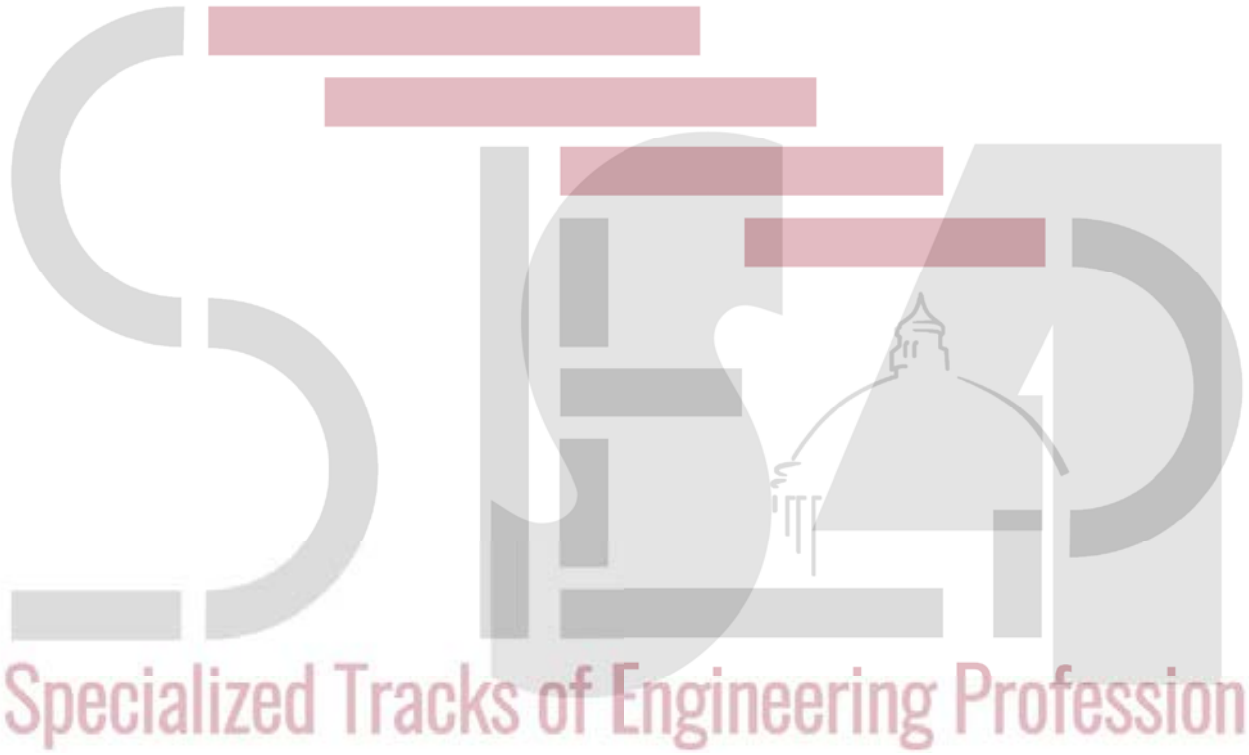

PART [C]: SPECIALIZED PROGRAMS

(4) CIVIL INFRASTRUCTURE ENGINEERING Program (CIE)

برنامج البنية التحتية المدنية

(4) Civil Infrastructure Engineering Program (CIE)

برنامج البنية التحتية المدنية

VISION رؤية البرنامج

To become leaders in the field of civil infrastructure engineering education to achieve national and regional recognition for the innovation of Egypt and all humanities.

أن نصبح الرواد في مجال تدريس هندسة البنية التحتية في مصر والشرق الأوسط لتحقيق مستوى متميز يسهم في تقدم البشرية.

MISSION رسالة البرنامج

The field of civil infrastructure engineering is by far the most growing and demanding field in the construction market in Egypt. The country is in a need for more public works projects: roads, highways, airports, railways, water and wastewater treatment plants, water distribution networks, and sanitary sewers, to satisfy the community's needs of both citizens and investors. This sector is also lacking specialized engineers for its operation, maintenance, and rehabilitation of those projects.

This program is the first of its kind, as one of the Credit Hours System programs in Egypt, and would provide the regional and Egyptian job market with engineers having an intense knowledge of the different infrastructure sciences: geotechnical, survey, transport, highways and airports, railways, and sanitary and environmental engineering.

The mission of the program is to educate students to become qualified engineers who are capable of generating effective solutions by using engineering approaches in the field of Civil Infrastructure Engineering.

The program achieves its mission via teaching, scholarship, creative work, research, and service, and commits itself to the highest ideals of the profession of infrastructure.

CIE program aims at preparing proficient civil infrastructure engineers capable of supporting the progress efforts and urban renaissance in Egypt and the middle-east region by possessing good knowledge and hands-on skills according to the latest technical advancement to work in the areas of, surveying and mapping, geotechnical engineering, environmental engineering and sanitary, and transportation and traffic engineering. It will also assist in fulfilling the on-growing demand on skillful infrastructure engineers in the job-market.

يهدف برنامج البنية التحتية في الهندسة المدنية الي اعداد خريجين متخصصين ومتميزين في مجال البنية التحتية المدنية قادرين على تحقيق النهضة والتقدم في مصر والشرق الوسط عن طريق امتلاك المعرفة السليمة والمهارات المطلوبة طبقا لأحدث التكنولوجيات في مجال الاعمال المساحية والجيوتقنية والهندسة الصحية، والبيئية وهندسة النقل والمرور. يهدف ايضا البرنامج الي توفير احتياجات سوق العمل من المهندسين المتميزين في مجال البنية التحتية.

GRADUATE ATTRIBUTES مواصفات الخريج

The CIE program has adopted the National Academic Reference Standards (NARS) for Engineering issued by the National Authority for Quality Assurance and Accreditation for Education (NAQAAE) as the program objects to ensure the satisfaction of the national quality assurance standards. The NARS 2018 for Engineering are broad statements that define the main characteristics and performance expected from all engineering students upon their graduation so that the graduate attributes of the CIE program can be achieved as follows:

CIVIL Engineering graduate must be able to:

1. Develop solutions for complicated engineering problems by applying engineering fundamentals, basics of science and mathematics and by conducting experiments and analyzing data using statistical analysis and engineering judgement.
2. Use engineering processes to develop cost-effective solutions, considering global, cultural, social, environmental, ethical, factors within the principles of sustainable design and development. Also, applying cutting-edge technology and standards, quality norms, safety regulations, environmental concerns, and risk management principles.
3. Practice research strategies and investigation procedures in Engineering projects by conducting good planning and supervision.
4. Practice performing individually or in a team using modern techniques of communication with a variety of audiences.
5. Utilize pioneering thinking and develop the leadership skills to adequately react to complex situations, apply modern knowledge of practice, lifelong learning strategies.
6. Select modern construction methods for structures using numerical techniques or measurements. Examine the construction method by applying civil engineering techniques such as: Structural Analysis and Mechanics, Properties and Strength of Materials, Surveying, Soil Mechanics, and Fluid Mechanics. Optimize the design of Reinforced Concrete and Steel Structures, Foundations and Earth Retaining Structures; Familiarize with Transportation and Traffic, Roadways and Airports, Railways, Sanitary Works, Irrigation, Water Resources and Harbors.
7. Design the construction processes and evaluate the construction defects, instability, and quality issues; and maintain safety measures in construction and materials. Understand biddings, contracts, project insurance and guarantees and assess environmental impacts of civil engineering projects.

PROGRAM BENCHMARK مرجعية البرنامج

NARS 2018	LEVEL A	LEVEL B	LEVEL C	LEVEL D
√	Totally Adopted P. A11	Totally Adopted	See below	NA

In addition to the Engineering competencies, Civil Engineer competencies, the CIE graduate must be able to:

LEVEL C

1. Plan, analyze, design, and manage water and wastewater networks, and treatment works.
2. Plan, analyze, design, and manage transportation systems, roadway networks, and airports.
3. Design and construction of foundations, retaining systems, tunnels, and dewatering works.
4. Deal with mapping and setting out the infrastructure projects.

SPECIALIZED COURSES CONTENTS توصيف المقررات

Code	Name	Credit Hours	Category	Pre-requisite
CIES280	Engineering Seminar	1	DR	30 CR.HRS. + AA APROVAL
CIES281	Industrial Training-1	1	FR	60 CR.HRS. + AA APROVAL
CIES381	Industrial Training-2	2	DR	CIES281. + AA APROVAL
CIES481	Graduation Project-1	1	FR	110 CR.HRS. + AA APROVAL
CIES482	Graduation Project-2	3	DR	CIES481 + AA APROVAL
Total		**2+6**		

COURSES CONTENTS توصيف المقررات

Code	Name/Content	Credit Hours	Contact Hours							
			Lec	Tut (2)	App. Tut	Lab	Stud	Off. Tut	Off. Hrs	Total
Faculty Requirements										
CIES280	Engineering Seminar	1	1	0						1
	Pre-requisites: 30 CHs. + AA Approval									
	Talks and presentations are invited from industrial establishments relevant to the program. The guest speaker should discuss the organization, management, and recent technologies implemented in his/her industrial establishment. Students exercise writing brief technical reports on the guest presentation and deliver their own presentation about the topic. *The course is graded as Pass/Fail grade-system.*									
CIES281	Industrial Training-1	1	0	0						0
	Pre-requisites: 60 CR.HRS. + AA APPROVAL									
	Training In industrial establishments relevant to the program. Training lasts for total of 90 hours, during a minimum period of three weeks. The program training advisor schedules at least one follow up visit to the training venue and formally report on performance of trainee(s). A Mentor in the industrial establishment provides a formal report on the student's performance during training. The student submits a formal report and presentation to be evaluated by a panel of three members with one member being an external examiner appointed from industry or other colleges of engineering. *The course is graded as Pass/Fail grade-system.*									

Code	Name/Content	Credit Hours	Contact Hours							
			Lec	Tut (2)	App. Tut	Lab	Stud	Off. Tut	Off. Hrs	Total
CIES381	Industrial Training-2	2	0	0						0
	Pre-requisites: CIES281 + AA APPROVAL									
	Training In industrial establishments relevant to the program. Training lasts for total of 180 hours, during a minimum period of six weeks. The program training advisor schedules at least two follow-up visits to the training venue and formally report on performance of trainee(s). A Mentor in the industrial establishment provides a formal report on the student's performance during training. The student submits a formal report and presentation to be evaluated by a panel of three members with one member being an external examiner appointed from industry or other colleges of engineering. *The course is graded as Pass/Fail grade-system.*									
CIES481	Graduation Project-1	1	0	2	0					2
	Pre-requisites: 110 credits + SOPHOMORE									
	Students – in groups (or individually in some programs) - undertake a final project as part of the program. In GP1, students provide a clear identification of a real-life problem that represents an actual need for the industry or the community and reflects the mission and strategic objective of CUFE. Students are expected to survey the related literature, collect, and interpret market data, and proposed an approach for the solution, using the engineering knowledge and skills acquired. The course is graded as Pass/Fail based upon a report/oral presentation stating the expected cost and required material, tools, and facilities as well as a timed list of deliverables.									
CIES482	Graduation Project-2	3	1	4						5
	Pre-requisites: CIES481 + AA Approval									
	Graduation Project-2 is the second phase of the graduation project. The aim is to develop innovative solutions to problems encountered during the implementation process thus fulfilling the deliverables stated in Graduation Project-1. A dissertation on the project is submitted taking into consideration technical, economic, social, and environmental requirements while analysing the major results and presenting direct conclusions.									

PROGRAM REQUIREMENTS متطلبات البرنامج

Category		No. of courses	Course Credit Hour	Total Credit Hours
Discipline Requirements (DR)	core/ compulsory	15	3	45
		7	2	14
		2	1	2
	Elective	2	3	6
		0	2	-
Total DR courses				67
Program Requirement (PR)	core/ compulsory	9	3	27
		1	2	2
	Elective	5	3	15
		-	2	-
Total PR courses		15		44
Total Elective courses (DR & PR)		7	3	21

- **Discipline Requirements (DR) core/compulsory courses list**

Code	Name	Credit Hours	Pre-requiste
ARCS110	Basic Architectural Design & Building Construction	2	INTS001
ARCS216	Introduction to CAD System for Civil Engineering	2	INTS005 + INTS001
MTHS102	Linear Algebra and Multivariable Integrals	3	MTHS002 + MTHS003
MTHS104	Differential Equations	3	MTHS003
MTHS300	Statistical Analysis for Civil Engineers	1	70 Credits
IHDS204	Civil Engineering Drawing	3	INTS001
IHDS201	Fluid Mechanics	3	PHYS001
IHDS302	Open Channel Hydraulics	2	IHDS201
INTS203	Mechanical and Electrical Systems	2	50 credits

Code	Name	Credit Hours	Pre-requiste
PBWS202	Surveying for Engineers	3	MTHS003
PBWS207	Basics of Environmental Engineering	2	CHES001
PBWS302	Soil Mechanics	3	STRS202 + STRS204
PBWS402	Foundations	3	PBWS302
STRS101	Structural Analysis-1	3	AMTS001
STRS202	Structural Analysis-2	3	STRS101
STRS203	Engineering Materials	3	PHYS001 + AMTS001
STRS204	Mechanics of Materials	3	STRS203
STRS205	Human Resources Management	2	34 Cr Hrs
STRS301	Reinforced Concrete Design I	3	STRS202 + STRS204
STRS324	Construction Project Management	3	68 Cr Hrs
STRS302	Steel Structures Design I	3	STRS202 + STRS204
Total	Including CIES280, 380, 382	**61**	

- **Discipline Requirements (DR) elective courses list**

Code	Name	Credit Hours	Pre-requiste
ELECTIVE (E-2)			
IHDS401	Coastal and Harbor Engineering	3	IHDS201
PBWS358	Solid and Hazardous waste management	3	70 Cr
STRS303	Reinforced Concrete 2	3	STRS301
STRS322	Construction Planning and scheduling	3	STRS324
Total		**6**	

- **Program Requirements (PR) core/compulsory courses list**

Code	Name	Credit Hours	Pre-requiste
PBWS200	Transportation Planning	3	-
PBWS306	Geomatics	3	PBWS202
PBWS300	Water Supply Works	3	IHDS201, PBWS207
PBWS305	Traffic Engineering Theory and Applications	3	PBWS200
PBWS307	Railway Engineering-1	3	PBWS200
PBWS309	Wastewater Works	3	PBWS300
PBWS310	Geometric Design and Safety of Highways	3	PBWS305
PBWS404	Highways Pavement Design and Construction	3	PBWS305
PBWS407	Advanced Water and Wastewater Treatment Technologies	3	PBWS309
PBWS453	Tunnel Engineering	2	PBWS402
Total		**29**	

- **Program Requirements (PR) elective courses list**

Code	Name	Credit Hours	Pre-requiste
ELECTIVE (E-3)			
PBWS446	Deep excavation and side support	3	PBWS302
PBWS432	Ground water control systems	3	PBWS302
PBWS451	Advanced topics in geotechnical engineering	3	PBWS302
Total		**3**	

Code	Name	Credit Hours	Pre-requiste
ELECTIVE (E-4)			
PBWS405	Data Analysis and Least Squares Adjustment in Geomatics	3	PBWS202
PBWS403	Advanced Railways Engineering	3	PBWS307
PBWS440	Airport Planning and Design	3	PBWS310, PBWS404
PBWS442	Freight Transportation and ITS Applications	3	PBWS200
PBWS454	Fundamentals of Intelligent Transportation Systems	3	PBWS305
PBWS444	Role of Advanced Positioning Techniques in Infrastructure Projects	3	PBWS306
PBWS445	GIS and Remote Sensing Applications	3	PBWS202
PBWS459	Hydrographic Survey	3	PBWS202, PBWS306
Total		**6**	

Code	Name	Credit Hours	Pre-requiste
ELECTIVE (E-5)			
PBWS452	Management of water & wastewater Facilities	3	PBWS309
PBWS455	Environmental Systems Analysis	3	110 Cr
PBWS456	Advanced Topics in Networks Design	3	PBWS309
PBWS457	Introduction to Environmental Modelling	3	PBWS309
PBWS458	Membrane technology for water and wastewater treatment	3	PBW300
STRS466	Design and Construction of Water & Wastewater Structures	3	STRS303
Total		**6**	

Proposed Study Plan - 8 semesters - Including Freshman Level

S	Code	Name	Credit Hours	Contact Hours							
				Lec	Tut (2)	App Tut	Lab	Stud	Off Tut	OffHr	Total
SEMESTER 1	PHYS001	Mechanical Properties of Matter anc Thermodynamics	3	2		2	1				5
	MTHS002	Calculus I	3	2	2						4
	EMCS001	Engineering Mechanics – Dynamics	3	1	2		1				4
	CHES001	Chemistry for Engineers	2	1	2						3
	INTS001	Engineering Graphics	3	2				3			5
	INTS005	Information Technology	2	1			3				4
	GENS004	Proficiency and Capacity Building	1	1							1
	GENS001	Critical and Creative Thinking	2	2							2
		Sub-Total	**19**	**13**	**6**	**2**	**4**	**3**	**0**	**0**	**28**

S	Code	Name	Credit Hours	Contact Hours							
				Lec	Tut (2)	App. Tut	Lab	Stud	Off Tut	Off. Hrs	Total
SEMESTER 2	MTHS003	Calculus 2	3	2	2						4
	EMCS002	Engineering Mechanics – Statics	2	1	2						3
	PHYS002	Electricity and Magnetism	3	2		2	1				5
	GENS002	Societal Issues	2	2							2
	E-A (GENS005)	Elective E-A (Writing and Presentation Skills)	2	2							2
	STRS101	Structural Anaysis - 1	3	2	2						4
	MDPS001	Fundamentals of Manufacturing Engineering	2	1		1	2				4
	ARCS110	Basic Architectural Design and Builcing Construction	2	1		3					4
		Sub-Total	**19**	**13**	**6**	**6**	**3**	**0**	**0**	**0**	**28**

S	Code	Name	Credit Hours	Contact Hours							
				Lec	Tut (2)	App Tut	Lab	Stud	Off Tut	OffHr	Total
SEMESTER 3	IHDS204	Civil Engineering Drawing	3	2	2						4
	STRS202	Structural Analysis-2	3	2	2						4
	STRS203	Engineering Materials	3	2		1	2				5
	MTHS102	Linear Algebra and Multivariable Integrals	3	2	2						4
	MTHS104	Differential Equations	3	2	2						4
	STRS205	Human Resources Management	2	1	2						3
	ARCS216	Introduction to CAD Systems for Civil Engineers	2	1		1	2				4
		Sub-Total	**19**	**12**	**10**	**2**	**4**	**0**	**0**	**0**	**28**

S	Code	Name	Credit Hours	Contact Hours							
				Lec	Tut (2)	App. Tut	Lab	Stud	Off Tut	Off. Hrs	Total
SEMESTER 4	IHDS201	Fluid Mechanics	3	2	2						4
	STRS204	Mechanics of Materials	3	2	2						4
	E-A (GENS120)	Elective E-A (Fundamentals of Ecoromics and Accounting)	2	2	0						2
	PBWS200	Transportation Planning	3	2	2						4
	PBWS202	Surveying for Engineers	3	2		1	2				5
	PBWS207	Basics of Environmental Engineering	2	1		2	1				4
	MTHS005	Introduction to Probability and Statistics	3	2	2						4
		Sub-Total	**19**	**13**	**8**	**3**	**3**	**0**	**0**	**0**	**27**

S	Code	Name	Credit Hours	Contact Hours							
				Lec	Tut (2)	App Tut	Lab	Stud	Off Tut	OffHr	Total
SEMESTER 5	E-A (GENS110)	Elective E-A (Fundamental of Management, Risk and Environment)	2	2							2
	STRS301	Reinforced Concrete Design I	3	2	2						4
	STRS324	Construction Project Management	3	2	2						4
	IHDS302	Open Channel Hydraulics	2	1		3					4
	PBWS306	Geomatics	3	2	2						4
	PBWS305	Traffic Engineering Theory and Applications	3	2	2						4
	PBWS300	Water Supply Works	3	2	2						4
		Sub-Total	**19**	**13**	**10**	**3**	**0**	**0**	**0**	**0**	**26**

S	Code	Name	Credit Hours	Contact Hours							
				Lec	Tut (2)	App. Tut	Lab	Stud	Off Tut	Off. Hrs	Total
SEMESTER 6	PBWS302	Soil Mechanics	3	2	2						4
	XXXS3XX	Elective E-2	3	2	2						4
	PBWS307	Railway Engineering-1	3	2	2						4
	PBWS309	Wastewater Works	3	2	2						4
	PBWS310	Geometric Design and Safety of Highways	3	2	2						4
	INTS203	Mechanical & Electrical Systems	2	1	2						3
	MTHS300	Statistical Analysis for Civil Engineers	1	0	2						2
	CIES280	Engineering Seminar	1	1	0						1
		Sub-Total	**19**	**12**	**14**	**0**	**0**	**0**	**0**	**0**	**26**

S	Code	Name	Credit Hours	Contact Hours							
				Lec	Tut (2)	App Tut	Lab	Stud	Off Tut	OffHr	Total
SEMESTER 7	PBWS402	Foundations	3	2	2						4
	XXXS3XX	Elective E-2	3	2	2						4
	PBWS407	Advanced Water and Wastewater Treatment Technologies	3	2	2						4
	PBWS4XX	Elective E-4	3	2	2						4
	PBWS404	Highways Pavement Design and Construction	3	2	2						4
	CIES481	Graduation Project-1	1	0	2						2
	STRS302	Steel structures Design I	3	2	2						4
		Sub-Total	**19**	**12**	**14**	**0**	**0**	**0**	**0**	**0**	**26**

S	Code	Name	Credit Hours	Contact Hours							
				Lec	Tut (2)	App. Tut	Lab	Stud	Off Tut	Off. Hrs	Total
SEMESTER 8	GENS2XX	Elective E-1	2	2	0						2
	PBWS453	Tunnel Engineering	2	1	2						3
	PBWS4XX	Elective E-3	3	2	2						4
	PBWS4XX	Elective E-4	3	2	2						4
	PBWS4XX	Elective E-5	3	2	2						4
	PBWS4XX	Elective E-5	3	2	2						4
	CIES482	Graduation Project-2	3	1	4						5
		Sub-Total	**19**	**12**	**14**	**0**	**0**	**0**	**0**	**0**	**26**

COURSES CONTENTS توصيف المقررات

Code	Name/Content	Credit Hours	Contact Hours							
			Lec	Tut (2)	App. Tut	Lab	Stud	Off. Tut	Off. Hrs	Total
Discipline Courses (Compulsory)										
ARCS110	Basic Architectural Design and Building Construction	2	1	0	3					4
	Pre-requisites: GENS004 + INTS001									
	Introduction to design, Design as a goa Directed Activity, The Management of Architectural Information, Architectural Design and Decision Making, Basic Elements of Architectural Design, The Architectural Design Matrix, Form and Form Generation, Space and Compositions, The Building Matrix. Building Loads, Clarifications of Construction Systems, Substructures, Insulation, Staircase Terminologies									
References	Ernst Neufert, Peter Neufert, Architects' Data, Fourth Edition, U.S.A, 2012. Francis O.K. Ching, Building Construction Illustrated, Wiley, Fifth edition, 2014. Francis D.K. Ching, Architecture: Form, Space and Order, John Wiley and Sons, New York, Fourth Edition, 2014.									
ARCS216	Introduction to CAD Systems for Civil Engineering	2	1	0	3					4
	Pre-requisites: INTS005+ INTS001									
	The aim of this course is to explore current CAD technologies and develop skills in the use of specialist CAD software to produce 2D and 3D design specifications, to transform CAD drawings into photo realistic virtual products and to gain an awareness of CAD data and how such information can be transformed to engineering drawings. At the end of the course, the students will understand a variety of terms and terminology as applied to CAD technology; demonstrate the use of an industry standard operating system to create standard CAD packages for 2D and 3D design drawings.									
References	Yasser Shoukry, Jaiprakash Pandey: Practical Autodesk AutoCAD 2021 and AutoCAD LT 2021, PUPLISHING 2020 Nighat Yasmin, Introduction to AutoCAD 2023 for Civil Engineering Applications: Learning to use AutoCAD for Civil Engineering Projects. Publisher: SDC Publications (Schroff Development Corpora, ISBN-13: 9781630575212, 2022									

Code	Name/Content	Credit Hours	Contact Hours							
			Lec	Tut (2)	App. Tut	Lab	Stud	Off. Tut	Off. Hrs	Total
MTHS102	Linear Algebra and Multivariable Integrals	3	2	2	0					4
	Pre-requisites: MTHS002									
	Solving Linear Systems, Vector Spaces and Subspaces, Inner Product Spaces and Orthonormal Bases, The Eigenvalue Problem; Diagonalization of Matrices, Computing Functions of Matrices. Functions of Several Variables, The Gradient of a Scalar Function and its Applications, Vector Fields, Curl and Divergence, Double and Triple Integrals with Applications, Line and Surface Integrals with Applications.									
References	"Calculus Early Transcendentals" , by James Stewart, 8th edition, 2015, Cengage Learning. "Elementary Linear Algebra with Applications" by B. Kolman and D. Hill, 2013, Pearson international edition.									
MTHS104	Differential Equations	3	2	2	0					4
	Pre-requisites: MTHS003									
	First-order differential equations, separable, exact, linear, homogeneous and Bernoulli equations; modeling with first order differential equations; higher-order differential equations; method of undetermined coefficients; variation of parameters; modeling with higher order differential equations; series solutions; Laplace transform; properties and applications, shifting theorems, convolution theorem; solutions of differential equations using Laplace transform; Fourier series; Fourier transform.									
References	1. "A First Course in Differential Equations with Modeling Applications" 11th Edition 2017, by Dennis G. Zill 2. "Fundamentals of Differential Equations", 9th Edition, 2017,by R. Nagle, Edward Saff , Arthur Snider 3. "Advanced Engineering Mathematics", John Wiley & Sons, Inc., 10th Edition, 2011, by Erwin Kreyszig.									
MTHS300	Statistical Analysis for Civil Engineers	1	0	2	0					2
	Pre-requisites: 70 Credit Hours									
	Review of main probability and statistical concepts, observed data and graphical representation, samples and statistics, cuality criteria for estimates, methods of estimation, model verification type-i, and type-ii errors, chi-squared goodness-of-fit test, kolmogorov–smirnov test, simple linear regression, multiple linear regression, introduction to design of experiments, statistical distribution application in engineering.									
References	Soong, T. T. (2005). Fundamentals of Introduction to Probability and Statistics for Engineers. John Wiley and Sons.									

Code	Name/Content	Credit Hours	Contact Hours							
			Lec	Tut (2)	App. Tut	Lab	Stud	Off. Tut	Off. Hrs	Total
IHDS204	Civil Engineering Drawings	3	2	2						4
	Pre-requisites: INTS001									
	Introduction to civil engineering projects, General Concepts, Legend and symbols, Scales and drawing size, General layout and plans, Longitudinal and cross sections, Detailing, Earthworks and retaining walls, Applications on irrigation and land reclamation projects, Half-earth-removed views, Pitching and protection. Drawing of steel sections and connections, reinforced concrete sections. Projection of beams and columns.									
IHDS201	Fluid Mechanics	3	2	0	1	1				4
	Pre-requisites: PHYS001									
	Introduction, Dimensions and units, Fluid properties (density, specific weight, specific gravity, specific heat, vapor pressure, compressibility, viscosity, surface tension), Fluid Statics (absolute and gage pressure, pressure at a point, pressure transmit ion , pressure measurements, pressure prism, hydrostatic force on a plane surface, hydrostatic force on a curved surface, buoyancy, flotation, and stability), Rigid body motion of a fluid, Fluid Kinematics (continuity equation, steady and unsteady flow, laminar and turbulent flows, path line and stream line, ideal and real, rotational and ir-rotational flow, Fluid Dynamics (Bernoulli's Equation, total and hydraulic gradient lines, application of Bernoulli Equation, Pitot Tube, stagnation point, Venturi Meter, orifice, nozzles, flow over notches and weirs), Momentum analysis of flow Systems (conservation of momentum, control volume, forces on control volume, forces acting on plates, turbines concept, forces acting on bends & reducers , calculations of minor losses), Flow through pipe lines (Reynold's Number, Darcy-Weisbach Equation, friction head losses, Moody Charts, design of pipe flow system, branching pipe, pipes in series and in parallel, head loss problems, discharge problems, sizing problem, reservoir system).									
References	Applied Fluid Mechanics 7th edition, by Robert L. Mott published by Pearson Education (2014). Foundementals of Fluid Mechanics book 7th edition by Munson Published by Wiley (2012)									
IHDS302	Open Channel Hydraulics	2	1		3					4
	Pre-requisites: IHDS201									
	Introduction, Types of cross sections, Stage and depth measurements, Types of flow, Velocity distribution, Velocity measurements, Kinetic energy and momentum, correction factors, Curvilinear pressure distribution, Steady uniform flow, Resistance to flow, Design of cross sections, Design of circular cross sections, Specific energy and , critical flow, Applications on specific energy, Specific force, Steady rapidly varied flow, Hydraulic Jump, Weirs, Discharge measurements, Steady gradually varied flow, Water surface profiles, Computation of water surface profiles length, Flow control, Laboratory experiments									
References	Chaudhry, M. H. (2022). Open-channel flow. 3rd edition, New York: Springer.									

Code	Name/Content	Credit Hours	Contact Hours							
			Lec	Tut (2)	App. Tut	Lab	Stud	Off. Tut	Off. Hrs	Total
INTS203	Mechanical and Electrical Systems	2	1	2	0					4
	Pre-requisites: 50 CHs.									
	Introduction to electrical circuits; Electrical installation in residential and industrial buildings (illumination networks in rural areas, data lines, telephone lines & antenna, control of air conditioning, lift); Requirements of audio systems; Alarm devices (fire - security - gas); HVAC components and systems; Plumbing elements and features; Essential mechanical systems used in residential & institutional projects.									
References	Nilsson, James William, and Susan A. Riedel. Electric circuits. Pearson, 2020.									
PBWS202	Surveying for Engineers	3	2		1	2				4
	Pre-requisites: MTHS003									
	Engineering principles and applications of surveying sciences (with emphasis on plane surveying) are presented in relation to engineering. Popular techniques and engineering use of distance, angles and height difference measurements are studied and practiced. Applications in detail mapping, earthwork computations, and setting out engineering structures are covered in this course. Integrated digital surveying and mapping using total station are introduced.									
References	Charels D. Ghilani and Paul R. Wolf 2017 "Elementary surveying; an introduction to geomatics" (15th edition) Pearson Prentice Hall New Jersey.,									
PBWS207	Basics of Environmental Engineering	2	1		2	1				4
	Pre-requisites: CHS001									
	Basic concepts of chemistry, biology, and physics relevant to environmental engineering processes. Principles of reactors, mass transfer, and material and energy balances. Introduction to water, air, and soil pollution. Basics of metabolic activities of microorganisms, the interaction of microbes with their environment, and symbiotic relationships. Microbial growth in batch and continuous systems, and relationships between microbial growth rate and substrate utilization. Basics of molecular biology, genetics, detection, and identification. Molecular biology techniques for environmental applications. Fundamental parameters and concepts for environmental quality evaluation. Introduction to environmental regulations and environmental sustainability.									
References	Masten, Susan J., and Mackenzie Leo Davis, 2014, "Principles of Environmental Engineering and Science", 3rd Edition Sawyer, Clair N., et al., 2002, "Chemistry for Environmental Engineering and Science", 5th Edition Madigan, Michael T., et al. 2020, "Brock Biology of Microorganisms", 16th Edition									

Code	Name/Content	Credit Hours	Contact Hours							
			Lec	Tut (2)	App. Tut	Lab	Stud	Off. Tut	Off. Hrs	Total
PBWS302	Soil Mechanics	3	2	2	0					4
	Pre-requisites: STRS202, STRS204									
	Basic properties of soil, Soil classification, Compaction, Permeability, Soil stresses, Consolidation, Shear strength, and Lateral earth pressure.									
References	Das, B.M. (2020), "Introduction to Geotechnical Engineering," Thomson Learning, Toronto, Ontario, Canada,									
PBWS402	Foundations	3	2	2	0					4
	Pre-requisites: PBWS302									
	Basics of soil investigations, Soil bearing capacity, Designs of shallow foundations: wall footings, isolated footings, combined footings and strip footings, Design of retaining walls, Design of deep foundations: pile construction methods, estimation of pile bearing capacity, pile load tests, design of group piles. Considerations for selection of types of foundations.									
References	Das, B.M. (2020). "Principles of Foundation Engineering", 10th Edition, Cengage Learning, Hampshire, UK Egyptian Code of Practice for Soil Mechanics and Design and Construction of Foundations (2001), ASTM International (Formerly known as: American Society for Testing and Materials).									
STRS101	Structure Analysis -1	3	2	2	0					4
	Pre-requisites: AMTS001									
	Types of structures and idealized models. Loads; supports and reactions. Internal forces in plane and space structures. Analysis of statically determinate structures such as beams, frames, and trusses. Influence lines of beams and frames.									
References	Structural Analysis, Author: R.C. Hibbler (10th edition) (2018), Pearson Education Inc.									
STRS202	Structure Analysis -2	3	2	2	0					4
	Pre-requisites: STRS101									
	Governing differential equation for beam deflections. Deformations by virtual work. Statically indeterminate structures. Flexibility analysis methods such as consistent deformations and three-moments equation. Moving loads on beams.									
References	Structural Analysis, Author: R.C. Hibbler (10th edition) (2018), Pearson Education Inc.									

Code	Name/Content	Credit Hours	Contact Hours							
			Lec	Tut (2)	App. Tut	Lab	Stud	Off. Tut	Off. Hrs	Total
STRS203	Engineering Materials	3	2		1	2				5
	Pre-requisites: PHYS001, AMTS001									
	Classification of types of materials; Concrete and asphalt concrete; constituent materials and their properties, mix design, manufacture, properties, and standard and quality control testing; Steel, Building stones; Bricks; Timber; Heat insulating and acoustic materials. Laboratory: Testing for QC.									
References	"Properties of concrete", Neville, A.M., Pearson Education Limited, Edinburgh Gate. Harlow, England, 2011 (Reference book) "Engineering Materials a: An Introduction to Properties Applications and Design",Ashby, M.F. and Jones D.H.R., Butterworth-Heinemann, Massachutess, USA, 2012. Egyptian Code of Practice ECP#203/2020.									
STRS204	Mechanics of Materials	3	2	2	0					4
	Pre-requisites: STRS203									
	Properties of plane areas. Stresses and strains for axial loading. Normal stresses due to normal force and bi-axial moments. Shear stresses due to shear force. Shear stresses due to torsion. Principal stresses and maximum shear stress for 2D element. Buckling of columns.									
References	'Mechanics of Materials', Beer, Johnston & DeWolff, Structural Mechanics', Metwally Abdel Aziz									
STRS205	Human Resources Management	2	1	2						3
	Pre-requisites: 34 Credits									
	HR planning: Job analysis, demand for HR, Supply of HR – Staffing: Recruitment, Selection – Training and development – Performance Appraisal – Compensation: Type of equity, Designing the pay structure, employee benefits – Labour/management relations – Motivation – Leadership – Communication									
STRS301	Reinforced Concrete Design -I	3	2	2	0					4
	Pre-requisites: STRS202, STRS204									
	Methods of design; Codes; Structural systems and load distribution; Design using limit states method; Section subjected to bending moments; Section subjected to shear and torsion; Reinforcement details for beams; Design and reinforcement details for solid slabs ; Design and reinforcement details of concrete short columns; Limit state of deflection, Working stress design method.									
References	Design of Reinforced Concrete Structures (Mashhour and El-Mihilmy) Volumes 1., الكود المصري لتصميم وتنفيذ المنشآت الخرسانية كود رقم 203- 2020, الكود المصري لحساب الأحمال والقوى في الأعمال الإنشائية وأعمال المباني - كود رقم 201 - 2012									

Code	Name/Content	Credit Hours	Contact Hours							
			Lec	Tut (2)	App. Tut	Lab	Stud	Off. Tut	Off. Hrs	Total
STRS324	Construction Project Management	3	2	2	0					4
	Pre-requisites: 68 CHs.									
	Project management definition, project delivery methods, contracting strategies, basic management functions, construction scheduling, bar charts, AOA and AON networks, critical path method, construction resources, material management, labor productivity, construction equipment, design and analysis of construction operations, construction cost, cost estimating, direct and indirect costs, cash flow calculations, introduction to management information systems.									
References	Halpin, D. W. (2010). Construction management. John Wiley & Sons. Project Management Institute. (2021). A guide to the Project Management Body of Knowledge (PMBOK guide) (7th ed.). Project Management Institute..									
STRS302	Steel Structures Design -I	3	2	2	0					4
	Pre-requisites: STRS202, STRS204									
	Introduction to structural steel design – Design criteria (materials, loads, and systems) – General layout – Design of tension members – Design of compression members – Design of beams – Design of beam-columns.									
References	"Behavior, Analysis, and Design of Structural Steel Elements", Elsayed Bahaa Machaly - "Egyptian Code of Practice for Steel Construction and Bridges, ECP 205", latest edition									
Elective E-2										
STRS322	Construction Planning and Scheduling	3	2	2	0					4
	Pre-requisites: STRS324									
	Construction planning, importance of scheduling, scheduling techniques, program evaluation and review technique (PERT), line of balance, schedule updating, project crashing, time cost trade-off, resource scheduling, resource allocation and leveling techniques, project planning and control using commercial software.									
References	A Handbook for Construction Planning and Scheduling, by Andrew Baldwin, David Bordoli, 2014 by John Wiley & Sons Delay analysis in construction contracts / P.J. Keane & A.F. Caletka. – 2nd edition, 2015 "Project Scheduling and Management for Construction" by David R. Pierce, 4th ed., John Wiley & Sons, Inc., Hoboken, New Jersey, 2013, Construction project management: plann ng, scheduling and controlling, by K. K. Chitkara, 2014, McGraw-Hill Education									

Code	Name/Content	Credit Hours	Contact Hours							
			Lec	Tut (2)	App. Tut	Lab	Stud	Off. Tut	Off. Hrs	Total
PBWS358	Solid and Hazardous waste management	3	2	2						4
	Pre-requisites: 70 Credits									
	Solid waste characteristics and composition, Onsite handling, storage and processing of solid wastes, Transfer and transportation of solid wastes, Street cleansing, Recovery of resources, conversion products and energy, Processing techniques and technologies, Management of solid wastes in developing countries, Planning in solid waste management, hazardous wastes.									
References	Tchobanoglous G, Kreith F. Handbook of solid waste management. McGraw-Hill Education; 2002. Tchobanoglous G, Eliassen R, Theisen H. Solid wastes; engineering principles and management issues. McGraw-Hill; 1977. Worrell WA, Vesilind PA. Solid waste engineering. 2022.									
STRS303	Reinforced Concrete Design -II	3	2	2	0					4
	Pre-requisites: STRS301									
	Design and reinforcement details: ribbed slabs, paneled beams slab, flat slabs (beamless slabs), stairs; Design of sections under eccentric forces; Design and reinforcement details of concrete long columns.									
References	Design of Reinforced Concrete Structures (Mashhour and El-Mihilmy) Volumes 2. الكود المصري لتصميم وتنفيذ المنشآت الخرسانية كود رقم 203- 2020 الكود المصري لحساب الأحمال والقوى في الأعمال الإنشائية وأعمال المباني - كود رقم 201 - 2012									
IHDS401	Coastal and Harbour Engineering	3	2	2	0					4
	Pre-requisites: IHDS201									
	Introduction - Wave theory and characteristics - Wave forecasting - Wave transformation - Tides and water levels - Coastal sediment - Harbour planning - Harbour and port facilities - Design of breakwaters - Design of berths - Inland navigation - Case studies.									
References	Introduction to Coastal Engineering and Management (J. William Kamphuis, 2000, 472pp.)									

Program Compulsory Courses										
Code	Name/Content	Credit Hours	Contact Hours							
			Lec	Tut (2)	App. Tut	Lab	Stud	Off. Tut	Off. Hrs	Total
PBWS200	Transportation Planning	3	2	2						4
	Pre-requisites									
	This course provides the student with the ability to design and execute an urban transportation planning study including travel demand modelling, analysis of environmental impacts, modelling transportation - and use interactions and transportation project evaluation. The course focuses on person-based travel in urban regions. A brief introduction to freight and intercity passenger transportation is also provided.									
References	National Academies of Sciences, Engineering, and Medicine 2014. Activity-Based Travel Demand Models: A Primer. Washington, DC: The National Academies Press. https://doi.org/10.17226/22357. Bowman, J., The Day Activity Schedule Approach to Travel Demand Analysis, 1998. Chiu, Y., Bottom, J., Mahut, M., Paz, A., Balakrishna, R., Waller, T., Hicks, J., Dynamic Traffic Assignment: A Primer, Transportation Research Circular E-C153. Ortúzar, J., Willumsen, L., Modelling Transport, Fourth Edition, John Wiley & Sons, Ltd. Published 2011.									
PBWS306	Geomatics	3	2	2		1				
	Pre-requisites: PBWS202									
	Coordinate systems, Cartesian, Geographic, and plane. Horizontal and vertical datum. Coordinates transformation and datum transformation problem. Computation on Ellipsoid. GNSS Overview with emphasis on GPS. Absolute, Differential, and Relative positioning by GPS. Using of RTK and kinematic positioning by GPS for surveying, construction and as built of infra-structures projects. Basic principles for Map Projection with emphasis on current situation for Egypt. Introduction for Photogrammetry. Camera Calibration- Aerial Photogrammetry and Close-Range Photogrammetry- overview for Mobile Mapping Systems-UAV Photogrammetry concept and applications- Remote Sensing definition and basic concept - Classification of Sensor Overview for GIS & BIM applications in CIE.									
References	Mikhail, E.M., Bethel, J.S. and McGlone, J.C., 2001. Introduction to modern photogrammetry. New York. Introduction to GPS: The Global Positioning System, Second Edition, 2nd Revised ed. Edition ISBN-13: 978-1596930162, ISBN-10: 1596930160									

Code	Name/Content	Credit Hours	Contact Hours							
			Lec	Tut (2)	App. Tut	Lab	Stud	Off. Tut	Off. Hrs	Total
PBWS300	Water Supply Works	3	2	2						4
	Pre-requisites: IHDS201, PBWS207									
	Water resources studies including: ground, surface, rain and sea water- water consumption and population studies- collection works for ground and surface water- treatment works: coagulation, filtration, sedimentation, filtration, disinfection, taste and odor control, iron and manganese removal, RO. Water distribution Systems: Planning, and design using WaterCAD.									
References	John C. Crittenden, R. Rhodes Trussell, David W. Hand, Kerry J. Howe and George Tchobanoglous (2012), MWH's Water Treatment: Principles and Design, 3rd Edition. الكود المصري لاسس التصميم وشروط التنفيذ لخطوط المواسير المستخدمة في شبكات مياه الشرب والصرف الصحي. كود 1/102. 2010 الكود المصري لاسس التصميم وشروط تنفيذ محطات مياه الشرب والصرف الصحي ومحطات الرفع. كود 3/101. 2016 الجزء الثالث محطات تنقية مياه الشرب									
PBWS305	Traffic Engineering Theory and Applications	3	2	2						4
	Pre-requisites: PBWS200									
	The Traffic Engineering course will introduce students to the fundamentals of traffic flow characteristics and theory, macroscopic and microscopic traffic flow models, traffic network modeling, traffic simulation models, shockwave analysis, queuing theory and applications, traffic operations analysis, capacity and level of service, traffic impact studies, and traffic signal design and control. Students wi l be introduced to specialized traffic simulation and control design software and applications (e.g. Synchro, VISSIM, Aimsun, etc.)									
References	Nicholas J. Garber and Lester A. Hoel, Traffic & Highway Engineering Fred L. Mannering, Scott Washburn, Walter Kilareski: Principles of Highway Engineering and Traffic Analysis									
PBWS307	Railway Engineering	3	2	2						4
	Pre-requisites: PBWS200									
	Train resistance and tractive forces. Elements of geometric alignment of railway. Design of different elements of railway track, • Renewal and maintenance of railway lines, Geometric design of different types of turnouts & crossings, Design of railway stations and yards, Safety and types of railway signals.									
References	V A Profillidis, 1995,"Railway Engineering." R. Agor, 1996,"Railway Track Engineering." S.C. Saxena & S.P. Arora, 2011,"A textbook of Railway Engineering." William W.Hay, 1982,"Railroad Engineering (Second Edition)" C. Esveld (2014), Modern Railway Track, 2nd Edition.									

Code	Name/Content	Credit Hours	Contact Hours							
			Lec	Tut (2)	App. Tut	Lab	Stud	Off. Tut	Off. Hrs	Total
PBWS309	Wastewater Works	3	2	2						4
	Pre-requisites: PBWS300									
	Collection works: Planning, flow components and estimation, pipe sizing and design using SewerCad.Pump stations: types, and sizing. Wastewater treatment: physical, chemical and biological processes. Design of treatment units: screens, grit chambers, sedimentation tanks with full details, biological treatment units: trickling filters, activated sludge, and oxidation ponds, introduction to anaerobic treatment systems, and Sludge Handling.									
References	Metcalf & Eddy Inc., George Tchobanoglous, Franklin L. Burton, Ryujiro Tsuchihashi, and H. David Stensel. 2013. Wastewater Engineering: Treatment and Resource Recovery. 5th ed. New York, NY: McGraw-Hill. الكود المصري لاسس التصميم وشروط التنفيذ لخطوط المواسير المستخدمة في شبكات مياه الشرب والصرف الصحي. كود 2010 .1/102 الكود المصري لاسس التصميم وشروط تنفيذ محطات مياه الشرب والصرف الصحي ومحطات الرفع. كود 2017 .1/101 الجزء الاول محطات معالجة الصرف الصحي									
PBWS310	Geometric Design & Safety of Highways	3	2	2						4
	Pre-requisites: PBWS305									
	Introduction and Highway Classifications, Driver, Vehicle, and Road Characteristics, Route Layout, Highway Design Standards, Cross-Section Elements, Vertical Alignment, Horizontal Alignment, Evaluation of Earth Work Requirements, Design Consistency, Safety Considerations, Intersection Design, Computer tools (Civil 3D, AutoCAD)									
References	Garber, N. J., & Hoel, L. A. (2019). Traffic and highway engineering. Cengage Learning. The Egyptian Code on Policies of design and requirements for urban and rural road works construction Code No.104 - 2008									
PBWS404	Highways Pavement Design & Construction	3	2	2						4
	Pre-requisites: PBWS305									
	Introduction, Principles of pavement design, Stresses in flexible pavements, Stresses in rigid pavements, Traffic loads and its characteristics, Soil classification systems,Material characterization, Pavement materials, Design of flexible highway pavements ,Design of rigid highway pavement, Pavement Construction Equipment and methods, Pavement Evaluation, Maintenance and Rehabilitation Technicues.									
References	Garber, N. J., & Hoel, L. A. (2019). Traffic and highway engineering. Cengage Learning. The Egyptian Code on Policies of design and requirements for urban and rural road works construction Code No.104 - 2008									

Code	Name/Content	Credit Hours	Contact Hours							
			Lec	Tut (2)	App. Tut	Lab	Stud	Off. Tut	Off. Hrs	Total
PBWS407	Advanced Water and Wastewater Treatment Technologies	3	2	2						4
	Pre-requisites: PBWS309									
	Nitrogen and Phosphorus removal, Stabilization ponds, SBR, MBR, MBBR, Ion exchange, floatation, Anaerobic treatment, Wastewater Re-use and reclamation, Riverbank filtration, Softening, Iron and manganese removal, Color and odor removal.									
References	Metcalf & Eddy Inc., George Tchobancglous, Franklin L. Burton, Ryujiro Tsuchihashi, and H. David Stensel (2013), Wastewater Engineering: Treatment and Resource Recovery, 5th ed. New York, NY: McGraw-Hill. John C. Crittenden, R. Rhodes Trussell, David W. Hand, Kerry J. Howe and George Tchobanoglous (2012), MWH's Water Treatment: Principles and Design, 3rd Edition. الكود المصري لاسس التصميم وشروط تنفيذ محطات مياه الشرب والصرف الصحي ومحطات الرفع. كود 1/101. 2017 الجزء الاول محطات معالجة الصرف الصحي									
PBWS453	Tunnel Engineering	2	1	2						3
	Pre-requisites: PBWS402									
	Geological investigation and ground characterization, Methods of construction, Tunnel design, Design of supports, Field monitoring of stresses and displacements, Construction control.									
References	Carranza-Torres, C., & Labuz, J. (2006). Class notes on underground excavations in rock. Topic, 8, 1-6. Celada, B., & Bieniawski, Z. T. (2019). Ground Characterization and Structural Analyses for Tunnel Design. CRC Press. Goel, R. K., & Singh, B. (2011). Engineering rock mass classification: tunnelling, foundations and landslides. Elsevier. Hoek, E., Carranza-Torres, C., Diederichs, M. S., & Corkum, B. (2012). Rock-Support Interaction analysis for tunnels in weak rock masses. Technical note, 19p. National Highway Institute (US), Parsons, Brinckerhoff, & Quade & Douglas. (2010). Technical manual for design and construction of road tunnels--civil elements. AASHTO. Zhang, D., & Huang, X. (Eds.). (2018). Proceedings of GeoShanghai 2018 International Conference: Tunnelling and Underground Construction. Springer.									

Code	Name/Content	Credit Hours	Contact Hours							
			Lec	Tut (2)	App. Tut	Lab	Stud	Off. Tut	Off. Hrs	Total
Elective (E-3)										
PBWS446	Deep excavation and side support	3	2	2						4
	Pre-requisites PBWS302									
	Theory of earth pressure, Gravity type retaining walls, Flexible type retaining walls, Deep excavation.									
References	Das, B. M., & Sobhan, K. (2014). Principles of geotechnical engineering, SI edition. Boston: .Cengage Learning									
PBWS332	Ground water control systems	3	2	2						4
	Pre-requisites: PBWS302									
	Soil permeability, Seepage, Flow nets, Theory of wells, Ground water control systems.									
References	Cashman, P. M., & Preene, M. (2020). Groundwater lowering in construction: a practical guide to dewatering. CRC Press. Egyptian Code of Practice for Soil Mechanics and Design and Construction of Foundations (2001).									
PBWS451	Advanced topics in geotechnical engineering	3	2	2						4
	Pre-requisites: PBWS302, PBWS402									
	Laterally loaded piles, Soil improvement techniques, Problematic soils									
References	Egyptian Code of Practice for Soil Mechanics and Design and Construction of Foundations (2001).									
Elective (E-4)										
PBWS405	Data Analysis and Least Squares Adjustment in Geomatics	3	2	2						4
	Pre-requisites: PBWS202									
	Geomatics data and data errors types. Blunder detection, systematic errors modeling, and random error distribution. Pre-analysis for Geomatics measurements and evaluation of expected results. Least squares principles and concepts. Reasons for applying least squares solutions to geomatics observations. Determining input into, and analyzing output from, typical least squares adjustment software. Modelling observations, observation equations, and parametric method. Linearization of equations. Derivation of least squares. Methods of forming normal equations. Worked examples in various Geomatics areas such as leveling, positioning, and deformation monitoring.									
References	Charels D. Ghilani and Paul R. Wolf 2017 "Adjustment computations: spatial data analysis" (6th edition) John Wiley & Sons, Hoboken, NJ.									

Code	Name/Content	Credit Hours	Contact Hours							
			Lec	Tut (2)	App. Tut	Lab	Stud	Off. Tut	Off. Hrs	Total
PBWS403	Advanced Railways Engineering	3	2	2						4
	Pre-requisites: PBWS307									
	Characteristics of brakes for passenger and freight trains, stopping distance and breaking time estimation by the graphical method. The definition of braked weight and its characteristics- Curve rectification of railway track-Long-welded rails and safety against buckling -Advanced turnouts for high speeds - Marshalling yards and Loco yards - Applications on electric signals.									
References	V A Profillidis, 1995,"Railway Engineering " R. Agor, 1996,"Railway Track Engineering." S.C. Saxena & S.P. Arora, 2011,"A textbook of Railway Engineering." William W.Hay, 1982,"Railroad Engineering (Second Edition)" C. Esveld (2014), Modern Railway Track, 2nd Edition.									
PBWS440	Airport Planning and Design	3	2	2						4
	Pre-requisites: PBWS310, PBWS404									
	Introduction, Aircraft Technology and Characteristics, Air Traffic Control Systems, Airport Master Planning and Site Selection, Demand Forecasting in Airport Planning, Airport Configuration Design, Airport Airside Capacity Analysis, Capacity Models, Geometric Design, Airport Terminal Configurations, Terminal Design, Pavement Design (Flexible Pavement), Pavement Design (Rigid Pavements), Lighting and Marking, Airport Financing and Economic Analysis, Air Cargo Terminals.									
References	Robert Horonjeff (2010), "Planning and Design of Airports", 5th Edition. Norman J. Ashford (2011), "Airport Engineering Planning, Design, and Development of 21st Century Airports", Fourth Edition. ICAO Annex 14 - Aerodromes - Volume I - Aerodrome Design and Operations - 8th Edition 2020.									
PBWS442	Freight Transportation and ITS Applications	3	2	2						4
	Pre-requisites: PBWS200									
	Supply of Freight Services, Basics of Logistics and Supply Chains, Demand Models, Shipper Behavior, Role of Advanced Technologies, Implications of E-commerce, Data Sources and Needs, Overview of Planning and Policy Issues.									
References	Oskarbski, J., & Kaszubowski, D. (2016). Potential for ITS/ICT Solutions in Urban Freight Management. Transportation Research Procedia, 16, 433-448. Ben-Akiva, M., Meersman, H. and Van de Voorde, E. Freight transport modelling, Emerald, 2013. Tavasszy, L. and De Jong, G. Modelling freight transport, Elsevier, 2014. Taniguchi, E., R.G. Thompson, City Logistics: Mapping the Future CRC Press, 2014 Chopra, S., Meindl, P., Supply Chain Management: Strategy, Planning and Operation, 2015.									

Code	Name/Content	Credit Hours	Contact Hours							
			Lec	Tut (2)	App. Tut	Lab	Stud	Off. Tut	Off. Hrs	Total
PBWS444	Role of Advanced Positioning Techniques in Infrastructure Projects	3	2	2						4
	Pre-requisites: PBW206									
	Choosing Coordinate system and map projection method to eliminate distortion. Shop drawing preparation for some infrastructure projects. Using of RTK and kinematic positioning by GPS for surveying and construction of projects. As built survey using and advanced surveying equipment such GPS, 3D laser scanner, Total station, and level. Data collection and linking data with maps through GIS & BIM.									
References	Torge, Wolfgang and Müller, Jurgen. 2012. Geodesy (4th edition). De Gruyter. Berlin. (ISBN: 9783110207187). Meyer, Thomas. 2010. Introduction to Geometrical and Physical Geodesy: Foundations of Geomatics. ESRI Press, Redlands, CA (ISBN: 9781589482159).									
PBWS445	GIS and Remote Sensing Applications	3	2	2						4
	Pre-requisites: PBWS202									
	This course provides a conceptual overview and hands-on experience using the GIS software, giving the background knowledge to quickly take advantage of GIS powerful display and query capabilities in such enhanced format supporting decision makers. It Introduce the concepts of GIS, Present GIS different uses, learn basic ArcView functionality, become familiar with the ArcView user interface, and Use ArcView to create charts and layouts. GIS graphic user interface (GUI): Interacting with the application window and its components; using online help, Projects and documents: How projects organize, manage and store documents (view, tables, charts and layouts), Creating and editing themes: Using GIS modules to create and edit shape themes, Tables: Creating tables from a variety of tabular data sources; selecting from a table; joining multiple tables; modifying table structure, Charts: Creating a chart for presenting and analyzing tabular data, Layouts: Combining views, tables, charts and images, as well as, logos and scale bars, to create layouts. BIM will be introduced with emphasis on CIE Projects.									
References	DeMers, Michael N., 2016 "Fundamentals of geographic information systems" (4th edition) John Wiley & Sons, USA. CRCSI (2017) Earth Observation: Data, Processing and Applications. (Eds: Harrison, B.A., Jupp, D.L.B., Lewis, M.M., Forster, B.C., Mueller, N., Phinn, S., Coppa, I., Hudson, D., Smith, C., Grant, I., Anstee, J., Dekker, A.G., Ong, C., and Lau, I.) CRCSI, Melbourne. Khorram, Siamak, van der Wiele, Cynthia F, Koch, Frank H, Nelson, Stacy A. C & Potts, Matthew D 2016, Principles of Applied Remote Sensing, Springer International Publishing AG, Cham.									

Code	Name/Content	Credit Hours	Contact Hours							
			Lec	Tut (2)	App. Tut	Lab	Stud	Off. Tut	Off. Hrs	Total
PBWS454	Fundamentals of Intelligent Transportation Systems	3	2	2						4
	Pre-requisites: PBWS305									
	Overview of ITS, Transportation Networks Modeling for ITS, Traffic surveillance technologies and practices, ITS-Capable Traffic Simulation, Traffic Operations Control and Optimization, Introduction to Artificial Intelligence and Applications for ITS, Introduction to ITS Architecture, Standards and Specifications, software applications.									
References	Mashrur A. Chowdhury & Adel W. Sadek (2003), Fundamentals of Intelligent Transportation Systems Planning, Artech House.									
PBWS459	Hydrographic Survey	3	2	2						4
	Pre-requisites: PBWS202, PBWS306									
	Elements of hydrography, tides and water levels. Fundamental of RF and acoustic propagation. Marine positioning; shore-based and satellite-based radio navigation systems, integrated positioning systems, positioning accuracies. Sounding methods: shipborne single beam and multibeam echo-sounding, sonars, airborne laser and electromagnetic methods, related corrections. Real time kinetic (RTK) GPS. Maritime boundaries. Choice and establishment of sea level datum for depth sounding.									
Elective (E-5)										
PBWS452	Management of water & wastewater Facilities	3	2	2						4
	Pre-requisites: PBWS309									
	Reliability of Treatment Processes, Process control Parameters, Process performance control and management, Odor / Air emissions management, Energy considerations, Introduction to Sludge management systems, Upgrading treatment performance via process optimization, Introduction to Operation and Maintenance planning, Regulations and legislation, EIA and auditing.									
References	الكود المصري لاسس التصميم وشروط تنفيذ محطات مياه الشرب والصرف الصحي ومحطات الرفع. كود 101/1. 2017 الجزء الاول محطات معالجة الصرف الصحي الكود المصري لاسس التصميم وشروط تنفيذ محطات مياه الشرب والصرف الصحي ومحطات الرفع. كود 101/3. 2016 الجزء الثالث محطات تنقية مياه الشرب									

Code	Name/Content	Credit Hours	Contact Hours							
			Lec	Tut (2)	App. Tut	Lab	Stud	Off. Tut	Off. Hrs	Total
PBWS455	Environmental Systems Analysis	3	2	2						4
	Pre-requisites: 110 Credits									
	Tools for environmental systems analysis, Strategic environmental assessment, Environmental impact assessment, Life-cycle assessment, Material flow analysis, Cost-benefit analysis.									
References	Matthews et al. (2015), Life Cycle Assessment, Quantitative Approaches for Decisions That Matter.									
PBWS456	Advanced Topics in Networks Design	3	2	2						4
	Pre-requisites: PBWS309									
	Distribution networks, water quality in distribution networks, storm water, vacuum and pressure sewers.									
References	Fair, Geyer, and Okun's, "Water and Wastewater Engineering: Water Supply and Wastewater Removal", 3rd Edition, 2011. الكود المصري لاسس التصميم وشروط التنفيذ لخطوط المواسير المستخدمة في شبكات مياه الشرب والصرف الصحي. كود 2010 .1/102									
PBWS457	Introduction to Environmental Modelling	3	2	2						4
	Pre-requisites: PBWS309									
	Movement and fate of environmental pollutants, Principles of kinetics, stoichiometry, mass balances, and reactor theory, Mathematical modeling of water quality in rivers and lakes, Introduction to microbial kinetics, Introduction to mathematical models for Wastewater treatment, Introduction to BioWin computer software.									
References	Metcalf & Eddy Inc., George Tchobanoglous, Franklin L. Burton, Ryujiro Tsuchihashi, and H. David Stensel (2013), Wastewater Engineering: Treatment and Resource Recovery, 5th ed. New York, NY: McGraw-Hill. الكود المصري لاسس التصميم وشروط تنفيذ محطات مياه الشرب والصرف الصحي ومحطات الرفع. كود 2017 .1/101 الجزء الاول محطات معالجة الصرف الصحي									

Code	Name/Content	Credit Hours	Contact Hours							
			Lec	Tut (2)	App. Tut	Lab	Stud	Off. Tut	Off. Hrs	Total
PBWS458	Membrane technology for water and wastewater treatment	3	2	2						4
	Pre-requisites: PBWS300									
	Low-pressure membranes (UF and MF), Desalination by Reverse osmosis (RO), Pre-treatment for RO systems, Fouling and cleaning in membrane systems, Membrane bioreactors for wastewater treatment.									
References	Metcalf & Eddy Inc., George Tchobanoglous, Franklin L. Burton, Ryujiro Tsuchihashi, and H. David Stensel (2013), Wastewater Engineering: Treatment and Resource Recovery, 5th ed. New York, NY: McGraw-Hill. John C. Crittenden, R. Rhodes Trussell, David W. Hand, Kerry J. Howe and George Tchobanoglous (2012), MWH's Water Treatment: Principles and Design, 3rd Edition. الكود المصري لاسس التصميم وشروط التنفيذ لمحطات تحلية المياه المالحة. 2018									
STES466	Design and Construction of Water & Wastewater Structures	3	2	2						4
	Pre-requisites: STES201									
	Cracking limits, Design of watertight sections, Water pipe sections, Design of water structures; underground circular and rectangular tanks and swimming pools, elevated circular and rectangular deep and shallow tanks, Detailed design and construction of RC water and wastewater treatment facilities.									
References	الكود المصري لتصميم وتنفيذ المنشآت الخرسانية كود رقم 203-2020									