by standards and aspects of the evaluation program such as Green Building Tools "GBT", the Building Research Establishment Environmental Assessment Method "BREEAM" or "Leadership in Energy and Environmental Design "LEED", their definitions, their scope of usage, the advantages and disadvantages of each program.					
References:					
• Gou, Z., Wang, L., & Liu, J. (Eds.). (2019). Evaluation and Optimization of Green Buildings: New Technologies, IGI Global. • Howard, L., Thompson, B., & Smith, J. (Eds.). (2017). Green Building: A					

Professional's Guide to concepts, Codes and Innovation (3rd Ed.). Jones and Bartlett Learning.
- U.S. Green Building Council. (2013). LEED reference guide for building design and construction. U.S. Green Building Council.

Course Title:	Assessment of Environmental Impact for Urban Project				
Course Code:	Pre-requisite	Credit hrs.	Contact hrs.		
			Lec.	Tut.	Lab.
GAU602		3	2	2	0
Course Grades	Class Works	Prac/Oral	Final Exam	Total	Exam Time hr.
	40	20	40	100	3
Course Content					
The course deals with goals, nature and elements of the environmental impact of urban projects and its analysis. The impact of development on the social and economic aspects and the degree of noise, pollution, traffic and overall appearance. Ways and techniques of measuring the degree and quality of environmental impact like matrices, check lists, surveys and develop plans, identifying obstacles and possibilities. Administrative aspects in the stages of the work prepare reports of the environmental impact as sources of regulations and concerns of the different sectors of government and affected the quality of the change.					
References:					
• Canter, L.W. (2017). Environmental Impact Assessment (3rd ed.). Routledge. • Glasson, J., Therivel, R., & Chadwick, A. (2012). Introduction to Environmental Impact Assessment (4th ed.). Routledge. • Morris, P., Therivel, R. (2018). Methods of Environmental Impact Assessment (3rd ed.). Routledge.					

Course Title:	Retrofitting and the Use of Old Buidings				
Course Code:	Pre-requisite	Credit hrs.	Contact hrs.		
			Lec.	Tut.	Lab.
GAU603		3	2	2	0
Course Grades	Class Works	Prac/Oral	Final Exam	Total	Exam Time hr.
	40	20	40	100	3
Course Content					
The syllabus includes retrofitting standards and the usage of older buildings and the appropriate methods of analysis which will achieve sustainability and green architecture criteria. Identify the contemporary trends and tolls needed to retrofitting old buildings, learn how to analyze constituents for the validity of the re-use of buildings. It also provides a case analysis of the process of modernizing old buildings as models for learning and understanding challenges and opportunities.					
References:					

- Heritage Council of Victoria. (2013). The Illustrated Burra Charter: Making Good Decisions about the Care of Important Places. Heritage Council of Victoria.
- Fawcett, P. (2017). Building Adaptation (2nd ed.). Butterworth-Heinemann.
- English Heritage. (2010). Practical Building Conservation: Earth, Brick, and Terracotta. Ashgate.

Course Title:	Sustainable Cities				
Course Code:	Pre-requisite	Credit hrs.	Contact hrs.		
			Lec.	Tut.	Lab.
GAU604		3	2	2	0
Course Grades	Class Works	Prac/Oral	Final Exam	Total	Exam Time hr.
	40	20	40	100	3

Course Content

The course covers the decision-making process for learning vision for sustainable cities based on the strategies and policies for sustainability, as ell as displaying different styles applied by Sustainable Cities to activate the partnership and establishing principles of social justice and improvement discusses urban management for sustainable cities and the distribution of roles and responsibilities. Studying how to integrate green spaces and deign buildings in a way that improves air quality and reduces energy consumption.

References:

- Beatley, T. (2012). Green Cities of Europe: Global Lessons on Green Urbanism. Island Press.
- Newman, P., & Jennings, I. (2008). Cities as Sustainable Ecosystems: Principles and Practices. Island Press.
- Roseland, M. (2012). Toward Sustainable Communities: Solutions for Citizens and their Governments. New Society Publishers.

Course Title:	Green Building Life Cycle				
Course Code:	Pre-requisite	Credit hrs.	Contact hrs.		
			Lec.	Tut.	Lab.
GAU605		3	2	2	0
Course Grades	Class Works	Prac/Oral	Final Exam	Total	Exam Time hr.
	40	20	40	100	3

Course Content

Sustainability requires a systems-based approach to design iteration. It is important to accurately account for the financial impacts of a design proposal. Also, understanding how systems thinking can be applied to cost can develop a better idea of how investment costs can be offset with Lifecycle Cost Analysis.

References:

- Baird, G. (2017). Green Building Design and Construction: A Life-Cycle Approach. CRC Press.

- السلطة الوطنية الفلسطينية. (٢٠١٦). "تقييم دورة الحياة للمبانى الخضراء". رام الله: السلطة الوطنية الفلسطينية.
- مجلس البيئة للمبانى الخضراء-الإمارات العربية المتحدة. (٢٠١٧). "تقييم دورة الحياة للمشاريع الخضراء: دليل الممارسة". دبى: مجلس البيئة للمبانى الخضراء.

Course Title:	Sustainable Landscaping				
Course Code:	Pre-requisite	Credit hrs.	Contact hrs.		
			Lec.	Tut.	Lab.
GAU60٦		3	2	2	0
Course Grades	Class Works	Prac/Oral	Final Exam	Total	Exam Time hr.
	40	20	40	100	3

Course Content

The course covers the definition of the concept of sustainability and the study of the relationship between sustainable landscape designs, the study of possible policies that could be applied to raise the level of sustainability through coordination of site as a whole and through the diverse elements as detailed parts. It also presents approaches and approaches to environmental site coordination within the framework of concepts of sustainability and ecological considerations for different sites and ecosystems, the role used in developing coordination, and its relationship to project programming.

References:

- Thiele, L.P. (2012). Sustainable Landscape Construction: A Guide to Green Building Outdoors (3rd ed.). Island Press.
- Beatley, T. (2011). Biophilic Cities: Integrating Nature into Urban Design and Planning. Island Press.
- Udall, B., & Sanderson, J. (2007). Sustainable Landscape Construction: A Guide to Green Building Outdoors (2nd ed.). Island Press

Course Title:	Climate Change Adaptation in Cities				
Course Code:	Pre-requisite	Credit hrs.	Contact hrs.		
			Lec.	Tut.	Lab.
GAU607		3	2	2	0
Course Grades	Class Works	Prac/Oral	Final Exam	Total	Exam Time hr.
	40	20	40	100	3

Course Content

The course discusses how local authorities can respond and adapt to climate change, plan and implement solutions for environmental and natural resource challenges and promote more sustainable ways of development. Leading international experts and practitioners will share the latest insights on climate change adaptation and mitigation and the impact for local authorities. We will zoom in on the design and implementation of sustainable local development programmers that project the environment and improve the quality of life of citizens.

References:

- Moser, S.C., & Boykoff, M.T. (eds.). (2013). Successful Adaptation to Climate Change: Linking Science and Policy in a Rapidly Changing World. Routledge.
- Bulkeley, H., & Betsill, M. M. (Eds.). (2013). Cities and Climate Change: Urban Sustainability and Global Environmental Governance. Routledge.
- مؤسسة البحرين للتنمية المستدامة. (٢٠١٧). "الخطة الاستراتيجية لتكييف البحرين مع تغير المناخ". المنامة: مؤسسة البحرين للتنمية المستدامة.

Course Title:	**Sustainable Neighborhood Planning**				
Course Code:	**Pre-requisite**	**Credit hrs.**	**Contact hrs.**		
			Lec.	**Tut.**	**Lab.**
GAU608		**3**	**2**	**2**	**0**
Course Grades	**Class Works**	**Prac/Oral**	**Final Exam**	**Total**	**Exam Time hr.**
	40	**20**	**40**	**100**	**3**

Course Content

The syllabus includes the theoretical framework for sustainable planning on the scale of cities to neighborhood and the criteria to achieve this. Using strategies aimed at enhancing environmental, social and economic sustainability, it also includes learning how to distribute mixed land use and achieve good communication between residential neighborhoods and planned role in the provision of design alternatives and balanced development and integration with the environment.

References:

- Sussman, R., & Freedman, J. (2019). Toward Sustainable Communities: Transition and Transformations in Environmental Policy. Routledge.
- Beatley, T. (2011). Green Cities of Europe: Global Lessons on Green Urbanism. Island Press.
- المركز العربى للبيئة والتنمية. (٢٠١٨). "التخطيط المستدام للمجاورات العمرانية: الإرشادات والتجارب العربية". بيروت: المركز العربى للبيئة والتنمية.

Course Title:	**Instruments and Systems of Sustainable and Smart Transport**				
Course Code:	**Pre-requisite**	**Credit hrs.**	**Contact hrs.**		
			Lec.	**Tut.**	**Lab.**
GAU609		**3**	**2**	**2**	**0**
Course Grades	**Class Works**	**Prac/Oral**	**Final Exam**	**Total**	**Exam Time hr.**
	40	**20**	**40**	**100**	**3**

Course Content

This syllabus includes the basic science of transportation, traffic, sustainable road networks planning to identify theories and their applications and some of the basic concepts of science and transport elements. The concepts of sustainable urban transport within cities components and traffic characteristics and estimates of capacity and density specifications of roads.

References:

- Hall, R. P., & Hurdle, J. F. (2014). Sustainable Transportation: Indicators, Frameworks, and Performance Management. Springer.
- Banister, D., & Stead, D. (2004). Sustainable Transport: Planning for Walking and Cycling in Urban Environments. Taylor & Fracis.
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