لائحة الدراسات العليا لقسم هندسة البتروكيماويات

- **مقدمة**

انطلاقا من مواكبة التقدم العلمي والتكنولوجي المتسارع خاصة في مجال صناعة البتروكيماويات يتميز قسم هندسة البتروكيماويات

كلية الهندسة بجامعة فاروس بالتطوير الدائم للمقررات الدراسية واسلوب تدريسها خاصة لبرنامج الدراسات العليا وذلك عن طريق التكامل والربط بين الدور الصناعي والدور الأكاديمي في الارتقاء بمستوى الخريج واطلاعه على أحدث التكنولوجيات والتقنيات الحديثة واكسابه المهارات اللازمة سواء في المجال البحثي او المجال العملي والتطبيقي بما يتواكب مع متطلبات سوق العمل وترسيخ مفهوم الاستدامة ليصبح منهاج عمل.

- **مواصفات خريج برنامج الدراسات العليا :**

يتميز خريج الدراسات العليا بقسم هندسة البتروكيماويات بالمواصفات الاتية:

- الكفاءة العلمية في المجالات البحثية والتطبيقية.
- القدرة على تقديم حلول مبتكرة للمشكلات الصناعية.
- القدرة على التطوير في مجالات العمل المختلفة.
- الكفاءة في استخدام أحدث التقنيات والاساليب العلمية الحديثة سواء في المجال البحثي او في المجال التطبيقي والصناعي.
- ذو كفاءة عالية في ادارة العمليات والتشغيل لمصانع البترول والبتروكيماويات.

- **فرص الخريج للالتحاق بسوق العمل :**

من خلال المقررات الدراسية التي يدرسها الطالب سواء دبلوم الدراسات العليا او الماجيستير يكتسب الخريج افضلية في سوق العمل بمجالاته المختلفة والتي نذكر منها على سبيل المثال الصناعات التالية:

- البتروكيماويات الوسيطة والنهائية.

- البلاستيك.
- الجلود.
- الطلاءات.
- تكرير البترول.
- الأسمدة.

بالإضافة الى العمل في المراكز البحثية المتخصصة.

*** وصف عام للبرامج المقدمة:**

لائحة الدراسات العليا لقسم هندسة البتروكيماويات

يمنح قسم هندسة البتروكيماويات **درجة دبلوم الدراسات العليا** كالآتي:

1- دبلوم هندسي اساسي في هندسة البتروكيماويات

2- دبلوم هندسي متقدم في التخصصات الآتية:

- هندسة البوليمرات" Polymer Engineering "
- هندسة معالجة المخلفات الصناعية "Treatment of Industrial Waste Engineering"
- هندسة ادارة العمليات وتشغيل مصانع البترول والبتروكيماويات.

"Process management for Petroleum and Engineering" Petrochemical Plants

3- ماجيستير العلوم في هندسة البتروكيماويات

<u>المقررات الدراسية</u> :

- **دبلوم هندسي اساسي في هندسة البتروكيماويات**
- **عدد الساعات المعتمدة المطلوبة 12 ساعة**

يتم دراسة اربع مقررات دراسية **اجبارية** بإجمالي 12 ساعة لجميع طلاب الدبلوم طبقا لما ورد في الجدول رقم 1

جدول-1 المقررات الإجبارية لدبلوم الدراسات العليا

SN	Code	Course	Credit Hours	Marks		Exam Hours
				Class Work	Written Exam	
1	**PCE 501**	**Advanced Petroleum and Petrochemical Industry**	3	40	60	3
2	**PCE 502**	**Transport Phenomena**	3	40	60	3
3	**PCE 503**	**Reactor Design in petrochemical industry**	3	40	60	3
4	**PCE 504**	**Experimental Design and Scientific Research**	3	40	60	3
		Total credit hours	**12**			

- **دبلوم هندسي متقدم في تخصص هندسة البوليمرات "Polymer Engineering "**
  - **عدد الساعات المعتمدة المطلوبة 24 ساعة**

- يتم دراسة أربع مقررات دراسية **اجبارية** بإجمالي 12 ساعة واربعة مقررات اختيارية بإجمالي 12 ساعة طبقا

لما يلي:

- **المرحلة الاولى** :يتم دراسة 12 ساعة معتمدة اجبارية بمستوى 500 وهي الدبلوم الأساسي كما هو موضح في الجدول رقم .1
- **المرحلة الثانية** :يتم دراسة 12 ساعة معتمدة اختيارية من المستوى 500-600 طبقا للجدول رقم **2**

جدول-2 المقررات الاختيارية لدبلوم الدراسات العليا المتقدم في هندسة البوليمرات

SN	Code	Course	Credit Hours	Marks		Exam Hours
				Class Work	Written Exam	
1	**PCE 505**	**Polymer Composite**	3	40	60	3
2	**PCE 506**	**Rheology of Polymeric Fluids**	3	40	60	3
3	**PCE 601**	**Advanced polymer Science and Engineering**	3	40	60	3
4	**PCE 602**	**Analysis and Design of Polymer Processing Operations**	3	40	60	3
5	**PCE 603**	**Thin-Film Polymer Technology**	3	40	60	3
6	**PCE 604**	**Polymer recycling and waste management**	3	40	60	3
		Total selected credit hours	**12**			

- **دبلوم هندسي متقدم فى هندسة معالجة المخلفات الصناعية " Treatment of Industrial Waste Engineering "**
  - **عدد الساعات المعتمدة المطلوبة 24 ساعة**

- يتم دراسة اربع مقررات دراسية **اجبارية** بإجمالي 12 ساعة واربع مقررات اختيارية باجمالي 12 ساعة طبقا لما يلى:

- **المرحلة الاولى** :يتم دراسة 12 ساعة معتمدة **اجبارية** بمستوى 500 وهى الدبلوم الاساسى كما في الجدول رقم 1
- **المرحلة الثانية** :يتم دراسة 12 ساعة معتمدة **اختيارية** من المستوى 500-600 طبقا للجدول رقم **3**

جدول-3 المقررات الإختيارية لدبلوم الدراسات العليا المتقدم فى هندسة معالجة المخلفات الصناعية

SN	Code	Course	Credit Hours	Marks		Exam Hours
				Class Work	Written Exam	
1	**PCE 507**	**Air Pollution Control**	3	40	60	3
2	**PCE 508**	**Fuels and Combustion**	3	40	60	3
3	**PCE 605**	**Industrial Wastewater & Solid Waste Management**	3	40	60	3
4	**PCE 606**	**Environmental Engineering for Petroleum and Petrochemical Industries**	3	40	60	3
5	**PCE 607**	**Process Safety Engineering**	3	40	60	3
6	**PCE 608**	**Energy Management in Petrochemical Industries**	3	40	60	3
		Total selected credit hours	**12**			

- **دبلوم هندسي متقدم في هندسة ادارة العمليات وتشغيل مصانع البترول والبتروكيماويات**

"Process management for Petroleum and Engineering" Petrochemical Plant

- **عدد الساعات المعتمدة المطلوبة 24 ساعة**

- يتم دراسة اربعة مقررات دراسية **اجبارية** بإجمالي 12 ساعة واربعة مقررات اختيارية باجمالي 12 ساعة طبقا لما يلى:

- **المرحلة الاولى** :يتم دراسة 12 ساعة معتمدة اجبارية بمستوى 500 وهى الدبلوم الاساسى كما في الجدول رقم 1
- **المرحلة الثانية** :يتم دراسة 12 ساعة معتمدة اختيارية من المستوى 500-600 طبقا للجدول رقم **4**

جدول-4المقررات الإختيارية لدبلوم الدراسات العليا المتقدم فى هندسة ادارة العمليات وتشغيل مصانع البترول والبتروكيماويات

SN	Code	Course	Credit Hours	Marks		Exam Hours
				Class Work	Written Exam	
1	**PCE 509**	**Gas Processing**	3	40	60	3
2	**PCE 510**	**Fuels and Combustion**	3	40	60	3
3	**PCE 609**	**Advanced Project Management Techniques**	3	40	60	3
4	**PCE 610**	**Petrochemical Industries II**	3	40	60	3
5	**PCE 611**	**Optimization Application in Petroleum and Petrochemical Industries**	3	40	60	3
6	**PCE 612**	**Alternative Fuels**	3	40	60	3
7	**PCE 613**	**Production Planning and Management**	3	40	60	3
8	**PCE 614**	**Energy Management in Petrochemical Industries**	3	40	60	3
9	**PCE 615**	**Feasibility Studies and Economics**	3	40	60	3
10	**PCE 616**	**Oil and Gas Field Processing**	3	40	60	3
			Total selected credit hours	**12**		

- **ماجيستير العلوم الهندسية في هندسة البتروكيماويات " Master of Engineering Sciences"**
  - **عدد الساعات المعتمدة المطلوبة 36ساعة**

تتم الدراسة علي المراحل التالية طبقا لما يلى:

- **المرحلة الاولى**: يتم دراسة 12 ساعة معتمدة اجبارية بمستوى 500 وهى الدبلوم الاساسى كما في الجدول رقم 1

- **المرحلة الثانية** :يتم دراسة 12 ساعة معتمدة اختيارية من المستوى 500-600 طبقا للتخصص في دبلوم الهندسي

المتقدم وجدول المقررات المخصص له.

- **المرحلة الاخيرة**: يقوم الطالب بعمل البحث الاكاديمى في صورة رسالة الماجستير والذى يوازى **12** ساعة معتمدة

▪ توصيف مقررات الدبلوم الهندسي الاساسي في هندسة البتروكيماويات

Description of Compulsory Courses for Diploma in Petrochemical Engineering

PCE 501 Advanced Petroleum and Petrochemical Industry:

Refinery configuration. Characterization of crude oils and products. Coking. Catalytic cracking. Catalytic hydro-cracking. Hydro-processing and hydro-treating. Reforming. Integration between refining and petrochemicals. Role of FCC in petrochemicals production. Maximizing petrochemicals from refining. Review of petrochemical processes. Petrochemical complexes Techno – economic factors Integration between petroleum refining and petrochemicals. Source of olefinic and aromatic hydrocarbons Steam cracking. Catalytic reforming. Treatment of olefinic C4 and C5 cuts Treatment of aromatic gasolines. Computer simulation for a selected process commercial simulator.

PCE 502 Transport Phenomena:

Advanced concepts and methods of transport phenomena. Methods for prediction of transport properties (viscosity, thermal conductivity and diffusivities). Equations of change in 2-D and 3-D for isothermal fluid flow, heat conduction, diffusivity. General cases of simultaneous transport; dimensional analysis of the equations of transport and its use in scale up.

Applications of the basic equations to the study of forced and free convection, laminar flow, turbulent flow, heat conduction, diffusion and multi-component systems will be presented. Case studies will include: viscometers, transpiration cooling, free convection heat transfer, simultaneous heat and mass transfer, evaporative cooling, drying, mass transfer with chemical reaction, etc. Multidimensional and transient problems will be covered, as will those involving compressible flows, non-Newtonian flows and turbulence modelling.

An introduction to the numerical solution of partial differential equations. Application of commercial numerical software such as COMSOL to solve practical problems.

PCE 503 Reactor Design in petrochemical industry:

Types of reactors used in petrochemical industry. Design of different types of reactors. General concepts of design of fixed bed reactors. Slurry reactors. Gas phase reactors. Design of reformers. Design of naphtha crackers. Design of fluidized bed reactors. Design of Fluid catalytic cracking (RFCC) in petrochemical industry.

PCE 504 Experimental Design and Scientific Research:

Advanced Experimental Design. Advanced Data Collection Techniques. Advanced Statistical Analysis. Sampling Techniques and Power Analysis. Experimental Control and Randomization. Multivariate Data Analysis. Mixed-Methods Research. Longitudinal and Observational Studies. Philosophical Foundations of Scientific Research. Research Design and Planning. Interdisciplinary Research Integration. Communicating Research Findings. Advanced Research Methodologies. Research Communication and Publication. Research Ethics and Compliance.

▪ توصيف المقررات الاختيارية للدبلوم الهندسي المتقدم في تخصص هندسة البوليمرات :

Description of Elective Courses for Advanced Diploma in Polymer Engineering:

PCE 505 Polymer Composite:

This course is designed to provide a comprehensive overview of the polymer composite, including its constituents, design, fabrication, testing, and evaluation. The course will cover the basic nature of different polymers and their comparative properties, classification of reinforcement materials and their processing techniques, and various fabrication techniques of polymeric composites such as Open Molding, Resin Infusion, Extrusion, Thermoforming, Compression molding, etc. The fundamental concepts and classification of composite materials, various issues, challenges, and opportunities in the processing of polymer composites will also be explained. Common manufacturing and test methods for polymer composites. Material selection, engineering design principles and reliability of polymer composites.

PCE 506 Rheology of Polymeric Fluids:

Experimental methods of determination of rheological properties of polymer melts, solutions, elastomers. Structure-flow behavior relationships, viscoelastic fluid theory, application to extrusion, fiber, film processing molding. Structure development in processing.

PCE 601 Advanced polymer Science and Engineering

The course is interdisciplinary in nature and involves a combination of theoretical and practical approaches. The latest experimental techniques in engineering, examine the characteristics, structure and properties of materials in greater depth will be explored and have the option to explore modules ranging from Manufacturing Processes to Nanotechnology and Nanomedicine, Nanocomposites, Renewable Energy and Energy Storage Engineering. Therefore, physicochemical properties of amorphous and crystalline polymers. Glass transitions, crystallization, molecular orientation and morphology of important commercial polymers, fabricated products and composite materials.

PCE 602 Analysis and Design of Polymer Processing Operations:

Mathematical modeling and engineering design analysis of polymer processing operations including extruder screws, injection molds, dies, fibers, film formation.

Basic studies on non-isothermal phenomena in polymer engineering emphasizing crystallization, vitrification, frozen-in orientation and residual stresses, applications, including fiber spinning and film extrusion.

PCE 603 Thin-Film Polymer Technology

History of thin-film technology, applications of thin-films, methods which used to fabricate the thin films such as casting, electrospinning, elctrospraying, electroplating, spin coating, and plasma deposition. Characterization methods which were used to investigate thin polymer films such as XPS, FTIR, SEM, and AFM.

PCE 604 Polymer recycling and waste management

Types of recycling, equipment/machinery used in recycling, recycling of urban plastic waste, recycling of specific polymers, and tools for combating plastic waste as alternatives to single use plastics. The recent progress on recycling of polymeric waste of some traditional polymers and their systems (blends and composites) such as polyethylene (PE), polypropylene (PP), and polystyrene (PS), and introduces the mechanical and chemical recycling concepts. In addition, the effect of mechanical recycling on properties including the mechanical, thermal, rheological and processing properties of the recycled materials is highlighted. various steps from collection to disposal; Classification, collection, transport, and transfer

- **توصيف المقررات الاختيارية للدبلوم الهندسي المتقدم في تخصص هندسة معالجة المخلفات الصناعية :**

Description of Elective Courses for Advanced Diploma in Treatment of Industrial Waste Engineering:

PCE 507 Air Pollution Control:

Natural and man-made Air pollution. Types and classification of air pollutants. Transport and diffusion of pollutants. Laws governing behavior of pollutants in the atmosphere. Effect of air pollutants on human health, plants, animals, microbes and materials. Acid rain. Ozone depletion. Global warming and climate change. Meteorology of air pollution: Wind speed, direction and their vertical profiles, turbulence, temperature inversion, atmospheric stability classes and characteristic. Heat Island effects and Wind valley effect. Dispersion models. Sampling of gaseous and particulate pollutants: Ambient air and stack; Elements; sampling systems: active and passive sampling.

PCE 508 Fuels and Combustion:

Introduction to energy sources, Solid Fuels- Biomass, Processing of Solid Fuels- and gasification of solid fuels. Gaseous Fuels- Natural gas, refinery gases, LPG, oil gasification, cleaning and purification of gaseous fuels. Liquid Fuels.

PCE 605 Industrial Wastewater & Solid Waste Management:

Design of sustainable technologies for liquid & solid waste management: conventional industrial wastewater treatment plants, sanitary landfills & destruction processes for hazardous wastes; advanced reuse technologies, including wastewater nutrient removal, heavy metals, hydrocarbons, salts, …., energy recovery from liquid & solid wastes; product recovery from oily wastes, solvents & abattoir wastes. Waste exchange case studies will include example from petroleum refining and petrochemicals industries. Engineering principles applied to the control of hazardous waste generation, handling, collection, transport, processing, recovery, and disposal. Treatability and design of hazardous waste treatment process.

PCE 606 Environmental Engineering for Petroleum and Petrochemical Industries

Environmental impact, sources of pollution from petrochemical industries, petrochemical waste handling and treatment. Environmental auditing, Preventing pollution from refinery and petrochemical companies, Advanced treatment for petrochemical waste, environmental management systems, sludge treatment, sustainability in petroleum and petrochemical engineering (Carbon foot print), green -house gas emissions and SDGs.

PCE 607 Process Safety Engineering:

Comprehensive information about core elements of the Process Safety discipline in engineering and operations by focusing on the risk management process, comprehend the necessary steps to define risk within the practical sessions. Inherently Safer Design Bowtie Diagram. Protective Systems. Plant Layout. Introduction to Safety in Operations Process Safety Performance

identifying Safety-critical equipment and linking them to performance standards. Compliance with applicable standards. Properly design, procure, build, install and test.

PCE 608 Energy Management in Petrochemical Industries:

Energy management principles, needs of organization and goal setting, energy audit in plant metering, review of conservation technologies. Properties of Hydrogen with respect to its utilization as a renewable form of energy. Energy conservation economics, basic discounting life cycle, costing and other methods, factors affecting economics. Thermodynamics and energy conservation. Energy and separation processes. Optimization of heat exchanger networks, thermally coupled distillation systems, heat pump, hybrid desalination systems, modelling of technical solution to energy conservation problems, energy for sustainable development in refinery and petrochemical industries.

- **توصيف المقررات الاختيارية للدبلوم الهندسي المتقدم في تخصص هندسة ادارة العمليات وتشغيل مصانع البترول والبتروكيماويات**

Description of Elective courses for Advanced Engineering Diploma in Process management for Petroleum and Petrochemical Plant:

PCE 509 Gas Processing:

New trends in gas treatment, recovery process, applications of gas processing in petrochemical industries. Advanced treatment process in gas treatment. This course studies the important role of natural gas in petrochemical industry. Oil – field gas processing.; studies the important properties, which used to characterize natural gas and condensate; studies some important applications of phase behavior in production operations; and make basic design of major equipment in natural gas processing. phase behavior in natural gas processing. Three- and two-phase separation from wells. sour gas treatment. gas dehydration. Natural gas liquids recovery, new applications of gas processing in petrochemical industries. C1 - petrochemicals. computer simulation of selected processes.

PCE 510 Fuels and Combustion:

Introduction to energy sources, Solid Fuels- Biomass, Processing of Solid Fuels- and gasification of solid fuels. Gaseous Fuels- Natural gas, refinery gases, LPG, oil gasification, cleaning and purification of gaseous fuels. Liquid Fuels.

PCE609 Advanced Project Management Techniques:

The course focuses on the planning, resourcing, organizing, monitoring & control, assessing risk including invention to bid documents (ITB), Basic engineering criteria and technology selection.

The course includes the following topics: introduction to project management; project initiation; project organization, structure and culture; estimating project times and costs; project planning; resource scheduling and budgeting; reducing project duration; project control; managing risk; leadership and project teams.

PCE 610 Petrochemical Industries II:

Strategic planning and concepts for petrochemical industry and proposed schemes. Statistical information on Egypt petroleum and petrochemical industries, updated petrochemical products and their specifications. Modeling and simulation of some petrochemical processes. New trends in Petro – refinery integration industries.

PCE 611 Optimization Application in Petroleum and Petrochemical Industries:

Concepts of Optimization. Optimization of Unconstrained Functions: One-Dimensional Search. Unconstrained Multivariable Optimization. Linear Programming (LP) and Applications. Nonlinear Programming with Constraints. Mixed-Integer Programming. Global Optimization for Problems with Continuous and Discrete Variables. Applications of Optimization in: Heat Transfer and Energy Conservation, Separation Processes, Fluid Flow Systems, and Chemical Reactor Design and Operation. Optimization in Large-Scale Plant Design and Operations. Integrated Planning, Scheduling, and Control in the Process Industries.

PCE 612 Alternative Energy sources:

Preparation of fuel, Biofuel, Biodiesel (method of production, properties and quality), Bioethanol, Ethanol, Methanol, Biogas production and economy, vegetable oils, NGL, Hydrogen modelling application of alternatives fuels.

PCE 613 Production Planning and Management:

The course focuses on the planning and design of continues production processes. The course includes the following topics: production problems that typically occur in continues production systems; system design – product and service design; capacity planning; process selection and layout; design of work systems; location planning and analysis and optimization planning.

PCE 614 Energy Management in Petrochemical Industries:

Energy management principles, needs of organization and goal setting, energy audit in plant metering, review of conservation technologies. Properties of Hydrogen with respect to its utilization as a renewable form of energy. Energy conservation economics, basic discounting life cycle, costing and other methods, factors affecting economics. Thermodynamics and energy conservation. Energy and separation processes. Optimization of heat exchanger networks, thermally coupled distillation systems, heat pump, hybrid desalination systems, modelling of technical solution to energy conservation problems, energy for sustainable development in refinery and petrochemical industries.

PCE 615 Feasibility Studies and Economics:

The course focuses on how to analyze and evaluate a proposed project to determine if it is technically feasible. The course includes the following topics: feasibility study versus business plan; feasibility study preparation steps; feasibility study elements: market feasibility (market

research and analysis, market research data types, sales projections analysis); technical feasibility (critical technical questions, supply feasibility, operational feasibility) ; financial feasibility (project costs, indirect costs, ongoing costs); feasibility study appraisal and analysis; feasibility study evaluation and implementation.Economics of petrochemical industry and the feedstock/price inter-relationships affecting market competitiveness. Basic strategies and valuation techniques for investment analysis and investment decision. Fundamentals of competitiveness in producing petrochemical industry products and how these will affect business decisions, process and feedstock selection. Case study from Egyptian petrochemical industry.

PCE 616 Oil and Gas Field Processing:

Field oil and gas separation from the wells, gas processing techniques such as dehydration and gas sweetening. Oil desalting, sweetening and dehydration. Gas and oil transportation through pipelines. Gas liquefaction and hydrate formation. Models and gas/oil processing case studies.

----------END----------
