PROGRAMME SPECIFICATION

2009

in Chemical Engineering

FOR ENGINEER
CONTENT

PROGRAMME SPECIFICATION........................................................................................................ 1
CONTENT ........................................................................................................................................ ii
1  Programme Objectives .................................................................................................................. 8
2  Expected Learning Outcomes ........................................................................................................ 8
3  Standard length of study, mode of study and total credits ................................................................ 9
4  Admission criteria.......................................................................................................................... 10
5  Training procedure and Exit award requirements .......................................................................... 10
6  Grading .......................................................................................................................................... 10
7  Programme structure ...................................................................................................................... 11
Course list for the Chemical Engineering program ........................................................................... 12
Outline of all courses in chemical engineering ................................................................................ 24
I. General Education............................................................................................................................ 24
   MI1110 Analysis I (Giải tích I) 4(3-2-0-8) ...................................................................................... 24
   MI1120 Analysis II (Giải tích II) 3(2-2-0-6) .................................................................................... 24
   MI1130 Analysis III (Giải tích III) 3(2-2-0-6) ............................................................................... 24
   MI1140 Algebra (Đại số) 4(3-2-0-8) ............................................................................................ 24
   PH1110 Physics I (Vật lý I) 3(2-1-1-6) ........................................................................................... 24
   PH1120 Physics II (Vật lý II) 3(2-1-1-6) ......................................................................................... 24
   IT1110 Introduction to Computer Science (Tin học đại cương) 4(3-1-1-8) .............................. 25
   EM1010 Introduction to Management (Quản trị học đại cương) 2(2-0-0-4) ............................ 25
   FL1101 English I (Tiếng Anh I) 3(0-6-0-6) ................................................................................ 25
   FL1102 English II (Tiếng Anh II) 3(0-6-0-6) ............................................................................. 25
   CH1010 General Chemistry (Hóa học đại cương) 3(2-1-1-6) ...................................................... 26
   MI3180 Experimental Probability and Statistics (Xác suất thống kê và QHTN) (3-1-0-6) .......... 26
2. Core and Fundamental Courses ..................................................................................................... 26
   ME2015 Basic Engineering Graphics (Đồ họa kỹ thuật cơ bản) 3(3-1-0-6) ............................... 26
   CH2000 Introductory to Chemical Engineering (Nhập môn kỹ thuật hóa học) 3(2-1-1-4) 27
   CH3120 Inorganic Chemistry (Hóa vô cơ) 3 (3-1-0-6) ................................................................. 27
   CH3130 Inorganic Chemistry Lab (Thí nghiệm hóa vô cơ) 1 (0-0-2-2) ...................................... 27
   CH3220 Organic Chemistry (Hóa hữu cơ) 4 (4-1-0-8) ................................................................. 27
   CH3230 Organic Chemistry Lab (Thí nghiệm Hóa hữu cơ) 1 (0-0-2-2) ...................................... 28
   CH3050 Physical Chemistry 1 (Hóa lý 1) 2 (2-1-0-4) ................................................................. 28
   CH3052 Physical Chemistry Lab 1 (Thí nghiệm Hóa lý 1) 1 (0-0-2-2) ...................................... 28
   CH3060 Physical Chemistry 2 (Hóa lý 2) 3 (3-1-0-6) ................................................................. 28
   CH3062 Physical Chemistry Lab 2 (Thí nghiệm Hóa lý 2) 1 (0-0-2-2) ...................................... 29
   CH3330 Analytical Chemistry (Hóa phân tích) 2 (2-1-0-4) ......................................................... 29
   CH3340 Analytical Chemistry Lab (Thí nghiệm Hóa phân tích) 2 (0-0-4-4) ............................. 29
   CH3323 Instrumental Methods of Analysis (PHương pháp phân tích bằng công cụ) ... 30
   CH3400 Chemical Process Engineering 1 (Hydraulic processes, Pump, Fan, Compressor) ... 30
   CH3412 Chemical Process Engineering 2 (Heat transfer) (Quá trình và Thiết bị CN Hóa học) 2(2-1-0-4) .................................................................................................................. 30
   CH3420 Chemical Process Engineering 3 (Mass transfer) (Quá trình và Thiết bị CN Hóa học 3) (Các quá trình chuyển khối) 3 (3-1-0-6) ........................................................................ 31
   CH3480 Chemical Process Engineering Lab 1 ................................................................................ 31
   CH3490 Chemical Process Engineering Lab 2 ................................................................................ 31
   CH3440 Project in Chemical Engineering (Đồ án Quá trình và Thiết bị CN Hóa học). 31
2. List of specialized courses (Phần tự chọn theo định hướng)

3.1. ORGANIC-PETROCHEMICAL TECHNOLOGY (ĐỊNH HƯỚNG CÔNG NGHỆ CÔ HÓA DÂU)

CH4032 Oil and Gas Chemistry (Hóa học dầu mỏ và khí) 2 (2-1-0-4) ...................................................... 32
CH4030 Kinetics and catalysis (Động học xúc tác) 2 (2-1-0-4) ................................................................. 33
CH4032 Reactors in Refinery and Petro-chemistry (Thiết bị tổng hợp hóa học dầu) 33
CH4040 Organic Synthesis and Petrochemical Processes (Công nghệ tổng hợp hóa học - hóa dầu) 2 (2-1-0-4) ................................................................. 33
CH4036 Oil refining processes (Công nghệ chế biến dầu) 3 (3-1-0-6) .......................................................... 33
CH4038 Gas Processing Technology (Công nghệ chế biến khí) 2 (2-1-0-4) ............................................... 33
CH4034 Petroleum Products (Sản phẩm dầu mỏ) 2 (2-0-0-4) ................................................................. 34
CH4026 Project - plant design (Đồ án chuyên ngành) 2 (0-0-4-4) ............................................................ 34
CH5200 Green Fuels (Nhiên liệu sạch) 2 (2-1-0-4) .......................................................................................... 34
CH5201 Technology for Synthesis of Petrochemical Intermediates (Tổng hợp hợp chất trung gian) 2 (2-1-0-4) ........................................................................................................ 34
CH5202 Solid Fuel (Nhiên liệu rắn) 2 (2-1-0-4) ............................................................................................ 34
CH5203 Petroleum Chemistry and Products (Hóa học và sản phẩm dầu) 2 (2-1-0-4) .................. 34
CH5204 Oil and Gas Processing Technologies (Công nghệ chế biến dầu và khí) 2 (2-1-0-4) .... 34

CH5205 Petroleum laboratory testing ( (Thí nghiệm chuyên ngành) 3 (0-0-6-6) ............... 35
CH5206 Petrochemical Process Design Engineering Project (Đồ án chuyên ngành kỹ sư hóa dầu) 2 (0-0-4-4) ........................................................................................................ 35
CH5800 Graduation Internship (Thực tập cuối khóa) 3(0-0-6-6) ............................................................ 35

2.2. POLYMER - COMPOSITE MATERIAL TECHNOLOGY (KỸ SƯ CÔNG NGHỆ POLYME – COMPOZIT)

CH4090 Hóa lý polyme cơ sở (Basic Physical Chemistry of Polymers) 2 (2-0-0-4) ......... 35
CH4092 Hóa học polyme cơ sở (Basic Polymer Chemistry) 3 (3-0-1-6) .......................... 35
CH4094 Hóa học các chất tạo mạng và son (Membrane and Paint Chemistry) 2 (2-0-0-4) ............................ 36
CH4096 Công nghệ cao su (Rubber Technology) 2 (2-0-0-4) ....................................................... 36
CH4098 Công nghệ chất dẻo (Plastic Technology) 2 (2-0-0-4) ...................................................... 36
CH4100 Công nghệ vật liệu polyme-compozit (Polymer and Composite Materials) 2 (2-0-0-4) .............................. 36
CH4074 Môi trường trong gia công vật liệu polyme và compoizit (Polymer Materials and Environment ) .................................................................................. 36
CH4084 Đồ án chuyên ngành cử nhân CN Polyme-Compozit (Senior Project) 2 (0-0-4-4) ......... 36

CH5250 Hóa lý polyme nâng cao (Advance in Physical Chemistry of Polymer) 2.............. 36
CH5251 Hóa học polyme nâng cao (Advance in Chemistry of Polymer) ................................. 36
CH5252 Kỹ thuật vật liệu son (Paint Material Engineering ) 2 (2-0-1-4) .................................. 37
CH5253 Kỹ thuật vật liệu cao su (Rubber Material Engineering) 2 (2-0-1-4) .................... 37
CH5254 Kỹ thuật vật liệu chất dẻo (Plastic Material Engineering) 2 (2-0-0-4) ............... 37
CH5255 Kỹ thuật vật liệu polyme compoizit (Polymer composite Material Engineering) .... 37

CH5256 Máy và thiết bị gia công polyme (Equipment and Instrument for Polymer Processing) 2 (2-0-0-4) ......................................................................................................................... 37
CH5257 Đồ án chuyên ngành kỹ sư polyme (Project specialized in Polymer Engineering)
<table>
<thead>
<tr>
<th>Code</th>
<th>Course Title</th>
</tr>
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<tbody>
<tr>
<td>CH4150</td>
<td>Theoretical Electrochemistry - Điện hóa lý thuyết 4 (3-1-1-8)</td>
</tr>
<tr>
<td>CH4152</td>
<td>Plating Technology - Công nghệ mạ 3 (2-1-1-6)</td>
</tr>
<tr>
<td>CH4154</td>
<td>Corrosion and Protection of Metals. 3 (2-1-1-6)</td>
</tr>
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<td>CH4156</td>
<td>Electrowinning</td>
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<td>CH4157</td>
<td>Electrochemical Power Sources</td>
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<tr>
<td>CH4146</td>
<td>Senior Project 2 (0-0-4-4)</td>
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<tr>
<td>CH5300</td>
<td>Surface Electrochemistry 2 (2-1-0-)</td>
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<tr>
<td>CH5301</td>
<td>Electrochemical equipment and design</td>
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<td>CH5302</td>
<td>Inorganic Electrosynthesis 2 (2-1-0-4)</td>
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<tr>
<td>CH5303</td>
<td>Organic Electrosynthesis 2 (2-1-0-4)</td>
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<tr>
<td>CH5304</td>
<td>Electrochemical Engineering Lab 3 (0-0-6-6)</td>
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<tr>
<td>CH5305</td>
<td>Glass technology (Công nghệ thủy tinh)</td>
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<tr>
<td>CH5306</td>
<td>Refractory technology (Công nghệ vật liệu chịu lửa)</td>
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<td>CH5307</td>
<td>Specialized experiments 1 (Thí nghiệm chuyên ngành Silicat 1) 2(0-0-4-4)</td>
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<td>CH5308</td>
<td>Silicate engineering project (Dò án chuyên ngành kỹ sư Silicat) 2 (0-0-4-4)</td>
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<tr>
<td>CH5309</td>
<td>Specialized experiments 2 (Thí nghiệm chuyên ngành Silicat 2) 2(0-0-4-4)</td>
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<td>CH4210</td>
<td>Physical Chemistry of Silicates 1 (Hóa lý Silicat 1)</td>
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<td>CH4212</td>
<td>Silicate Industrial Equipments 1 (Thiết bị công nghiệp Silicat 1)</td>
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<tr>
<td>CH4214</td>
<td>Heating Equipments in Silicate Industry 1 (Lò công nghiệp Silicat 1)</td>
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<tr>
<td>CH4195</td>
<td>Mineralogical Silicates (Khảo sát và việc silicat)</td>
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<td>CH4193</td>
<td>Specialized experiments (Thí nghiệm cơ sở chuyên ngành silicat)</td>
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<tr>
<td>CH4208</td>
<td>Senior Project Đồ án chuyên ngành cử nhân</td>
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<tr>
<td>CH5352</td>
<td>Technology of inorganic binders (Công nghệ các chất kết dính vô cơ)</td>
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<tr>
<td>CH5353</td>
<td>Pottery and porcelain technology (Công nghệ gốm sứ)</td>
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<tr>
<td>CH5354</td>
<td>Glass technology (Công nghệ thủy tinh)</td>
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<tr>
<td>CH5355</td>
<td>Refractory technology (Công nghệ vật liệu chịu lửa)</td>
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<tr>
<td>CH5356</td>
<td>Specialized experiments 1 (Thí nghiệm chuyên ngành Silicat 1) 2(0-0-4-4)</td>
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<tr>
<td>CH5357</td>
<td>Specialized Silicat Experiment 2 (Thí nghiệm chuyên ngành Silicat 2) 2(0-0-4-4)</td>
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<tr>
<td>CH5358</td>
<td>Silicate engineering project (Dò án chuyên ngành kỹ sư Silicat) 2 (0-0-4-4)</td>
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</tbody>
</table>

2.4. TECHNOLOGY OF SILICATE MATERIALS - KỸ SƯ CÔNG NGHỆ VẬT LIỆU SILICAT

<table>
<thead>
<tr>
<th>Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>CH4251</td>
<td>Mineral Salt Technology (Công nghệ muối khoáng) 2(2-1-0-4)</td>
</tr>
<tr>
<td>CH4272</td>
<td>Separation and Purification (Khử trùng và làm sạch) 2 (2-1-0-4)</td>
</tr>
<tr>
<td>CH4274</td>
<td>Chemical Kinetics and Reaction Equipment (Động học và thiết bị phản ứng)</td>
</tr>
<tr>
<td>CH4278</td>
<td>Industrial Inorganic Chemistry (Hóa vô cơ công nghiệp) 2(2-1-0-4)</td>
</tr>
<tr>
<td>CH4242</td>
<td>Chemical Engineering Thermodynamics (Niệm động kỹ thuật hóa học) 2 (2-1-0-4)</td>
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<tr>
<td>CH4257</td>
<td>​​Mineral Processing (Chế biến khoáng sản) 2 (2-1-0-4)</td>
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<tr>
<td>CH4276</td>
<td>Inorganic materials (Vật liệu vô cơ) 2 (2-1-0-4)</td>
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<tr>
<td>CH4266</td>
<td>Advanced Experiments 1 (Thí nghiệm chuyên ngành 1) 2 (0-0-4-4)</td>
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<td>CH4280</td>
<td>Senior Project (Đồ án chuyên ngành cử nhân) 1 (0-0-2-2)</td>
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<tr>
<td>CH5408</td>
<td>Fertilizer Technology (Công nghệ phân bón) 2 (2-1-0-4)</td>
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<tr>
<td>CH5400</td>
<td>Nitrogen Compound Technology (Công nghệ các chất Nitơ) 2(2-1-0-4)</td>
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<tr>
<td>CH5409</td>
<td>Soda and Sodium Hydroxide Technology (Công nghệ Soda và các chất kiềm)</td>
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<tr>
<td>CH5410</td>
<td>Sulfuric acid technology (Công nghệ axit sunfúric) 2 (2-1-0-4)</td>
</tr>
<tr>
<td>CH5411</td>
<td>Water treatment (Xử lý nước)</td>
</tr>
<tr>
<td>CH5401</td>
<td>Inorganic Pigment Materials for Industry (Chất màu vô cơ công nghiệp)</td>
</tr>
<tr>
<td>CH5402</td>
<td>Experiments Specialized in Inorganic Engineering 2</td>
</tr>
</tbody>
</table>
2.6. **PHYSICO-CHEMICAL ENGINEERING KỸ SƯ CÔNG NGHỆ HÓA LÝ**

CH4330 Electrochemical Processes 2 (2-1-0-4) .......................................................... 46
CH4332 Physical and Physico-chemical Methods for Studying Structure of Matters 2 (2-1-0-4) .......................................................... 46
CH4328 Waste Water Treatment ................................................................................ 46
CH4336 Complex Catalysts and Applications ............................................................ 46
CH4338 Chemistry of Surfactants .............................................................................. 47
CH4313 Chemistry of Advanced Materials ............................................................... 47
CH4334 Applied Informatics in Chemistry 2 (2-1-0-4) .................................................. 47
CH4324 Senior Project 3 (0-0-6-6) ........................................................................... 47
CH5450 Solid Chemistry (Hóa học chất rắn) ............................................................. 48
CH5451 Catalytic Engineering (Kỹ thuật xúc tác) ..................................................... 48
CH5452 Physical Chemistry of Surface Phenomena (Hóa lý các hiện tượng bề mặt) .. 48
CH5455 Experimental Design and Optimization Theory (Quy hoạch thực nghiệm và lý thuyết tối ưu) 48
CH5453 Applied Electrochemistry (Diễn hóa ứng dụng) ............................................. 48
CH5454 Chemical Kinetics and Catalysis (Động học và xúc tác) ............................. 48
CH5805 Graduation Internship (Thực tập cuối khóa) ................................................. 48

2.7. ** PROCESSES AND EQUIPMENT OF CHEMICAL ENGINEERING -KỸ SƯ QUÁ TRÌNH VÀ THIẾT BỊ CÔNG NGHỆ HÓA HỌC**

CH4392 Advanced Chemical Process Engineering Lab .............................................. 49
CH4362 General Chemical Technologies ................................................................. 49
CH4394 Optimization in chemical engineering ....................................................... 49
CH4396 Reaction engineering ................................................................................... 49
Course description: This course presents the mathematical principle and methodology of fluid mechanic equations; reaction kinetics of homogeneous, heterogeneous mixtures; thermal dynamic, reaction equilibrium, reaction rate; operation and description of reactors, resident time, and dynamics of chemical reactions .......................................................... 50
CH4390 Senior Project ............................................................................................... 50
ME4911 CAD 2D and Elements Drawing (CAD 2D và vẽ tách) ............................... 50
CH4400 Process control (Diều khiển quá trình) 3(3-0-1-6) ..................................... 50
CH5503 Plant engineering (Kỹ thuật công trình công nghệ hóa học) 2(2-1-0-4). 50
CH5504 SEPARATION TECHNIQUE MULTI COMPONENT SYSTEMS (Kỹ thuật tách hỗn hợp nhiều cấu tử) ................................................................. 50
CH5505 System Engineering 2(2-1-0-4) ................................................................. 50
CH5506 Models for Automation and Control 2(2-1-0-4) ........................................... 51
CH5507 Membrane technology (Công nghệ màng) 3(3-1-0-6) .............................. 51
CH5501 Project 3 for Machininery ......................................................................... 51
CH5806 Graduation Internship Thực tập cuối khóa ................................................. 51

2.8. **PULP AND CELLULOSE TECHNOLOGY -KỸ SƯ CÔNG NGHỆ XENULOZA VÀ GIẤY**

CH4450 Wood chemistry 2(2-1-0-4) ................................................................. 52
CH4452 Cellulose chemistry 2(2-0-0-4) ................................................................. 52
CH4454 Pulping technology 3(3-0-0-6) ................................................................. 52
Course description: .................................................................................................. 53
CH4456 Papermaking technology 3 (3-0-0-6) .......................................................... 53
CH4444 Wood and Cellulose Chemistry Lab. 3 (0-0-6-6) ...................................... 53
CH4458 Pulping and papermaking machines 2 (2-1-0-4) ........................................ 53
CH4446 Specific project 2 (0-0-4-4) ................................................................. 54
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CH4009</td>
<td>Chemistry and Physicochemistry of Polymers</td>
<td>2</td>
</tr>
<tr>
<td>CH5550</td>
<td>Paper recycling Technology</td>
<td>3</td>
</tr>
<tr>
<td>CH5557</td>
<td>Wet chemistry</td>
<td>2</td>
</tr>
<tr>
<td>CH5558</td>
<td>Mechanical pulping</td>
<td>2</td>
</tr>
<tr>
<td>CH5559</td>
<td>Paper coating</td>
<td>2</td>
</tr>
<tr>
<td>CH5560</td>
<td>Environment protection in paper industry</td>
<td>2</td>
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<tr>
<td>CH5551</td>
<td>Pulping and papermaking Lab.</td>
<td>3</td>
</tr>
<tr>
<td>CH5807</td>
<td>Final internship course</td>
<td>3</td>
</tr>
</tbody>
</table>

2.9. **PHARMACEUTICAL CHEMISTRY AND PESTICIDES TECHNOLOGY - KỸ SƯ CÔNG NGHỆ HÓA ĐƯỢC & BẢO VỆ THỰC VẬT**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
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<tbody>
<tr>
<td>CH4480</td>
<td>Basic Processes of Organic Synthesis</td>
<td>2</td>
</tr>
<tr>
<td>CH4482</td>
<td>Chemistry of natural compounds</td>
<td>2</td>
</tr>
<tr>
<td>CH4484</td>
<td>Basic processes of pharmaceutical chemistry</td>
<td>2</td>
</tr>
<tr>
<td>CH4490</td>
<td>Pharmaceutics's fomulation technology</td>
<td>2</td>
</tr>
<tr>
<td>CH4512</td>
<td>Spectroscopic Identification of Organic Compounds</td>
<td>2</td>
</tr>
<tr>
<td>CH4486</td>
<td>Plant Protection Chemistry (Pesticide Chemistry)</td>
<td>3</td>
</tr>
<tr>
<td>CH4510</td>
<td>General pharmaceutical chemistry</td>
<td>2</td>
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<tr>
<td>CH4508</td>
<td>Specialized project</td>
<td>2</td>
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<tr>
<td>CH5608</td>
<td>Good Manufacturing Practice (GMP)</td>
<td>2</td>
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<td>CH5609</td>
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<td>2</td>
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<td>CH5603</td>
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<td>CH5604</td>
<td>Specialized experiments</td>
<td>3</td>
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<td>CH5808</td>
<td>Graduation practice</td>
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2.10. **CHEMICAL AND PETRO-CHEMICAL PROCESS EQUIPMENT**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
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<tbody>
<tr>
<td>ME3061</td>
<td>Nguyên lý máy (Theory of Mechanisms and Machinery)</td>
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<tr>
<td>ME3091</td>
<td>Chỉ tiết máy (Machine Elements)</td>
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<tr>
<td>ME3131</td>
<td>Đồ án chi tiết máy (Project of Machine Element Design)</td>
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<td>ME2012</td>
<td>Đồ họa kỹ thuật 2 (Engineering Graphics 2)</td>
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<td>CH4640</td>
<td>Cơ sở tính toán thiết bị hóa chất (Fundamentals of Chemical Engineering</td>
<td>3</td>
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<td>CH4642</td>
<td>Cơ sở tính toán máy hoá chất (Fundamentals of Chemical Engineering Machine</td>
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<td>CH4628</td>
<td>Đồ án chuyên ngành cứu nhân Máy và Thiết bị công nghiệp hóa chất-dầu khí</td>
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<td>CH5650</td>
<td>Kỹ thuật phân riêng 1 (Separation Process Technology 1)</td>
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<td>CH5651</td>
<td>Kỹ thuật phân riêng 2 (Separation Process Technology 2)</td>
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<td>CH5652</td>
<td>Thiết bị phản ứng (Reactor Design)</td>
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<td>CH5658</td>
<td>Máy gia công vật liệu rắn (Solid Materials Processing Machinery)</td>
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<td>CH5659</td>
<td>Máy gia công vật liệu dẹo (Plastics Processing Machinery)</td>
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<td>Thiết kế thiết bị trao đổi nhiệt (Heat Exchanger Design)</td>
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<td>CH5654</td>
<td>Đồ án 3 (Project of Chemical Engineering Equipment Design 3)</td>
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<td>CH5809</td>
<td>Thực tập cuối khóa (Graduation Internship)</td>
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<td>List</td>
<td>compulsory electives package A</td>
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<td>CH4031</td>
<td>Additives for Petroleum Products (Phụ gia sản phẩm dầu mỏ)</td>
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<td>Equipment in Oil refineries (Thiết bị nhà máy lọc hóa dầu)</td>
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<td>CH4011</td>
<td>Piping and Tank (Đường ống bể chứa)</td>
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<td>Chemistry and Physico-chemistry of Polymers (Hóa học và Hóa lý Polyme)</td>
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<td>English for students of Petrochemical Technology. Tiếng Anh dành cho sinh viên</td>
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<td>Hóa học polyme phân hủy sinh học (Biodegradable Polymer Chemistry)</td>
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CH5259  Bí quyết về sinh học (Biomedical Polymer Chemistry) 2(2-0-0-4) .......... 65
CH5260  Bí quyết về silic (Silicon Chemistry)  2(2-1-0-4) ........................................ 66
CH5261  Công nghệ hóa học poly (Polymer Blend Engineering ) 2(2-0-0-4) . 66
CH5552  Tăng cường hoạt động của giấy viết (Paper writing) 2(1-0-4).................................. 66
CH5555  Tăng cường hoạt động của giấy viết (Paper writing) 2(1-0-4) .................................. 66
CH5605  Tăng cường hoạt động của giấy viết (Paper writing) 2(2-0-0-4) .................................. 67
CH5606  Tăng cường hoạt động của giấy viết (Paper writing) 2(2-0-0-4) .................................. 68
CH5607  Chất liệu và mỹ phẩm (Chất liệu và mỹ phẩm) 2(2-0-0-4) ................................. 68
List of compulsory electives package B .......................................................... 68
CH5306  Phân loại và Kỹ thuật (Surface finishing) 2(2-1-0-4) ............................................ 68
CH5307  Kỹ thuật hóa học (Chemical corrosion) 2(2-1-0-4) ............................................ 69
CH5308  Kỹ thuật hóa học (Chemical corrosion) 2(2-1-0-4) ............................................ 69
CH5309  Kỹ thuật hóa học (Chemical corrosion) 2(2-1-0-4) ............................................ 69
CH5310  Kỹ thuật hóa học (Chemical corrosion) 2(2-1-0-4) ............................................ 69
CH5311  Kỹ thuật hóa học (Chemical corrosion) 2(2-1-0-4) ............................................ 69
CH5312  Kỹ thuật hóa học (Chemical corrosion) 2(2-1-0-4) ............................................ 69
CH4192  Kỹ thuật hóa học (Chemical corrosion) 2(2-1-0-4) ............................................ 69
CH5359  Kỹ thuật hóa học (Chemical corrosion) 2(2-1-0-4) ............................................ 70
CH5360  Kỹ thuật hóa học (Chemical corrosion) 2(2-1-0-4) ............................................ 70
CH5361  Kỹ thuật hóa học (Chemical corrosion) 2(2-1-0-4) ............................................ 70
CH5362  Kỹ thuật hóa học (Chemical corrosion) 2(2-1-0-4) ............................................ 70
CH5363  Kỹ thuật hóa học (Chemical corrosion) 2(2-1-0-4) ............................................ 70
CH5364  Kỹ thuật hóa học (Chemical corrosion) 2(2-1-0-4) ............................................ 70
CH5404  Kỹ thuật hóa học (Chemical corrosion) 2(2-1-0-4) ............................................ 71
CH5405.  Kỹ thuật hóa học (Chemical corrosion) 2(2-1-0-4) ............................................ 71
CH5406  Kỹ thuật hóa học (Chemical corrosion) 2(2-1-0-4) ............................................ 71
CH5407  Kỹ thuật hóa học (Chemical corrosion) 2(2-1-0-4) ............................................ 71
CH5456  Kỹ thuật hóa học (Chemical corrosion) 2(2-1-0-4) ............................................ 71
CH5457  Kỹ thuật hóa học (Chemical corrosion) 2(2-1-0-4) ............................................ 71
CH5458  Kỹ thuật hóa học (Chemical corrosion) 2(2-1-0-4) ............................................ 71
CH5459  Kỹ thuật hóa học (Chemical corrosion) 2(2-1-0-4) ............................................ 71
CH5460  Kỹ thuật hóa học (Chemical corrosion) 2(2-1-0-4) ............................................ 72
List of compulsory electives package C .......................................................... 73
CH4363  Kỹ thuật điện (Electrical technology) 2(2-1-0-4) ............................................... 73
CH4382  Kỹ thuật điện (Electrical technology) 2(2-1-0-4) ............................................... 73
CH4380  Kỹ thuật điện (Electrical technology) 2(2-1-0-4) ............................................... 73
CH4368  Kỹ thuật cảnh báo (Safety and Environmental Engineering) ................. 74
CH5660  Kỹ thuật điện (Electrical technology) 2(2-1-0-4) ............................................... 74
CH5665  Kỹ thuật điện (Electrical technology) 2(2-1-0-4) ............................................... 74
CH5667  Kỹ thuật điện (Electrical technology) 2(2-1-0-4) ............................................... 74
CH3800  Kỹ thuật điện (Electrical technology) 2(2-1-0-4) ............................................... 75
UNDERGRADUATE PROGRAMME

Programme Title: Chemical Engineering
Level: Undergraduate
Major: Chemical Engineering
Programme Code: 52520301
Final Award: Bachelor/Engineer in Chemical Engineering

(Release at Decision No 561/QĐ -DHBK-ĐTĐH dated 25/04/2011 of HUST Rector)

1 Programme Objectives

The general goal of Chemical Engineering Programme is training highly qualified workforce with innovative thought, professional responsible, being able to adapt with working environment, having capability of self-learning and updating with incessant development of the science and technology, having health, political quality, awareness of serving people, for chemical engineering and related fields.

In details, the objective of this training programme is providing graduation students with knowledge specialized in application areas of chemical engineering, attaching special importance to development of calculation, design and technical capabilities in the study field, with skills of innovative thought, judgement, communication, and other professional ones. After a certain period of graduation, chemical engineers are expected to be successful in the following aspects:

(1) Becoming a proficient expert in chemical engineering, having capability of shaping idea, design, implement and operation of complicated and high-technological production lines.

(2) Being able to continue study at higher education levels (master, PhD).

(3) Having capability of leading, management with wide vision and knowledge on contemporary issues.

(4) Having professional working behaviour, ethic and social responsibility, capability of self-training and desire of long life studying.

2 Expected Learning Outcomes

1. Having strong core knowledge for adapting various works and positions in the field of chemical engineering, specifically

1.1. Application of general knowledge on mathematics, physics, chemistry, drawing, engineering drawing, foreign language, informatics, administration for dealing with chemical engineering issues.
1.2. Application of core knowledge on physical chemistry, inorganic chemistry, organic chemistry, analytical chemistry, instrumental analysis, chemical engineering for study, research, analysis and design processes, equipments in chemical engineering field.

1.3. Application of specialized knowledge for performance of experimental research, including design of experimental systems, implement of experiments, study on various chemical conversions in chemical engineering, by using mathematical & statistical tools in analysis and processing of experimental data.

1.4. Application of knowledge on simulation, modeling in combination with new and modern methods, devices for calculation, design, simulation and evaluation of technological solutions in chemical engineering field.

2. Having essential professional and personal qualities to be successful at work, including of

2.1. Judgement, analysis and giving solutions for technical issues; Testing, study and discovery knowledge;

2.2. System and critical thingking;

2.3. Self-motivation, innovation and seriourness;

2.4. Ethic, equity and professional responsibilities;

2.5. Conceiving of contemporary issues and awareness of long life learning.

3. Having essential social skills for effective working in multidiscipline and international environments, such as

3.1. Administrative, leading, and working skills in multidiscipline groups;

3.2. Effective communication skills through documentation, presentation, discussion, negotiation, self-control of all events, effective application of modern tools and devices;

3.3. Effective English practice at work, with TOEIC ≥ 450.

4. Having capability of conceiving, design, implementing and operating systems and propose of engineering solutions in the field of chemical engineering, meeting requirements of economical, social and environmental context, particularly

4.1. Conceiving of strong relations between technological solution and economical, social and environmental factors in the global context;

4.2. Having ability in conceiving and shaping idea of technological solution, participation in development of projects;

4.3. Having capability of participation in system design, technological processes, and product design and giving technological solutions for processing, production and application of chemicals and materials;

4.4. Participation in implementation of system, process, product design and giving technological solutions for processing, production and application of chemicals and materials;

4.5. Having capability of operation, development of instrumental systems, production lines for resulting expected products and test of technological solutions for improvement of effectiveness and productivity of processes.

5. Having suitable political quality, good ethic, awareness of serving people, health meeting requirements of development and defence of fatherland. This criterion is proved by political theory level, physical education certificate, and national defence – security education certificate according to General Regulations of the Ministry of Education and Training.

3 Standard length of study, mode of study and total credits

Mode and standard length of study: full time, 4 years for bachelor, 5 years for engineer
4 Admission criteria

Pupils who have successfully graduated from the National Highschool Graduation Exam with the benchmark of admission to HUST Chemical Engineering programme were calculated based on math, physics and chemistry test results.

5 Training procedure and Exit award requirements

The training procedure and award criteria follow the HUST Regulations of undergraduate training based on credit model. Students who enrolled the dual-degree programmes also have to comply with the Regulations of the second major of HUST

6 Grading

Letters (A, B, C, D, F) corresponding to grade point value (4; 3; 2; 1; 0), respectively are used for the assessment. The 10-point scale is used to evaluate the component grade (i.e. direct grade) of the course.

<table>
<thead>
<tr>
<th>10-point scale (component grade)</th>
<th>Equivalents in 4 point scale</th>
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<tr>
<td></td>
<td>In letters</td>
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<tr>
<td><strong>Pass</strong></td>
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<tr>
<td>From 9.5 to 10</td>
<td>A+</td>
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<tr>
<td>From 8.5 to 9.4</td>
<td>A</td>
</tr>
<tr>
<td>From 8.0 to 8.4</td>
<td>B+</td>
</tr>
<tr>
<td>From 7.0 to 7.9</td>
<td>B</td>
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<td>From 5.0 to 5.4</td>
<td>D+</td>
</tr>
<tr>
<td>From 4.0 to 4.9</td>
<td>D</td>
</tr>
<tr>
<td><strong>Fail</strong></td>
<td>From 0.0 to 3.9</td>
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</table>

* For the graduation internship or graduation project, students must get at least 5 points (in the 10 points scale) from each of them.

Total credits: 161-163
## Programme structure

<table>
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<tr>
<th>No</th>
<th>Modules</th>
<th>Bachelor Credit hours</th>
<th>Engineer Credit hours</th>
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<td>48</td>
<td>Required module for all majors of engineering</td>
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<td>1.1</td>
<td>Maths and Fundamental Science</td>
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<td>32</td>
<td>26 credits for all majors of engineering + 6 credits for chemical engineering</td>
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<tr>
<td>1.2</td>
<td>Political Theory</td>
<td>10</td>
<td>10</td>
<td>Follow Regulars of MOET. Physical education and National Defense and Security Education parts are not taken into account the total credit hours of the programme.</td>
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<td>Specialised module</td>
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<td>52-54</td>
<td>According to each specialization area</td>
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## COURSE LIST FOR THE CHEMICAL ENGINEERING PROGRAM

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| V-2-1 Specialized Orientation | 17TC |
| CH4090 Basic Physical Chemistry of Polymers | 2(2-0-0-4) | 2 |
| CH4092 Basic Polymer Chemistry | 3(3-0-1-6) | 3 |
| CH4094 Membrane and Paint Chemistry | 2(2-0-0-4) | 2 |
| CH4096 Rubber Technology | 2(2-0-0-4) | 2 |
| CH4098 Plastic Technology | 2(2-0-0-4) | 2 |
| CH4100 Polymer and Composite Materials | 2(2-0-0-4) | 2 |
| CH4074 Polymer Materials and Environment | 2(2-0-0-4) | 2 |
| CH4084 Senior Project | 2(0-0-4-4) | 2 |
| V-2-2 Specialized courses | 16TC |
| CH5250 Advance in Physical Chemistry of Polymer | 2(2-0-1-4) | 2 |
| CH5251 Advance in Chemistry of Polymer | 2(2-0-1-4) | 2 |
| CH5252 Paint Material Engineering | 2(2-0-1-4) | 2 |
| CH5253 Rubber Material Engineering | 2(2-0-1-4) | 2 |
| CH5254 Plastic Material Engineering | 2(2-0-0-4) | 2 |
| CH5255 Polymer-Composite Material Engineering | 2(2-0-1-4) | 2 |
| CH5256 Equipment and Instrument for Polymer Processing | 2(2-0-0-4) | 2 |
| CH5257 Project specialized in Polymer Engineering | 2(0-0-4-4) | 2 |
| V-2-3 Compulsory electives (Choose 8 credits from package A) | 8TC |
| CH5801 Graduation Internship | 3 TC | 3 |
| CH5901 Graduation Project | 9 TC | 9 |
| Total | 162 TC | 16 17 18 16 17 16 19 16 14 12 |
| V-3 | Technology of Electrochemical and Metal Protection | 52 TC |  |  |  |  |
|-----|--------------------------------------------------|-------|---|---|---|
| V-3-1 | Specialized Orientation | 17 TC |
| CH4150 | Theoretical electrochemistry | 4 (3-1-1-8) | 4 |  |  |
| CH4152 | Plating Technology | 3 (2-1-1-6) | 3 |  |  |
| CH4154 | Corrosion and Protection of Metals | 3 (2-1-1-6) | 3 |  |  |
| CH4156 | Electrowinning | 2 (2-1-0-4) | 2 |  |  |
| CH4158 | Chemical Power Sources | 3 (2-1-1-6) | 3 |  |  |
| CH4146 | Senior Project | 2 (0-0-4-4) | 2 |  |  |
| V-3-2 | Specialized courses | 15 TC |
| CH5300 | Surface Electrochemistry | 2 (2-1-0-4) | 2 |  |  |
| CH5301 | Electrochemical equipment and design methods | 4 (4-1-0-8) | 4 |  |  |
| CH5302 | Inorganic Electrosynthesis | 2 (2-1-0-4) | 2 |  |  |
| CH5303 | Organic Electrosynthesis | 2 (2-1-0-4) | 2 |  |  |
| CH5304 | Electrochemical Engineering Lab | 3 (0-0-6-6) | 3 |  |  |
| CH5305 | Project Specialized in Electrochemical Engineering | 2 (0-0-4-4) | 2 |  |  |
| V-3-3 | Compulsory electives (Choose 8 credits from package B) | 8 TC |
| CH5802 | Graduation Internship | 3 TC | 3 |  |  |
| CH5902 | Graduation Project | 9 TC | 9 |  |  |
| Total | 161 TC | 16 | 17 | 18 | 16 | 17 | 19 | 17 | 13 | 12 |

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**Note:** The table above provides a clear and organized representation of the course credits and their distribution across semesters. The numbers in commas represent the semesters, while the numbers without commas are the total credits for each course or package.
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<td>CH5606</td>
<td>Separation and Purification Techniques</td>
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<td>CH5607</td>
<td>Flavors and Cosmetics</td>
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<td>CH4042</td>
<td>Reactors in Refinery and Petrochemistry</td>
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<td>CH3800</td>
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**List of compulsory electives package B**

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<td>CH5307</td>
<td>Atmospheric Corrosion</td>
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<td>CH5308</td>
<td>Electrochemical Materials</td>
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<td>Electrochemical Measurement Techniques</td>
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<td>CH5310</td>
<td>Electrochemical Methods for Waste Water Treatment</td>
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<td>CH5311</td>
<td>Electrochemistry in non-aqueous electrolytes</td>
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<td>CH3800</td>
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<td>CH4192</td>
<td>Informatics and automation in silicate plants</td>
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<td>CH5359</td>
<td>Information and Automation in silicate industry 2</td>
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<td>Physical Chemistry of Silicates II</td>
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<td>CH5351</td>
<td>Processing Equipments in Silicate Industry 2</td>
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<td>Heating Equipments in Silicate Industry 2</td>
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<td>CH5363</td>
<td>Advanced Ceramic Materials</td>
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<td>CH5364</td>
<td>AutoCAD for Designing of Silicate Factories</td>
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<td>Uranium Technology</td>
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<td>CH5405</td>
<td>Chemistry and Technology of Rare Earth Materials</td>
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<td>CH5406</td>
<td>Chemistry of Nano Materials</td>
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<td>CH5407</td>
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<td>Colloid chemistry</td>
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<td>CH5457</td>
<td>Conductive Polymer Materials</td>
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<td>CH5458</td>
<td>Application of Catalyst in New Technology and Environmental Protection</td>
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<td>CH5459</td>
<td>Application of Complexes</td>
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<td>CH5460</td>
<td>Materials for New Energy Sources</td>
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**List of compulsory electives package C**

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<td>CH4382</td>
<td>Industrial Waste Treatment</td>
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<td>CH4380</td>
<td>Heat and Mass Transfer of Complex Systems</td>
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<td>CH4368</td>
<td>Fluid Process and Mechanical Separation of Heterogenous Systems</td>
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<td>CH5502</td>
<td>Design of Thermal Connection Systems</td>
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<td>CH5655</td>
<td>Pumps - Fans - Compressors</td>
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<td>Pipeline Engineering</td>
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<td>CH5657</td>
<td>Design and Installation of Chemical Plants</td>
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<tr>
<td>CH5660</td>
<td>Safety and Environmental Engineering</td>
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OUTLINE OF ALL COURSES IN CHEMICAL ENGINEERING

I. GENERAL EDUCATION

MI1110  Analysis I (Giải tích I)  4(3-2-0-8)

Provide students the basic knowledge on univariable and multivariable functions.

MI1120  Analysis II (Giải tích II)  3(2-2-0-6)

Pre-requisite: MI1110 (Analysis I)

Provide students basic knowledge on parameter-dependent integrals, multiple (2 or 3) integrals, techniques of integration, linear integrals and surface integrals. Application of differentiation in geometry, Field theory.

MI1130  Analysis III (Giải tích III)  3(2-2-0-6)

Pre-requisite: MI1110 (Analysis I)

Provide students basic knowledge on sequences, series, series of functions: power series, Fourier series, first-order differential equations, second-order differential equations and System of first-order differential equations

MI1140  Algebra (Đại số)  4(3-2-0-8)

Provide students basic knowledge on matrix theory, determinants and linear maps. Logic; category theory and mapping; the field of complex number; some concepts of conic sections and quadric surfaces

PH1110  Physics I (Vật lý I)  3(2-1-1-6)

Goals: Provide students basic knowledge on General Physics (Mechanical and Thermal) for further study in Engineering.

Description:

Momentum, theorem and principles of momentum; angular momentum , theorems and principles of angular momentum ; kinetic energy , potential energy and the Law of Conservation of Mechanical Energy. Their application to rotation of rigid bodies, oscillations and mechanical waves. Kinetic molecular theory used statistics to explain and calculate the quantities : temperature, pressure, internal energy ( ideal gases ). the application of the Law of conservation of energy to thermal transition processes. Considering the direction of the thermal processes, and the principle of entropy increase.

PH1120  Physics II (Vật lý II)  3(2-1-1-6)

Pre-requisite: MI1110 (Analysis I) or equivenlent
Goals: Provide students basic knowledge on General Physics (Electric and Magnetic) for further study in Engineering.

Description: An electric field and a magnetic field: Properties and characteristic quantities (intensity, voltage, magnetic flux, ..); related principles and laws. Interaction between the fields and matters. Relationship between the magnetic and electric fields, an electromagnetic field and application to oscillations and electromagnetic waves.

IT1110  Introduction to Computer Science (Tin học đại cương) 4(3-1-1-8)
Goal: Provide students the basic knowledge about the structure and organization of a computer, computer programming and the way to perform a program; basic skills to effectively use computers in study, research and work in engineering and technologies.


EM1010  Introduction to Management (Quản trị học đại cương) 2(2-0-0-4)
Goals: Provide students basic knowledge and skills on management of company activities.

Course Description: The role of the enterprise management, methods to perform each type of activities, and enterprise managers.

FL1101  English I (Tiếng Anh I) 3(0-6-0-6)
Prerequisites: successfully completed Elementary English corresponding to TOEIC 250.
Objectives: After finish this course, students will get the following achievements:
- Improvement of his/her English level to the equivalent of 290 TOEIC scores.
- Development of all four language skills.
- Development of required skills to do the TOEIC test well.
- Development of vocabulary in daily situations and in the work environment
- Improvement of his/her understanding of common English grammar
- Getting used to international phonetic notation to improve the standard English pronunciation.

Content: This module is intended for students who have successfully completed a high school English language study, that equivalents to a basic level, or to TOEIC score of 250. The module provides students with access to English communication through combination skills including basic listening, speaking, reading, writing skills and grammar in the New Headway - Pre Intermediate textbook. The course also helps students familiarize themselves with useful strategies to access the common principles of a TOEIC test. In addition, the course also provides supplemental exercises for TOEIC test and listening skills and writing skills.

FL1102  English II (Tiếng Anh II) 3(0-6-0-6)
Prerequisites: FL1101 or certificate of English equivalent to 290 TOEIC scores.
Objectives: After finish this course, students will get the following achievements:
- Improvement of his/her English level to the equivalent of 330 TOEIC scores.
- Development of all language skills.
- Development of required skills to do the TOEIC test well.
- Development of vocabulary in daily situations and in the work environment
- Improvement of team work and independent working ability
- Improvement of his/her understanding of common English grammar
- Comprehension of different cultures.

**Content:** This module is intended for students who have successfully completed pre-intermediate level of English. The module provides students with access to English communication through integrated skills including basic listening, speaking, reading, writing and grammar in the New Headway - Pre Intermediate textbook, 3rd edition. The course also provides students strategies to do a TOEIC test. Supplemental exercises designed according to TOEIC test and listening skills and writing skills to help studen directly practice the skills.

**CH1010 General Chemistry (Hóa học đại cương) 3(2-1-1-6)**

**Prerequisites:** Maths, PH1110 (Physics I), PH1120 (Physics II)

**Goals:** After this course, students can be able to understand the basic knowledge on atomic, molecular structure and chemical bonds; practice critical thinking and prepare further studies; The course provide students the concepts, fundamental laws in chemical thermodynamics, electrochemistry, chemical kinetics and solution. Students can apply them to solve specific problems in many areas

**Course description:**

This course provides the foundation in concepts in: atomic and molecular structure, bonding, Lewis theory, the basic knowledge in valence bond (VB) theory and molecular orbital (MO) theory: the formation of bonding in complexes; an introduction to crystal types (ionic, atomic, molecular, and metallic), changes in quantities such as ΔU, ΔH, ΔS, ΔG,.. of chemical reactions and processes, spontaneity of a process and the conditions of an equilibrium, chemical equilibria and aqueous solution equilibria,: acid-base equilibrium, ionic equilibrium, complex formation equilibrium, reaction profiles and kinetics, structure, reactivity and mechanisms, interaction between redox reactions and current, gavanic cells and electrolysis. A number of exercises is required. Practicum.

**MI3180 Experimental Probability and Statistics (Xác suất thống kê và QHTN) 3(3-1-0-6)**

**Prerequisites:** MI1120 (Analysis II), MI1140 (Algebra)

**Course description:** This course provides the fundamentals of probability and statistics (random variables (one dimension and multidimension) including: Probability Distribution Laws, numerical characteristics, limit theorems, parameter estimation, hypothesis testing). Basic concepts of experimental design (least squares, orthogonal design experimental design to find the extremes)

2. **CORE AND FUNDAMENTAL COURSES**

**ME2015 Basic Engineering Graphics (Đồ họa kỹ thuật cơ bản) 3(3-1-0-6)**

**Prerequisites:** None

**Goals:** This course provides students with the basic knowledge of the projection geometry (the basis of technical drawing) and basic engineering drawing.
Content: Technical drawing: projection, representation of geometry, secondary projection and identification of the image; allocation of objects; Basic engineering drawing: standards in engineering drawing, flat drawing, projection, cut, cross-section, axes projection, 2D to 3D reading, drawing details and grafts, simple installation

CH2000 Introductory to Chemical Engineering (Nhập môn kỹ thuật hóa học) 3(2-1-1-4)
Prerequisites: None
Goals: The aims of course is to stimulate students’ interest in the field of chemical engineering, promote them to understand the connection between Maths, basic sciences and engineering courses, and the application of these courses in real industrial environment. Students are engaged in the industrial workspace to have a start to develop their personal, professional and social skills such as self discovery of knowledge, problem solving, time management and team work
Course description: Introduction to engineering design through a discipline-specific team project. Students will learn and apply professional engineering concepts and issues including: sustainability, safety, estimation, materials selection, decision making, project management, literature survey, communication (graphics, written, and oral), ethics, and prototyping (building). The course provides an introduction to chemical engineering as a profession field.

CH3120 Inorganic Chemistry (Hóa vô cơ) 3 (3-1-0-6)
Prerequisites: CH1010 (General Chemistry)
Course Description: The periodic variation of element properties in a group or in a row in the periodic table; The knowledge of chemical bonding and molecular structure in organic material; Direction of inorganic chemical reactions; Chemistry of main group elements and their compounds

CH3130 Inorganic Chemistry Lab (Thí nghiệm hóa vô cơ) 1 (0-0-2-2)
Prerequisites: CH1010 (General Chemistry), CH3120 (Inorganic Chemistry)
Course description:
Practicum 1 : Hydrogen and halogen
Practicum 2 : Oxygen and sulfur
Practicum 3 : Group VA
Practicum 4 : The groups IVA , IIIA , IIA and IA
Practicum 5 : The groups IVA , IIIA , IIA and IA (continued )
Practicum 6 : The properties of the d transition elements
Practicum 7 : The properties of the d transition elements (continued )
Practicum 8 : The properties of the d transition elements (continued )

CH3220 Organic Chemistry (Hóa hữu cơ) 4 (4-1-0-8)
Prerequisites: CH1010 (General Chemistry)
Goals: To provide students with basic knowledge of the theoretical basis of organic chemistry, the relationship between the structure and reactivity of organic compounds, the method to prepare and purify the most important organic compounds. Initially provides students with research methods, separation, purification and quantification of organic compounds; The first step is to train students
how to prepare, synthesize a several basic organic compounds, as well as how to do research in organic chemistry.

**Course description:** An introduction to organic chemistry: basic concepts of structure, isomers, nomenclature. Classification of organic reactions. The hybrid state of carbon atoms in organic chemistry, the nature of the $\sigma$ and $\pi$ bonds. Thermodynamics, kinetics, and effects applied to explain the mechanisms and properties of organic compounds. The preparation methods and chemical properties of acyclic and cyclic compounds.

**CH3230 Organic Chemistry Lab (Thí nghiệm Hóa hữu cơ) 1 (0-0-2-2)**

**Co-requisites:** CH3220 (Organic Chemistry)

**Course description:** The experiments on extraction, purification, preparation and synthesis of several organic compounds

**CH3050 Physical Chemistry 1 (Hóa lý 1) 2 (2-1-0-4)**

**Prerequisites:** CH1010 (General Chemistry)

**Course description:** Fundamental quantum mechanics: properties and characteristics of particle movement, wave functions, Schrodinger equation, and operators in quantum mechanics. Molecular structure and chemical bonding: types of chemical bonds, valence bonding method, molecular orbital method, chemical bond in complexes and evaluation of reaction ability by chemical quantum chemical method. Fundamental thermodynamics: thermal energies, spontaneity of a chemical reaction, or a physical process. Chemical equilibrium and effective factors. The applications of chemical thermodynamics in real chemical processes. Background on phase equilibrium in pure substance and multi-components, molelar solutions.

**CH3052 Physical Chemistry Lab 1 (Thí nghiệm Hóa lý 1) 1 (0-0-2-2)**

Prerequisites: CH1010 (General Chemistry); Co-requisites: CH3050 (Physical Chemistry 1)

**Course Description:**

Practicum 1: Chemical heat
Practicum 2: Vapour pressure
Practicum 3: Determination of molecular mass of a substance
Practicum 4: Distribution Law
Practicum 5: Two partially miscible liquids
Practicum 6: Chemical equilibrium
Practicum 7: Liquid-vapour equilibrium
Practicum 8: Distillation process

**CH3060 Physical Chemistry 2 (Hóa lý 2) 3 (3-1-0-6)**

**Prerequisites:** CH3050 (Physical Chemistry 1)

**Goals:** After this course, students can be able to get fundamental and modern knowledge of:
- Kinetic rules, mechanism, optimal conditions of a chemical reaction in nature, in lab, and in industries as well as in life.
- Electrolytes, electrodes and cells, kinetics of electrode reactions and their applications.
- Dispersion systems and surficial phenomena relating to chemical technology.

**Course description:** Kinetics, including reaction mechanism, chain reactions, polymerisation reactions and collision theory. Phase transitions, vapour pressure, solutions, interfaces, surface tension, wetting, absorption, surfactants, Gibbs adsorption isotherm, micelles, and adsorption at gas/solid interface, heterogeneous catalysis, and insoluble monolayers.

**CH3062 Physical Chemistry Lab 2 (Thí nghiệm Hóa lý 2)**

**Prerequisites:** CH1010 (General Chemistry), CH3050 (Physical Chemistry 1)

**Co-requisites:** CH3060 (Physical Chemistry)

**Goals:** After this course, the students can be able to define electrochemical phenomena, surface physical chemistry, methods to determined reaction rates and other kinetic parameters; to apply to determine parameters in electrochemistry, adsorption and colloid.

**Course description:**

Experiments on kinetics, adsorption and surface tension

Practicum 1: Kinetics of a pseudo-first order reaction
Practicum 2: Adsorption
Practicum 3: Electrode potential and cell electromotive force (EMF)
Practicum 4: Solution conductivity
Practicum 5: Viscosity of polymeric solutions
Practicum 6: Kinetics of hydrogen peroxide decomposition
Practicum 7: Transport number
Practicum 8: Preparation and coagulation of a colloid

**CH3330 Analytical Chemistry (Hóa phân tích) 2 (2-1-0-4)**

**Prerequisites:** CH1010 (General Chemistry)

**Course description:** This course provides the principles of analytical chemistry including acid-base equilibrium, complexes properties, redox reaction and precipitation and their applications in volumetric and gravimetric analysis and how these principles are applied in chemistry and related disciplines especially in life sciences and environmental science.

**CH3340 Analytical Chemistry Lab (Thí nghiệm Hóa phân tích) 2 (0-0-4-4)**

**Prerequisites:** CH1010 (General Chemistry), CH3330 (Analytical Chemistry)

**Description Course:** This course provides the principles and practical works of volumetric and gravimetric procedures and experiments to obtain quantitative information about the substances that have relevance to both fundamental understanding as well as applications in life sciences and environmental science. In addition, this course introduces the basic regulatory requirements of good laboratory practice and safety. It also aims at improving the required techniques of the students to
meet the requirements of quantitative analysis. This course presents 30 experiments in Analytical Chemistry Lab.

**CH3323 Instrumental Methods of Analysis (PHương pháp phân tích bằng công cụ)**
2(2-1-0-4)
Prerequisites: CH3330 (Analytical Chemistry), CH3340 (Analytical Chemistry Lab), CH3320 (Organic Chemistry); CH3060 (Physical Chemistry 2)
**Course description:** This course introduces principles of instrumentation followed by the instrumental techniques such as UV-VIS spectroscopy, atomic emission spectroscopy, atomic absorption spectroscopy, potentiometry, electrogravimetric, voltammetry, gas chromatography etc. Further we will know about the advantages and limitations of instrumental analysis.

**CH3324 Instrumental Methods of Analysis Lab (Thực hành phân tích bằng công cụ)**
1(0-0-2-2)
Prerequisites: CH3330 (Analytical Chemistry), CH3340 (Analytical Chemistry Lab), CH3320 (Organic Chemistry); CH3060 (Physical Chemistry 2)
Co-requisites: CH3323 (Instrumental Methods of Analysis)
**Course description:** This course provides the instrumental analytics conveys an overview of important methods of analysis including several modern and common experiments to support the knowledge obtaining from the course CH3323. This course presents 12 experiments in Instrumental Methods of Analysis Lab. They consist of the classical curriculum used at universities and universities of applied sciences with spectrometric methods, chromatographic procedures, atom spectrometric methods, potentiometric titration, electrogravimetric, voltammetric analysis.

**CH3400 Chemical Process Engineering 1 (Hydraulic processes, Pump, Fan, Compressor)**
Quá trình và Thiết bị CN Hóa học 1 (Các quá trình thủy lực và thủy cơ) 3 (3-1-0-6)
**Course description:** This subject presents the principle of hydrostatic and hydrodynamic of fluid, principle equations of fluid, fluid hydrodynamic in tube and different equipment, frictional and partial resistances. Separation of the gas and liquid heterogeneous mixture; Operation and description of pump, fan, and compressor; Operation and description of separation of heterogeneous mixture such sedimentation, filtration, centrifugation processes are studied. Otherwise, brief knowledge of mechanical processes such as crushing, milling and screening process is also presented.

**CH3412 Chemical Process Engineering 2 (Heat transfer) (Quá trình và Thiết bị CN Hóa học 2, các quá trình Nhiệt) 2(2-1-0-4)**
Pre-requisites: CH3400 (Chemical Process Engineering 1)
**Course description:** This subject presents the principle of heat transfer such as heat exchange, heat conduction, heat convection, and heat radiation. Detailed heat transfers such as heating, condensing, and cooling processes including operation and description of heat exchangers are described. Single and multi-effect evaporation processes are studied. Design of heat network applying heat integration is mentioned.
**CH3420 Chemical Process Engineering 3 (Mass transfer) (Quá trình và Thiết bị CN Hóa học 3) (Các quá trình chuyển khối) 3 (3-1-0-6)**

**Pre-requisites:** Physical Chemistry, CH3400 Chemical Process Engineering 1; CH3412 (Chemical Process Engineering 2)

**Objectives:** This course will introduce the theory of mass transfer, processes and equipment of mass transfer in chemical industry. This course requires student understanding the theory, structure and operation of mass transfer units such as distillation columns, absorption columns, adsorbers, crystallizers, dryers

**Course description:** This subject presents the theory of mass transfer, phase equilibrium, calculation of the basic sizes of mass transfer equipment. Methodologies and applications of distillation, absorption, extraction, crystallization, adsorption, and drying processes are studied.

**CH3480 Chemical Process Engineering Lab 1** 1(0-0-2-2)

**Prerequisites:** CH3400 (Chemical Engineering 1: Hydraulic processes, Pump, Fan, Compressor)

**Course description:**

**Goals:** This course consolidates knowledge of processes and hydraulic units, equips for student the experiment methodology, equipment operation, data measurement and data treatment.

**Contents:** 5 experiments: 1- Flow regime determination; 2- Centrifugal pump; 3- Tube drag; 4- Rotary vacuum-drum filter; 5- Velocity profile.

**CH3490 Chemical Process Engineering Lab 2** 1(0-0-2-2)

**Prerequisites:** CH3420 (Chemical Engineering 3: Mass transfer)

**Course description:**

**Goals:** This course consolidates knowledge of mass and heat transfers, equips for student the experiment methodology, equipment operation, data measurement and data treatment.

**Contents:** 3 experiments: 1- distillation; 2-Multi-effect evaporation; 3-Convection drying

**CH3440 Project in Chemical Engineering (Đồ án Quá trình và Thiết bị CN Hóa học)**

2 (0-0-4-4)

**Pre-requisites:** ME2015 (Basic Engineering Graphics), CH3420 (Chemical Engineering 3: Mass transfer)

**Course description:** Students will complete one of projects of calculation distillation, or multi-effect evaporation, or drying process. In this project, the equipment sizes, operation conditions are determined and detailed engineering draws are completed

**CH3454 Numerical Methods in Chemical Engineering (Phương pháp số trong CN Hóa học)**

2 (2-0-1-4)

**Objectives:** Students have to complete a project design of one of these processes: distillation, multi-effect evaporation, and drying processes. This course requires student applying knowledge of chemical engineering, technical drawing to calculation the given chemical process, equipment sizes, utility… and complete the technical drawings of main units in the process. Each student is assigned to evaluate and design a different technology and prepare a final design report
Course description: Students will complete one of projects of calculation distillation, or multi-effect evaporation, or drying process. In this project, the equipment sizes, operation conditions are determined and detailed engineering draws are completed.

CH3452 Simulation in Chemical Engineering (Mô phỏng trong CN Hóa học) 3(2-0-2-6)
Prerequisites: CH3454 (Numerical Methods in Chemical Engineering)

Course description: Introduction to ASPEN, HYSYS software,… (based on data and software) and applications in chemical technogies.

CH3456 Applied Mechanics (Cơ khí ứng dụng) 3 (3-1-0-6)
Objectives: After taking the course, students comprehend fundamentals of materials of construction for equipment/machinery manufacturing, mechanical processing techniques, mechanical elements, mechanical transitions, and pressure vessels so that they can figure out by themselves operation principles and manufacturing abilities of equipment/machinery used in chemical industry.

Content: The course provides background of materials of construction including mechanical properties and applications in chemical engineering, motion fundamentals of mechanisms, typical mechanical elements, principles of mechanical processing, fundamentals of mechanical transition, structure, manufacturing and testing procedures of high pressure vessels.

CH3900 Engineering Practicum (Thực tập kỹ thuật) 2 (0-0-4-4)
Course description: Consider general information of a company or an industrial manufacturer; Survey and evaluate raw materials (material specification, criteria, and suppliers), qualify the products. Analysis and evaluate the production line, the control system, operation units, the organization of the factory premises, the procedure of waste treatment and the water treatment system. The organization of production and the general management in the company.

2. LIST OF SPECIALIZED COURSES (PHÂN TỰ CHỌN THEO ĐỊNH HƯỚNG)
3.1. ORGANIC-PETROCHEMICAL TECHNOLOGY (ĐỊNH HƯỚNG CÔNG NGHỆ HỮU CƠ HÓA DÀU)

CH4032 Oil and Gas Chemistry (Hóa học dầu mỏ và khí) 2 (2-1-0-4)
Prerequisites: CH3120 (Inorganic Chemistry), CH3330 (Analytical Chemistry), CH3220 (Organic Chemistry)

Course description: This course consists of two major parts:
1 - Chemistry of crude oil: it provides knowledge related to the classification of crude oil; hydrocarbon and non-hydrocarbon components of crude oil; applications of the petroleum segments; determination of the physico-chemical characteristics of crude oil and crude oil segments; Qualification of crude oil. 2 – Chemistry of crude oil processing, including the processing, such as catalytic cracking, hydrocracking, catalytic reforming, isomerization, alkylation, polymerisation, aromatase; zeolites and its catalytic role in the oil refinery; Introduction ot Vietnam crude oil.
CH4030 Kinetics and catalysis (Động học xúc tác) 2 (2-1-0-4)

**Course description:** This course provides an understanding of Kinetics of homogenous catalysis, types of homogeneous catalysts, the mechanism of homogeneous catalysis and its applications; Kinetics of heterogeneous catalysis, heterogeneous catalysts, especially porous and solid catalysts; Theories of catalysts; industrial catalysts.

CH4042 Reactors in Refinery and Petro-chemistry (Thiết bị tổng hợp hữu cơ hóa dầu) 2 (2-1-0-4)

**Course description:** This course provide students concepts, classification, basic characteristics of the reactors in organic synthesis and petrochemical processes; Calculation of major parameters of typical reactors; Introduction and characterization of several kinds of typical reactors in organic synthesis and petrochemical industry.

CH4040 Organic Synthesis and Petrochemical Processes (Công nghệ tổng hợp hữu cơ – hóa dầu) 2 (2-1-0-4)

Prerequisite: CH3420 (Chemical Process Engineering 3)
Corequisite: CH4032 (Petroleum and Gas Chemistry); CH4030 (Kinetics and catalysis); CH4042 (Reactors in Refinery and Petro-chemistry)

**Course description:** This course provides an understanding of the technology of basic organic and petrochemical synthesis, chemistry, catalysts, kinetics and thermodynamics of organic reactions, physical methods of separation…. The production and application of olefin (ethylene, propylene, butene…), aromatic hydrocarbons (benzene, p-xylene…), synthetic gas, hydrogen, methanol, amonia, acetylene,… from natural gas, LPG, naphtha…, for example: steam cracking, catalytic reforming, steam reforming etc…..

CH4036 Oil refining processes (Công nghệ chế biến dầu) 3 (3-1-0-6)

Prerequisite: CH3420 (Chemical Process Engineering 3); CH4030 (Kinetics and catalysis); CH4032 (Petroleum and Gas Chemistry); CH4040 (Organic Synthesis and Petrochemical Technology)
Corequisite: CH4042 (Reactors in Refinery and Petro-chemistry)

**Course description:** This course provides students basic knowledge on crude oil such as its chemical composition, properties of crude oil, the most important processes in oil refining: atmospheric Distillation, vacuum distillation, thermal cracking, catalytic cracking, catalytic reforming and lubricants production technology..

CH4038 Gas Processing Technology (Công nghệ chế biến khí) 2 (2-1-0-4)

Prerequisite: CH3420 (Chemical Process Engineering 3)
Corequisites: CH4032 (Petroleum and Gas Chemistry); CH4030 (Kinetics and catalysis); CH4042 (Reactors in Refinery and Petro-chemistry)

**Course description:** This course provide students basic knowledge on natural gas and associated gas, the method to determine important parameters using in calculations and design of gas processing plant. The fundamental processing technology of natural gas and associated gas, including gas treating, light hydrocarbons separating to produce valuable raw materials for petrochemical and organic synthesis.
CH4034 Petroleum Products (Sản phẩm dầu mỏ) 2 (2-0-0-4)

Course description: This course provides student with classification, specification of petroleum products, the test methods for petroleum products. Introduction, classification and specification of fuels, lubricants, bitumen and other products..

CH4026 Project - plant design (Đồ án chuyên ngành) 2 (0-0-4-4)
- Prerequisite: CH4040 (Organic Synthesis and Petrochemical Technology)
- Corequisite: CH4038 (Gas Processing Technology), CH4036 (Oil refining processes)

Course description: This course provides student with process review, mass balance and heat balance, equipment and plant design of oil refining and petrochemical processes. Students will learn to interpret the process flow diagrams.

CH5200 Green Fuels (Nhiên liệu sạch) 2 (2-1-0-4)
Prerequisites: CH3220 (Organic Chemistry), CH4032 (Petroleum and Gas Chemistry)

Course description: The course provide knowledge of environmentally friendly fuels, which are mainly biofuels as ethanol gasoline, biodiesel, biomass, hydrogen fuel. In addition, mineral fuel in form of emulsion is known as a green fuel, easy to make and economically effective.

CH5201 Technology for Synthesis of Petrochemical Intermediates (Tổng hợp hợp chất trung gian) 2 (2-1-0-4)
Pre-requisite: CH4040 (Organic Synthesis and Petrochemical Technology)

Course description: Chemistry and technology of oxidation, hydrogenation, dehydrogenation, alkylation, hydroformylation, carbylontation, sulphonation, nitratration, hydration-dehydration, esterification, hydrolysis, ...to produce monomers for chemicals, pharmaceuticals, detergents and surfactants, pesticides, pigments, explosives, polymers, petroleum additives.

CH5202 Solid Fuel (Nhiên liệu rắn) 2 (2-1-0-4)

Course description: Overview of solid fuels (coal, biomass and municipal waste) of Vietnam, characterization and and their use in industry; The chemical composition of solid fuels; The method of evaluating the quality of solid fuels; Technological use of solid fuel to produce electricity, thermal energy or conversion to oil and gas …; Principal of the combustion, gasification; pyrolysis, liquidation process is introduced.

CH5203 Petroleum Chemistry and Products (Hóa học và sản phẩm dầu) 2 (2-1-0-4)
Pre-requisite: CH4032 (Petroleum and Gas Chemistry)
Corequisite: CH4034 (Petroleum Products)

Course description: The course provide students with the knowledge of the chemistry of the petroleum processing in modern refinery to produce high-quality petroleum products. The course also provides basic physicochemical properties of petroleum products such as, jet fuel, lubricants, bitumen and some common additives for petroleum products.

CH5204 Oil and Gas Processing Technologies (Công nghệ chế biến dầu và khí) 2 (2-1-0-4)
Pre-requisite: CH4038 (Gas Processing Technology), CH4036 (Petroleum Processing Technology)

Course description: This course provides an understanding of the different aspects found in the hydrocarbon based energy industry from the source to end-products, the influence of the
composition and the fundamental properties of oil to the oil refining industry, process manuals of the main units in refinery, operating procedure, troubleshooting of major equipment, material balance and heat balance of the main equipment in the oil and gas processing plant.

**CH5205 Petroleum laboratory testing (Thí nghiệm chuyên ngành)** 3 (0-0-6-6)

**Corequisite:** CH4034 (Petroleum Products)

**Course description:**
This course introduces the students to laboratory testing of petroleum samples using standard methods. Laboratory work includes the analysis of physical and chemical properties of petroleum and petroleum products using ASTM and TCVN methods, and the analysis of hydrocarbon samples by gas chromatography.

**CH5206 Petrochemical Process Design Engineering Project (Đồ án chuyên ngành kỹ sư hóa dầu)** 2 (0-0-4-4)

**Pre-requisite:** CH4038 (Gas processing technology), CH4036 (Petroleum processing technology)

**Course description:** Process Design Engineering is the inclusive practice of design, operation, optimization and control of refining and petrochemical processes. It focuses on the design or simulation of major units or equipments in the refinery, gas processing or petrochemical plant.

**CH5800 Graduation Internship (Thực tập cuối khóa)** 3(0-0-6-6)

**Pre-requisite:** CH4038 (Công nghệ chế biến khí), CH4036 (Công nghệ chế biến dầu); CH4040 (Công nghệ tổng hợp hữu cơ – hóa dầu)

**Course description:** The students are required to learn the regulations on safety, discipline, risk assessment in a real plant, safety and fire control; raw materials and products; technological production line, the optimal technological conditions, catalysts, productivity; learn about automation, automated control of technological processes; Understand the structure and function of devices; Know how to test and evaluate product quality in accordance with ASTM and ISO, troubleshooting and utility…..

**2.2. POLYMER - COMPOSITE MATERIAL TECHNOLOGY (KỸ SƯ CÔNG NGHỆ POLYME – COMPOZIT)**

**CH4090 Hóa lý polyme cơ sở (Basic Physical Chemistry of Polymers)** 2 (2-0-0-4)

**Pre-requisites:** CH3220 (organic chemistry); CH3060 (Physical chemistry 2)

**Corequisites:** CH4092 (basic polymer chemistry)

**Course description:** This course provide students concepts, physical properties of polymers as well as their behavior during processing and applications.

**CH4092 Hóa học polyme cơ sở (Basic Polymer Chemistry)** 3 (3-0-1-6)

**Pre-requisites:** CH3220 (organic chemistry); CH3060 (Physical chemistry 2)

**Corequisites:** CH4090 Basic Physical Chemistry of Polymers

**Course description:** This course provide students methods for synthesy, modifying and processing polymers including as basic concepts, ionic polymerrization, free radicals polymerrization, condensation and modifying.
CH4094 Hóa học các chất tạo màng và sơn (Membrane and Paint Chemistry) 2 (2-0-0-4)
Pre-requisites: CH3220 (organic chemistry); CH3060 (Physical chemistry 2)
Course description: This course provide students methods for synthesys and modifying polymer membrane, testing methods and preparation methods. Students are also provided knowledge about kind of paints and constituents as pigments, solvents, additives.

CH4096 Công nghệ cao su (Rubber Technology) 2 (2-0-0-4)
Pre-requisites: CH3220 (organic chemistry), CH3060 (Physical chemistry 2), CH3412 (Chemical Process Engineering 2)
Course description: Chemistry and technology for syntheses rubbers, additives, curing methods and testing physical properties of finished products.

CH4098 Công nghệ chất dẻo (Plastic Technology) 2 (2-0-0-4)
Pre-requisite: CH3220 (organic chemistry); CH3060 (Physical chemistry 2), CH3412 (Chemical Process Engineering 2)
Course description: This course provide students basic methods for syntheses and processing plastics. After this course, students will have knowledge about processing machines and equipments.

CH4100 Công nghệ vật liệu polyme-compozit (Polymer and Composite Materials) 2 (2-0-0-4)
Pre-requisite: CH3220 (organic chemistry); CH3060 (Physical chemistry 2), CH3412 (Chemical Process Engineering 2)
Course description: This course provide students basic concepts of polymers composite materials: matrix, reinforced fibers, additives, fillers and testing, processing methods for producing composite materials.

CH4074 Môi trường trong gia công vật liệu polyme và compozit (Polymer Materials and Environment) 2 (2-0-0-4)
Pre-requisite: CH4090 (basic polymer chemistry); CH4092 (basic physical chemistry of polymer)
Course description: This course provide students basic concepts of environment problems in industry during producing and processing polymer composite materials.

CH4084 Đồ án chuyên ngành cử nhân CN Polyme-Compozit (Senior Project) 2 (0-0-4-4)
Course description: Design: workshop, factory in polymer synthesis.

CH5250 Hóa lý polyme nâng cao (Advance in Physical Chemistry of Polymer) 2(2-0-1-4)
Course description: This course provide students basic states, physical properties of amorphous, crystal and solution polymers.

CH5251 Hóa học polyme nâng cao (Advance in Chemistry of Polymer)
Pre-requisite: CH4092 (basic polymer chemistry); CH4090 (basic physical chemistry of polymer)
Course description: This course provide students basic and advanced reactions occurred during syntheses, modifying and processing polymers including as basic concepts, ionic polymerrization, free radicals polymerrization, condensation and modifying polymers and methods for preventing polymers from aging.
CH5252  Kỹ thuật vật liệu sơn (Paint Material Engineering) 2 (2-0-1-4)
Course description: This course provides students methods for synthesys and modifying polymer membrane, testing methods and preparation methods. Students are also provided knowledge about kind of paints and constituents as pigments, solvents, additives.

CH5253  Kỹ thuật vật liệu cao su (Rubber Material Engineering) 2 (2-0-1-4)
Pre-requisite: CH4092 (basic polymer chemistry); CH4090 (basic physical chemistry of polymer)
Course description: This course provides students advanced chemistry and technology for syntheses and natural rubbers, blended rubbers. The influence of additives, fillers, anti aging additives are also presented in this course.

CH5254  Kỹ thuật vật liệu chất dẻo (Plastic Material Engineering) 2 (2-0-0-4)
Pre-requisite: CH4092 (basic polymer chemistry); CH4090 (basic physical chemistry of polymer)
Course description: This course provides students basic concept of plastics, methods for syntheses and processing plastics. After this course, students will have knowledge about processing machines and equipments.

CH5255  Kỹ thuật vật liệu polyme composit (Polymer composite Material Engineering) 2 (2-0-1-4)
Pre-requisite: CH4092 (basic polymer chemistry); CH4090 (basic physical chemistry of polymer)
Course description: This course provides students the influence of nano filler on the physical – mechanical properties of polymer composite materials including: methods for making nano polymer composite materials, surface modifying and advantage of nano polymer composite materials.

CH5256  Máy và thiết bị gia công polyme (Equipment and Instrument for Polymer Processing) 2 (2-0-0-4)
Pre-requisite: CH4092 (basic polymer chemistry); CH4090 (basic physical chemistry of polymer)
Course description: This course provides students the basic concept of plastic processing equipments and machines in plastic industry: injection moulding machine, extrusion machine, extrusion blowing machine, calendering machine, vaccum assisted blowing machine. This course also presents mould structure and mould making methods and thermal behaviors of plastic during processing.

CH5257  Đồ án chuyên ngành kỹ sư polyme (Project specialized in Polymer Engineering)
Course description: Research: A problem or a technical requirement set out for the field of polymer and composite materials. Design: workshop, factory in polymer synthesis and producing polymer composite materials.

CH5801  Thực tập cuối khóa (Graduation Internship) 3 (0-0-6-6)
Course description: The students are required to learn about polymer materials and products of a factory; technological production line in the field of plastics, rubber, adhesive, composite materials…
2.3. TECHNOLOGY OF ELECTROCHEMICAL AND METAL PROTECTION KỸ SƯ CÔNG NGHỆ DIỆN HÓA VÀ BẢO VỆ KIM LOẠI

CH4150  Theoretical Electrochemistry-Điện hóa lý thuyết 4 (3-1-1-8)
Prerequisites: CH3060 (Physical chemistry 2)
Objective(s): To equips students with fundamentals regarding theories and research methods.

CH4152  Plating Technology - Công nghệ mạ 3 (2-1-1-6)
Prerequisites: CH3060 (Physical Chemistry 2)
Objective(s): After this course, students can have following ability:
- Proceeding several basic plating technologies
- Calculating and designing small or medium sized-electroplating workshops with manual or automatic operation
- Investigating electrodeposition of desired plating coatings or enhancing quality of plating coatings
Content(s): Including 2 parts:
Electroplating: Basic concepts, fundamentals and theories of electroplating. Theory of initiation and growth of electroplating layer. Structure, and other properties of electropdeposited coatings. Factors affecting quality of the electrodeposited coatings. Distribution ability of plating solutions. Electroplating for decorative-protective coatings; electroplating for recovereded coatings; electroplating for abrasion resistant coatings; electroplating for magnetic coatings; electroplating for light metallic coating; electroplating for alloy coatings; electroplating in molten electrolytes; electroplating for special purposes.
Electroless plating: electroless plating on metallic and non-metallic substrates. Alternative ethods of metal deposition: hot-dip galvanizing, thermal-spray depostion, diffusion deposition, vapor deposition.

CH4154. Corrosion and Protection of Metals. 3 (2-1-1-6)
Prerequisites: CH3060 (Physical Chemistry 2)
Objective(s): Students gain basic background regarding corrosion of metals in different enviroments, have ability to apply protection methods for metals in natural and industrial environments.
Content(s): Basic concepts of corrosion of metals, types of corrosion. Chemical corrosion: Concepts, kinetic conditions, formation and growth of metal-oxide films at high temperature, factors affecting corrosion rate, protection methods of metals from chemical corrosion. Electrochemical
corrosion: Concepts, kinetic conditions, kinetics of corrosion processes, methods to determine corrosion rate of metals, passivation of metals, factors affecting corrosion rate, protection methods of metals from electrochemical corrosion.

**CH4156  Electrowinning** 2 (2-1-0-4)

Prerequisites: CH4150 (Theoretical Electrochemistry)

**Objective(s):** To equip students backgrounds regarding electrode processes in electorefining and production of metals in aqueous and molten media.

**Content(s):** Including 2 parts:


*Electrolysis in molten media:* Electrolysis of aluminium.

**CH4158  Electrochemical Power Sources** 3 (2-1-1-6)

Prerequisites: CH3060 (Physical Chemistry 2)

Co-requisites: CH4150 (Theoretical Electrochemistry)

**Objective(s):** To equip students with:

- Basic knowledge of electrode processes in electrochemical power sources
- Principle of energy storage and conversion via the electrochemical path
- Features of electrochemical power source
- Principal technique conditions of manufacturing processes

Goal: to use, preserve, product, investigate and improve traditional power sources, develop new power soruces..


**CH4146  Senior Project** 2 (0-0-4-4)

Prerequisites: CH4150 (Theoretical Electrochemistry)

**Objective(s):** To equip students with skills such as synthesis, analysis and manipulating backgrounds that they perceived during studying in the major of Electrochemistry and Corrosion protection in order to investigate various fields in the major or design production lines.

**Content(s):** Investigation of a technical issue or a technical requirement offered for Electrochemistry and Corrosion protection major; Design of workshops, factories related to Electrochemistry and Corrosion protection major.

**CH5300  Surface Electrochemistry** 2 (2-1-0-4)
Prerequisites: CH4150 (Theoretical Electrochemistry)

Objective(s): Students gain fundamental knowledge regarding surface electrochemistry phenomena that is fundamental for subsequently specialized courses.


CH5301  Electrochemical equipment and design methods  4(4-1-0-8)
Prerequisite course(s): CH4150 (Theoretical Electrochemistry)

Objective(s): To equip students with fundamental knowledge of main devices, processes and electrolysis technologies, plating, electrochemical power sources and preventing metals from corrosion; To train students knowledge of calculating and designing workshops for electrochemical production as well as automatical manipulation of an electrochemical production factory.


CH5302  Inorganic Electrosynthesis  2 (2-1-0-4)
Prerequisites: CH4150 (Theoretical Electrochemistry)

Objective(s): To equip students with fundamental knowledge of electrolytic process for the production of chlorine and sodium hydroxide and some other inorganic substances.

Content(s): Technology, equipment of electrolytic process for the production of chlorine and sodium hydroxide (solid cathode, mercury cathode). Technology, equipment of electrolytic process for the production of some other inorganic substance containing O and S. Calculation of process parameters, materials balance, electrical power for the electrolysis.

CH5303  Organic Electrosynthesis  2 (2-1-0-4)
Prerequisites: CH4150 (Theoretical Electrochemistry)

Objectives: To help students capture electrosynthesis methods for organic compounds, and understand reaction mechanisms of organic compounds occurring on the surface of electrodes


CH5304  Electrochemical Engineering Lab  3 (0-0-6-6)
Prerequisites: CH4150 (Theoretical Electrochemistry), CH4154 (Corrosion and Protection of Metals)

Objective(s): To equip students methods and techniques to know how to wash experimental instruments, to prepare solutions, to setup an experiment system, to use equipment and instruments. Students know how to handle, to calculate, to make comments and to make a report for experiments.
Content: Including all experiments related to electrochemistry and corrosion protection of metals such as: electrochemical measurements, electroplating, electroless plating, electrowinning, inorganic electrosynthesis, primary batteries, secondary batteries, electrochemical surface finishing, electrochemical oxidizing, metals corrosion.

CH5305: Project Specialized in Electrochemical Engineering 2 (0-0-4-4)
Prerequisite: CH5301 (Electrochemical Equipment and Design Methods)

Objective(s):
To equip students with necessary skills such as analysis, synthesis and manipulation of perceived knowledge in Electrochemistry and Corrosion Protection major in order to investigate and design production lines in various fields: Plating technology, Electrowinning, Inorganic Electrosynthesis, Organic Electrosynthesis, Corrosion and Protection of Metals.

Content(s): Investigation: A technical issue or technical requirement offered for one of aforementioned fields of Electrochemistry and Corrosion Protection major.

Design: Electrochemical workshops, or electrochemical factories

CH5802 Graduation internship 3 (0-0-6-6)
Prerequisite course(s): CH5301 (Electrochemical Equipment and Design Methods)

Objective(s): Students have ability to manipulate the knowledge that they have been trained from previous courses in electrochemistry and corrosion protection major in order to investigate a workshop concerning one of electrochemical fields: Plating technology, Electrowinning, Inorganic Electrosynthesis, Organic Electrosynthesis, Electrochemical Power Sources, Corrosion and Protection of Metals.

Content(s): Studying and practising on a production line of an electrochemical workshop or an electrochemical factory.

2.4. TECHNOLOGY OF SILICATE MATERIALS - KỸ SƯ CÔNG NGHỆ VẬT LIỆU SILICAT

CH4210 Physical Chemistry of Silicates 1 (Hóa lý Silicat 1) 4 (4-1-0-8)
Objectives: To systematize the knowledge about the structure and properties of inorganic silicate systems that exist in different aggregate states (crystal, glass, molten liquid and dispersed colloid); On phase balance and phase transition under the influence of temperature and pressure; The physicochemical processes are essentially the basis of technological processes in the production of inorganic silicate materials.

Content: aggregate states of silicate (crystal, glass, molten phase, dispersion of glue); Phase equilibrium and phase diagrams, physical and chemical processes mainly used in the silicate industry.

CH4212 Silicate Industrial Equipments 1 (Thiết bị công nghiệp Silicat 1) 4 (4-1-0-8)
Understand the theory of transport, supply, agitation, shaping, packaging Study the principle of composition, technical characteristics and scope of use of all the above facilities in silicate plants: cement, ceramics, refractory and glass Select, calculate parameters, design the equipment system in the silicate plant according to the technological goals

CH4214 Heating Equipments in Silicate Industry 1 (Lò công nghiệp Silicat 1) 3 (3-1-0-6)
How to design common kiln systems The main control loop of the furnace system Principles of the structure, operation of the experimental furnace

**CH4195  Mineralogical Silicates (Khoáng vật học silicat)  2 (2-1-0-4)**

Course description:
Understand the structure of silicates and the structural relationship - the technical properties of the material. Adjust the technical properties of silicate materials by modifying their mineral structure by various technical measures.

**CH4193  Specialized experiments (Thí nghiệm cơ sở chuyên ngành silicat)  2 (0-0-4-4)**

Course description:
Practical experiments use polarized microscopes to study mineral, crystal Practical experiments on some physiological processes are essentially the basis of technological processes in the manufacturing of silicate materials. Upon completion of this module, students should be able to: • Understand the nature of physical and chemical processes taking place in a number of technological processes of producing silicate materials. • Know how to understand silicate minerals on a polarized microscope

**CH4208  Senior Project Đồ án chuyên ngành cử nhân  2 (0-0-4-4)**

Objective: To equip students with the necessary steps to design a specific thermal technology of Silicate Material Technology. Content: Calculation Design of a Silicat Thermal Device..

**CH5352  Technology of inorganic binders (Công nghệ các chất kết dính vô cơ)  3(3-1-0-6)**

Học phần học trước: CH4210 (Hóa lý silicat 1), CH4212 (Thiết bị công nghiệp silicat 1),

Course description: Program content includes an introduction to inorganic binders in general and Portland cement in particular. Introduction of chemical processes and technologies for the manufacture, testing and monitoring of inorganic binders and Portland cement.

**CH5353  Pottery and porcelain technology (Công nghệ gốm sứ)  3(3-1-0-6)**

Course description: The program introduces a number of basic issues in ceramic technology, ranging from the selection of raw materials to the production of raw materials and materials, shaping, drying, firing, decorative products as well as Refers to the production technology of some specific ceramic products; Through theoretical, experiential and practical training at student production facilities, new ideas and suggestions are needed to improve product quality and explore new products

**CH5354  Glass technology (Công nghệ thủy tinh)  3(3-1-0-6)**

Course description: Glass chemistry (chemical composition, structure, properties, structure-nature relationships), glass technology and major industrial glass production techniques.

**CH5355  Refractory technology (Công nghệ vật liệu chịu lửa)  3(3-1-0-6)**

Course description: Theory of Classification, Structure and Properties of Refractory Products. Techniques for the manufacture of common and special refractories.

**CH5356  Specialized experiments 1 (Thí nghiệm chuyên ngành Silicat 1)  2(0-0-4-4)**

Course description
The experiment identified some characteristics / properties of pottery and porcelain. The experiment identified some characteristics / properties of refractory and refractory materials.

CH5357 Specialized Silicat Experiment 2 (Thí nghiệm chuyên ngành Silicat 2) 2(0-0-4-4)
Course description: The experiment identified some characteristics / characteristics of cement and cementitious materials. The experiment identified some characteristics / properties of glass.

CH5358 Silicate engineering project (Đồ án chuyên ngành kỹ sư Silicat) 2 (0-0-4-4)
Objectives: The module aims to provide students with the ability to set up, solve problems, calculate and present a topic related to the major in silicate technology. Provides students with the ability to search and collect materials, how to present a topic, and the ability to work independently when solving a problem.
Content: Research: A problem or a technical requirement for specialized areas of silicate material technology. Design: workshop, factory specialized in silicate materials.

CH5803 Graduation Internship (Thực tập cuối khóa) 3 (0-0-6-6)
Learn the entire production line for a particular silicate material product. Knowing enough technical and economic parameters to design a production plant such as cement, ceramics, or glass.

2.5. INORGANIC COMPOUND TECHNOLOGY - KỸ SỨ CÔNG NGHỆ CÁC CHẤT VÔ CƠ

CH4251 Mineral Salt Technology (Công nghệ muối khoáng) 2(2-1-0-4)
Course description: The course will provide students the knowledge of phase diagram of salt-water systems with 2, 3 and 4 components, calculating crystallization processes by different methods, technique productions of some mineral salts of sodium, potassium, magnesium, calcium and barium.

CH4272 Separation and Purification (Kỹ thuật tách và làm sạch) 2 (2-1-0-4)
Course description: The goal of the course is to provide students the physical and chemical characteristics of matters, and technical calculations involved in some typical separation processes in the production of cleaning substances by using separation methods such as crystallization, precipitation, liquid – liquid/solid extraction, adsorption, ion exchange etc..

CH4274 Chemical Kinetics and Reaction Equipment (Động học và thiết bị phản ứng) 2 (2-1-0-4)
Pre-requisite: CH3060 (Physical Chemistry 2)
Course description: The course will provide students the knowledge relating to the theory of chemical kinetics, the relationship between the reaction rate or time and the capacity of the equipment, the choice of reactor or the system of reactors for each reaction.

CH4278 Industrial Inorganic Chemistry (Hóa vô cơ công nghiệp) 2(2-1-0-4)
Pre-requisites: CH3120 (Inorganic Chemistry)
Course description: The course will provide students the knowledge of chemical technology in the production of basic inorganic chemicals and fertilizers. Specifically, knowledge of cleaning water, chemicals and
technologies for the production of hydrogen, hydrogen peroxide, nitrogen, phosphorus, sulfur, halogen and nitrogen, phosphorus and potassium fertilizers.

CH4242 Chemical Engineering Thermodynamics (Nhiệt động kỹ thuật hóa học) 2 (2-1-0-4)

Pre-requisite: CH3050 (Physical Chemistry 1)

Course description: This course provides students the basic knowledge of thermodynamic properties of pour substance. The first law of thermodynamics for closed systems. The second law of thermodynamics and process direction, chemical reaction, chemical and phase equilibrium, principle and energy calculations in chemical engineering

CH4257 Mineral Processing (Chế biến khoáng sản) 2 (2-1-0-4)

Pre-requisite: CH3120 (Inorganic Chemistry)

Course description: The course provides students the knowledge of chemistry and technology in processing of inorganic minerals, especially from available materials in the country such as the minerals of precious metal, apatite, bauxite, sedimentary ore, iron ore, baryta, dolomite, serpentine, limestone, sand and clay..

CH4276 Inorganic materials (Vật liệu vô cơ) 2 (2-1-0-4)

Học phần học trước: CH3120 (Hóa vô cơ)

Course description: The course gives students the knowledge of bondings in materials, the arrangement of atoms in the material, the process and technology in the production of inorganic materials such as adsorbents, inorganic pigments, fillers, nanomaterials, binders, inorganic polymers, ceramic materials, catalysts, electrical and magnetic materials from available raw materials in the country

CH4266 Advanced Experiments 1 (Thí nghiệm chuyên ngành 1) 2 (0-0-4-4)

Course description: This module will help students to have the skills in practicing the knowledge they have equipped in the field of fertilizers, chemicals, mineral processing, inorganic materials and water treatment

CH4280 Senior Project (Đồ án chuyên ngành cử nhân) 1 ( 0-0-2-2)

Course description: The course will help students having the skills to research and design in the fields of fertilizers, chemicals and inorganic materials concerning to the subjects they equipped.

CH5408 Fertilizer Technology (Công nghệ phân bón) 2 (2-1-0-4)

Pre-requisites: CH4251 (Mineral processing)

Course description: This course provides knowledge and skills in the design and research of technology in the field of inorganic fertilizers, such as: Urea, phosphate fertilizers, DAP, MAP, NPK, compound fertilizers, micro fertilizers, multi-element fertilizer etc. The process of production inorganic fertilizers from raw materials

44
CH5400 Nitrogen Compound Technology (Công nghệ các chất Nito) 2(2-1-0-4)
Course description: The course provides knowledge and skills in the design and research of technology in the field of nitrogen compound, ammonia synthesis, derivatives of ammonia, synthesis of urea from coal and petroleum gases.

CH5409 Soda and Sodium Hydroxide Technology (Công nghệ soda và các chất kiềm) 2(2-1-0-4)
Course description: This course provides knowledge and skills in the design and research of technology in the field of soda and alkalis, the Lebofan and Solvay processes, technical calculations related to the production of soda, sodium and aluminum hydroxide.

CH5410 Sulfuric acid Technology (Công nghệ axit sunfuric) 2 (2-1-0-4)
Course description: This course provides knowledge and skills in the design and research of technology in the field of sulfuric acid, such as properties of sulfur anhydride and sulfuric acid, producing SO₂ from S and pyrite ore, converting SO₂ to SO₃ on the catalyst, and production of sulfuric acid.

CH5411. Water treatment (Xử lý nước) 2 (2-1-0-4)
Course description: The module deals with the knowledge of water source characteristics, water treatment methods such as decantation, filtration, membrane separation, flocculation, redox reaction, biological methods applied in domestic wastewater treatment and industrial wastewater.

CH5401. Inorganic Pigment Materials for Industry (Chất màu vô cơ công nghiệp) 2(2-1-0-4)
Pre-requisites: CH3120 (Inorganic Chemistry)
Course description: The course provides students the basic knowledge of inorganic pigment materials, chemical technology in the manufacture of some important pigments applied in inorganic and silicate industries.

CH5402. Experiments Specialized in Inorganic Engineering 2
(Thí nghiệm chuyên ngành 2) 2 (0-0-4-4)
Pre-requisites: CH3120 (Inorganic Chemistry)
Course description: This module will help students to have the skills in practicing related to the production of sulfuric acid, soda ash, superphosphate fertilizer, inorganic coatings, inorganic pigments, extraction of a number of elements from the ore and water treatment.

CH5403 Project Specialized in Inorganic Engineering
(Đồ án chuyên ngành kỹ sư CNVC) 2 (0-0-4-4)
Course description: The course will help students having the skills to research and design in the fields of fertilizers, chemicals and inorganic materials concerning to the specialized subjects they equipped.
Nội dung: Sinh viên sẽ tiến hành các đồ án liên quan đến học thuật và công nghệ các chất vô cơ đã được trang bị.
CH5804  Graduation Internship (Thực tập cuối khóa)  3 (0-0-6-6)  
Course description: This course aims to provide students with practical knowledge in production, specific computational skills for a particular stage or production line in the field of inorganic fertilizers or basic inorganic substances.

2.6. PHYSICO-CHEMICAL ENGINEERING KỸ SƯ CÔNG NGHỆ HÓA LÝ

CH4330 Electrochemical Processes 2 (2-1-0-4)  
Pre-requisives: CH3060 (Physical Chemistry 2)  
Goals: After the course, students will obtain the fundamental of electrode kinetics which is background for electrochemical processes.  

CH4332 Physical and Physico-chemical Methods for Studying Structure of Matters 2 (2-1-0-4)  
Pre-requisives: CH3060 (Physical Chemistry 2)  
Objectives: The subject provides the students of the majors of Physico-chemistry Engineering, Chemistry, Materials Science and Engineering and other related majors with principle and modern knowledge and application of physical and physico-chemical methods for studying structure of matters. The subject is the scientific and practical background to solve various problems such as molecular structure and chemical bonding; molecule - molecule interaction; crystalline structure; the properties of matters and factors affecting the properties; kinetics and mechanism of a reactions; the relationship among structure, properties and characteristic of spectroscopy; calculate the thermodynamic functions.  
Course content: Electromagnetic wave and spectroscopy. Fundament of spectroscopy method. Dipole moment and molecular refract index. Infrared spectroscopy (FT-IR); Scattering Raman spectroscopy; Ultraviolet–visible spectroscopy (UV-Vis), X-ray diffraction, Nuclear Magnetic Resonance spectrometry (NMR), Electron Paramagnetic Resonance Spectroscopy (EPR). The relationship between the structure, composition, properties of substances and the characteristic quantities of each method.

CH4328 Waste Water Treatment 2 (2-1-0-4)  
Pre-requisives: CH3060 (Physical Chemistry 2)  
Goal: The subject provides students with background and modern knowledge on water treatment methods, particularly the method of wastewater treatment.  

CH4336 Complex Catalysts and Applications 2 (2-1-0-4)  
Pre-requisives: CH3060 (Physical Chemistry 2)  
Goal: The subject provides students basic and modern knowledge of complex catalysis and its application in technology.
Course content: Structure, chemical bonding, composition, thermodynamic stability, active nature and high selectivity of complex catalysts, as well as interrelationships between complex catalysts and biocatalysts. Thermodynamics of complex catalysts formation. Kinetics and mechanism of reactions in the presence of a complex catalyst. The scientific significance and the practical value of complex catalysts in various fields such as organic synthesis, process of petroleum production, improvement technology processes, treatment of industrial waste water; preservation of food, manufacture of pharmaceutical products, agricultural products, microquantitity analysis, ultra-microquantity analysis.

CH4338 Chemistry of Surfactants 2 (2-1-0-4)
Pre-requisitives: CH3060 (Physical Chemistry 2)
Objectives: The subject provides students with basic and modern knowledge about the chemistry and technology of surfactants as well as applications in various technology fields.

CH4313 Chemistry of Advanced Materials 2(2-1-0-4)
Pre-requisitives: CH1010 (General Chemistry), CH3120 (Inorganic Chemistry)
Objectives: The subject provides students with basic and advanced concepts of advanced materials chemistry from which students have the ability to self-study, develop and apply to solve a problem in the field of new material technology.
Course description: Introduction of traditional methods for material synthesis, of physical and chemical methods for advanced materials synthesis that allow to control some properties of materials. Introduction of some important development directions of advanced synthetic materials technology. Introduction of some typical families of materials and their applications. Introduction of specific methods, particularly chemical physical methods, to characterize the advanced materials and nano-structured materials.

CH4334 Applied Informatics in Chemistry 2 (2-1-0-4)
Pre-requisitives: CH3050 (Physical Chemistry 1), CH3060 (Physical Chemistry 2)
Objectives: The subject provides the students of physical chemistry engineering with basic knowledge of apply the MATLAB programming language to solve problems of physical chemistry and apply them in scientific research as well as in practical production.
Course description: Introduction of MATLAB programming language and computational chemistry. Two-dimensional and three-dimensional graphics in MATLAB. Basic programming in MATLAB. Application of MATLAB to solve problems of physical chemistry, experimental data process and scientific research.

CH4324 Senior Project 3 (0-0-6-6)
Pre-requisitives
Objectives: Students would complete one of the specialized syllabus. Systematize and summarize the knowledge of basic science subjects, fundamental engineering subjects to solve the problems related to physico-chemical processes in chemical technology.
Course description: Systematization and summarization of references. Carrying out the experiments and data treatment of some problems such as water treatment, synthesis of materials, catalyst, corrosion and metal protection and so on, according to the syllabus.

CH5450  Solid Chemistry (Hóa học chất rắn) 3(3-0-6)
Course description: Structure, chemical linkages, chemical and physical properties of solids and methodology; Factors that affect the structure, properties and reactivity of solids; Fabrication and application of materials with special structure and features in mechanical, optical, thermal, electromagnetic, chemical, catalytic ... in the fields of science and advanced technology.

CH5451  Catalytic Engineering (Kỹ thuật xúc tác) 3(3-0-6)
Course description: Introduction to the basic concepts of catalysts in the chemical industry: structure, composition, thermodynamic strength, factors influencing activity and selectivity of catalysts; Kinetics and mechanisms of catalytic reactions; The role of catalysis in nature, industry and life.

CH5452  Physical Chemistry of Surface Phenomena (Hóa lý các hiện tượng bề mặt) 3(3-0-6)
Course description: Basic knowledge of surface phenomena and its applications. Absorption and application of adsorbents in technical processes. Distribution systems and their applications in industry.

CH5453  Applied Electrochemistry (Điện hóa ứng dụng) 3(3-0-6)
Course description: Batteries and power sources; Electrochemical synthesis; Electrowinning and electroplating; Corrosion and protection of metal by electrochemical method;

CH5454  Chemical Kinetics and Catalysis (Động hóa học và xúc tác) 2(2-0-4)
Course description: Fundamental knowledge of chemical kinetics such as reaction rate, rate constants, activation energy, reaction order, molecularity, coefficient of ratio, factors affecting reaction rate, and reaction mechanism. Kinetics of homogeneous reactions: simple reactions, complex reactions, chain reactions, photochemical reaction. Theory of reaction rate. Kinetics of heterogeneous reactions. Structure, chemical bonding, activity, selectivity, other physical and chemical characteristics of homogeneous catalysts, heterogeneous catalysts , and methodologies. The laws of kinetics, mechanisms, factors influencing, optimal conditions and relationships of biological catalysis, complex catalysis and heterogeneous catalysis. Preparation and application of catalysts in the chemical industry and other related fields.

CH5805  Graduation Internship (Thực tập cuối khóa) 3(0-0-6)
Goals: To provide students with practical and visual knowledge about chemical and material production lines such as nitrogenous fertilizer, wine, coke, steel, etc. in one or several establishments. Large-scale production such as Ha Bac fertilizer and chemicals plant, Thai Nguyen Iron and Steel Company, etc. In addition to the purpose of survey and data collection for graduation project thesis, students also improve personal and professional skills such as analysis, syntheses an evaluation of an engineering problem, and opportunity of review fundamental knowledge of chemical engineering including general knowledge and skills, core and specialized knowledge in connection with practical production at a manufacture. At the same time, it provide students a chance to improve their basic attitude, psychology and skills to be ready to work in the industrial environment.

Course description: General information about the manufacture; Survey and evaluation of raw materials and products, chemical production line, production line control system, layout of workshops, technical equipment in the production line, process Production waste treatment technology, factory production structure and factory management, production cost structure and welfare distribution.

2.7. PROCESSES AND EQUIPMENT OF CHEMICAL ENGINEERING - KỸ SUẤT QUÁ TRÌNH VÀ THIẾT BỊ CÔNG NGHỆ HÓA HỌC

CH4392 Advanced Chemical Process Engineering Lab 2 (0-0-4-4)
Prerequisites: CH3420 (Chemical Engineering 3: mass transfer)
Course description:
Goals: Students will do experiments in the pilot-plant relating to mass and heat transfer processes. Students have to understand mechanisms of mass and heat transfer units, know how to measure data, analysis and excess the experiment results.
Contents: Multicomponent distillation, liquid-liquid extraction, liquid-solid extraction, multi-effect evaporation or single evaporation, and convection drying.

CH4362 General Chemical Technologies 3 (3-1-0-6)
Prerequisites: None
Course description: This course presents the general chemical processes technology such as basic chemical production (Sulphuric acid, base...), fertilizer production from coal and petroleum gas, oil refinery ... The course also introduce some separation techniques in the chemical industries.

CH4394 Optimization in chemical engineering 2 (2-1-0-4)
Prerequisites: MI3180 (Statistical probability and empirical planning)
Goals: The course consolidates for student the methodology to investigate a object in chemical engineering. Student will understand model approach to determine a chemical engineering system: Statistical model, physical model, mathematical model and relations among them. Student will be introduced basic knowledge of process control and application in the chemical engineering.
Contents: Random variables; Study chemical engineering by statistical model; optimization methods in chemical engineering.

CH4396 Reaction engineering 3 (3-1-0-6)
Prerequisites: MI1120 (Analytics II), MI1130 (Analytics III), PH1120 (Physic II), CH3060 (Physic chemistry 2), CH3420 (Chemical engineering 3)

Course description: This course presents the mathematical principle and methodology of fluid mechanic equations; reaction kinetics of homogeneous, heterogeneous mixtures; thermal dynamic, reaction equilibrium, reaction rate; operation and description of reactors, resident time, and dynamics of chemical reactions.

CH4390 Senior Project 2 (0-0-4-4)

Prerequisites: CH4396 (Reaction engineering)

Goals: The course consolidates knowledge of reaction engineering, modeling and simulation of reaction units.

Contents: Calculation of methanol synthesis unit/NH3 synthesis unit. Modeling and simulation of the whole processes.

ME4911 CAD 2D and Elements Drawing (CAD 2D và vẽ tách)
2 (2-1-0-4)
Pre-requisite: ME2015 (Basic Engineering Graphics)

Objectives: To provide students with basic knowledge and skills on 2D and element drawings

Nội dung: CAD 2D; comprehensive reading of element and assembly drawings.

CH4400 Process control (Điều khiển quá trình) 3(3-0-1-6)
In this course, student will be introduced to basic knowledge of control system in chemical and food industry:
- Control system analysis;
- Control system design.

CH5503 Plant engineering (Kỹ thuật công trình trong công nghệ hóa học) 2(2-1-0-4)
Course description: In this course, student will be introduced to basic knowledge of industrial processing plant: Chemical plant design; Chemical plant construction.

CH5504 SEPARATION TECHNIQUE MULTI COMPONENT SYSTEMS (Kỹ thuật tách hỗn hợp nhiều cấu tử) 2(2-1-0-4)
Pre-requisite CH3420 (Quá trình & thiết bị CN hóa học 3)
Course description: Methods for calculating phase equilibrium of multi component systems. Methods for calculating distilled tower of near - ideal multi component systems. Methods for calculating distilled tower of real multi component solutions..

CH5505 System Engineering 2(2-1-0-4)
Course description: After this course, students can gain the basics of a systematic approach to analyze and calculate chemical, petrochemical and biological processes; approach methods of analysis and synthesis of chemical engineering systems and the construction of mathematical representations of specific chemical engineering processes.
CH5506  Models for Automation and Control  2(2-1-0-4)
Pre-requisites: CH3420 (Quá trình & thiết bị CN hóa học 3)
Course description: This subject provides knowledge of process system engineering; methodology of analysis and synthesis of chemical process systems; degree-of-freedom analysis; methodology of development the physical, statistical, and mathematical models of chemical process systems; dynamic of the perfect mixing and plug flow reactors.

CH5507  Membrane technology (Công nghệ màng)  3(3-1-0-6)
Pre-requisite: CH3400, CH3412, CH3420
Course description: Following topics will be dealt within the framework of this subject:
- Mechanism of membrane processes
- Membrane modules
- Design and engineering of membrane systems

CH5500  Mechanical Designing in Chemical Machinery  2 (2-1-0-4)
Objectives: On successful completion of this module, students will be able to mechanically design equipments especially high-pressure equipments used in chemical and petroleum industries. Students also will be able to do R&D, innovation, new product development and product design.
Content: The syllabus will typically include basic knowledge of materials of construction and their mechanical properties, theoretical framework of material strengths, thin shell theory and its application into the calculation of internal and external pressure equipment, thick shell equipments (shell, bottom, cover, flanges, etc.), design and test of high-pressure equipments.

CH5501  Project 3 for Machninery  2(0-0-4-4)
Objectives: After taking the course, students are capable of design calculation of manufacturing processes related to the field of chemical industry; simulation of chemical engineering processes using specific computer software. During the course, students ar equipped with team working skill, ability of literature survey.
Content:
- Introduction and description of manufacturing processes of some products in the area of chemical industry
- Design of basic flow diagram (BFD) and process flow diagram (PFD)
- Design calculation and simulation of the selected process system.

CH5806  Graduation Internship Thực tập cuối khóa  3(0-0-6-6)
Objectives: The course helps students in making a proposal and problem-solved techniques of their graduation thesis. For students following research direction, research area and objectives are equipped and for ones following design orientation, they are geared to engineering and manufacturing processes in a workshop/enterprise or a plant.
Content: For students following research direction, content of the graduation thesis consits of: (1) General introduction; (2) Literature rerview of the research including methods of quality, specification, and analysis methodologies; (3) Review of experimental setup and procedures; (4) Extermiental conduction; (5) Writing the report of the internship. For students following design objective, content of the internship includes: (1) Taking the internship at a specific workshop/plant; (2) Data and reference collection and review; (3) Literature review of process design of the internshiped process; (4) Writing report of the internship.
2.8. PULP AND CELLULOSE TECHNOLOGY - KỸ SỰ CÔNG NGHỆ XENLULOZA VÀ GIẤY

CH4450 Wood chemistry 2(2-1-0-4)

Objectives:
This course equips students with basic knowledge about structure, chemical composition of wood and fiber plant, chemical properties of plant cell wall such as carbohydrate, lignin, extractives, chemical changes of wood during chemical refinery, provides students with basics to receive further knowledge about pulp and papermaking production, as well as to conduct scientific researching projects in the field of wood biorefinery.

After completion, students are able to:
• Describe micro- and macrostructure of wood, chemical compositions of wood;
• Present structure and chemical, physical properties of wood cell wall compositions;
• Understand chemical changes of wood cell wall compositions during pulping, bleaching and biorefinery of wood biomass;
• Classify extractives in wood and their changes during pulping.

Course description:

CH4452 Cellulose chemistry 2(2-0-0-4)

Objectives: This is a specific subject. Students are equipped with basic knowledge about structure, physical, chemical properties and changes of cellulose during bio-chemical and thermal-chemical refineries of plant materials, applications of cellulose in papermaking, synthesis methods and application of cellulose derivatives to many fields including industry and environment.

After completion, students are able to:
• Present structure, chemical-physical properties of cellulose, cellulose solution and its changes in pulping, papermaking, bio-chemical refineries and thermal chemistry of wood;
• Present methods to synthesize cellulose derivatives and some advanced materials from cellulose;
• Know properties of some cellulose derivatives and their applications.

Course description:
Chemical structure of cellulose; Physical-chemical properties of cellulose and its solution; Physical-chemical changes of cellulose during bio-chemical and thermal-chemical refineries of plant materials such as pulping, papermaking, hydrolysis, pyrolysis, alkaline treatment; Cellulose solution; Methods for synthesis of cellulose derivatives; Cellulose modification methods.

CH4454 Pulping technology 3(3-0-0-6)

Objectives: Students are equipped with basic knowledge about properties of fiber semi-products, pulping technologies, which enable students to work in the field of pulp and papermaking and other relevant fields.

After completion, students are able to:
• Present properties of fiber semi-products used in paper industry;
• Explain chemical-physical processes occurring in pulping;
• Present technical procedures, techniques for pulping using plant materials

Course description:

CH4456 Papermaking technology 3 (3-0-0-6)

Objectives:
Students are equipped with basic knowledge about papermaking technology: Pulp refining; Paper additives for different paper grades; Papermaking and defect treatment during paper formation.

After completion, students are able to:
• Select materials for production of a requested paper grade;
• Select refining conditions for each kind of paper;
• Analyze and select adhesives, fillers, and other additives to improve paper quality;
• Analyze, design, select paper machine to reach requirements of paper products;
• Calculate material and energy balance to use them effectively.

Course description:
Stock preparation. Papermaking, wet pressing, drying and finishing; Factors influencing paper properties.

CH4444 Wood and Cellulose Chemistry Lab. 3 (0-0-6-6)

Objectives: This is a specific subject, which equips students with basic knowledge about wood and cellulose chemistry via visual experiments, helping student review and understand deeply the two subjects: wood chemistry and cellulose chemistry. This is also a great chance for students to practice and train their laboratory skills, which will enable them to work in research institutions or do analytical works.

After completion, students are able to:
• Use lab tools, operate lab equipment;
• Present practical techniques to analyze wood and cellulose;
• Analyze chemical compositions of wood materials and cellulose;
• Distinguish, evaluate products extracted from wood and cellulose.

Course description:

CH4458 Pulping and papermaking machines 2 (2-1-0-4)

Objectives: Students are equipped with basic knowledge about structure, operating principle and uses of pulp and paper making machines.

After completion, students are able to:
• Present structure, operating principle, position of machines used in the pulp and paper production line;
• Calculate some basic technical parameters of some machines;
• Select suitable machines which reach the target and productivity of the production line;
• Present some methods to adjust and calibrate equipment when operating
Course description:
Infrastructure, operating principles of machines and equipment for raw materials preparation, pulping, pulp washing, pulp screening and cleaning; pulp bleaching; chemical recovery system of chemical pulping; pulp slurry preparation for papermaking machine; paper machine; press, dryer and finish.

CH4446 Specific project 2 (0-0-4-4)
Objectives: The subject equips students with synthesis, analysis, generalization skills and combination of knowledge from other specifica subjects to solve a specific issue (e.g. design a production line, solve an actual issue in the field of pulp and paper manufacturing technology).

After completion, students are able to:
- Conduct basic calculation to design a production line of a specific product;
- Select a production line with equipment for a target product;
- Write a report about solved issue;
- Present and discuss the solved issue;
- Investigate, evaluate a specific issue in a relevant field

Course description:
General theory of the issue which needs to solve. Investigation, selection of technology solutions. Designation (Summary, Solution suggestion) of production line.

CH4009 Chemistry and Physicochemistry of Polymers 2(2-0-0-4)
Course description: This course provide students concepts, chemical – mechanical properties of the synthestic polymers and synthetic methods in industry. This course also provides the basic chemical reactions during synthesyzing and modifying polymers.

CH5550 Paper recycling Technology 3(3-0-1-6)
Objectives: It equips students with basic knowledge, practicing skills of technology and equipment of paper recycling for papermakingion. This is need for working in field of papermaking from recycled fibers and related fields. Furthermore, the subject supports learners in “Tissue production technology” subject.

Course description: Technology and equipment for wastepaper recycling, stages of pulping, refining, screening and cleaning, deinking.

CH5557 Wet chemistry 2(2-1-0-4)
Objectives: The subject provides basic knowledge about the roles of chemicals used in papermaking process, chemical reactions occurring during pulping and papermaking, principles of using chemicals for papermaking in specific conditions for improving of paper quality and effective using of chemicals.

Course description: Chemicals and their roles in paper production. Chemical bonds in paper, internal sizing, water chemistry in the wet section of paper machine.
CH5558 Mechanical pulping 2(2-1-0-4)

Objectives: This is a special subject. Students will be equipped with basic knowledge about engineering and technology of high yield pulp production. The subject provides learners with necessary knowledge for working in the field of pulping and papermaking and other related fields.


CH5559 Paper coating 2(2-1-0-4)

Objectives: 
Students are equipped with basic and advanced knowledge about paper coating methods to improve paper quality

Course description: 
Coating mixture, paper for coating, pigments used for coating paper, coating chemicals, coating mixture preparation technology, paper coating technology.

CH5560 Environment protection in paper industry 2(2-1-0-4)

Objectives: Students are equipped with general knowledge about technical processes in pulp and paper production, can, therefore, develop methods to improve technology to minimize waste from paper manufacturer.

Course description: Influences of paper industry on ecological environment. Improvement of technology and equipment in paper industry to enhance paper quality, improve economic benefit, and minimize environmental impact.

CH5551 Pulping and papermaking Lab. 3(0-0-6-6)

Objectives: The subject equips students with knowledge about pulp and paper manufacturing technologies through practical experiments, helping students review and understand deeply about specific lessons.

Course description: Practical work in laboratory: pulping, washing, screening and cleaning; pulp bleaching, refining, adhesive preparation for paper sizing, paper sizing and additives addition; pulp and paper sampling for quality analysis; properties analysis of pulp and paper.

CH5807 Final internship course 3 (0-0-6-6)

Objectives: The course equips students with actual and visual knowledge about pulp and paper production line in several manufacturers. These will be helpful for students to do their final project before graduation. Furthermore, this is also a good chance for students to observe, even work in a real production line, providing them experiences before working in an industrial environment.

After completion, students are able to:

- Analyze, evaluate different kinds of raw materials, technical processes, manufacturing technology and equipment in the pulp and paper production line of the visited manufacturer;
- Present supplying system of raw materials, energy; waste treatment, the arrangement of the mill site, organization structure, management of the visited factory;

Course description: General information about the visited mill; Investigation, evaluation of raw materials and products, pulp and paper production line, equipment, waste treatment, organization structure…
2.9. PHARMACEUTICAL CHEMISTRY AND PESTICIDES TECHNOLOGY - KỸ SỰ CÔNG NGHỆ HÓA DƯỢC & BẢO VỆ THỰC VẬT

CH4480  Basic Processes of Organic Synthesis  2 (2-1-0-4)

Pre-requisites: CH3220 (Organic Chemistry)

Objectives: Students are provided with the basic knowledge on the way of transferring the substituents of organic compounds to synthesize or semi-synthesize drug as well as the intermediated compounds that be used in the pharmaceutical technology.

Contents: Basic knowledge of the commonly basic processes that be applied to the basic processes of organic synthesis (including: The formation of new substituents, the transferiation of the substituents that discuss the issues such as the range of reactions, reaction mechanisms, agents and catalysts, solvents, factor affecting the reaction (temperature, pressure, the ratio of adequate, the way of agent selection, catalysis), the side effects, byproducts, the general reaction methods, some examples using in the pharmaceutical chemistry and some typical manufacturing technologies.

CH4482  Chemistry of natural compounds (Hóa học các hợp chất thiên nhiên)  2(2-1-0-4)

Pre-requisites: CH3220 (Organic Chemistry)

Objectives: Introduce students to grasp the source and object of study of the subject and these practical valued applications of the natural products in life, as well as their development trend in our country in particular and in the world in general.

Contents: The concepts of structure (structure, configuration), some representative substance classes in nature (Carbohydrates (Glucides); Terpenoids; Steroids; Alkaloids). Applications and prospects of naturally occurring and naturally occurring synthetic natural compounds. The concepts of essential oils and flavors. Introduce some methods of flavors synthesis.

CH4484  Basic processes of pharmaceutical chemistry synthesis  2 (2-1-0-4)

Pre-requisites: CH3220 (Organic chemistry)

Corequisite: CH4480 (Basic processes of Organic synthesis)

Objectives: Students are provided with the basic knowledge of some of the reactions commonly used in the synthesis of compounds used to make drugs.

Contents: Students are provided with knowledge of the processes in the synthesis of highly complex, relatively complex organic molecular orientations; these basic processes are mainly used in the synthesis of compounds used to make drugs, as the processes of the Michael reaction, cyanide reaction Diels-Alder synthesis, andol and andol type reactions, ester condensation reactions, carbon chain extinction methods (including Friedels-Crafts reaction types, ketone synthesis from carboxylic acid derivatives Alkyl-metal compounds, transposition reactions), metal hydride reduction, racemic, peptide synthesis…

CH4490  Pharmaceuticals's formulation technology  2 (2-1-0-4)

Prerequisite module: CH3330 (Analytical Chemistry), CH3220 (Organic Chemistry), CH3050 (Physical Chemistry 1), CH3060 (Physical Chemistry 2)
Objectives: Provide students with basic knowledge in the engineering manufactures pharmaceutical ingredients into products.

Content: Introduction for students the majors know basics about the form of the drug used in the treatment. Provides basic knowledge about standards, requirement of the ingredients when put in to produce the drugs as well as the methods of manufacture, manufacture techniques, the methods reviews of quality control, packaging ... Provides basic knowledge about the factors that affect the speed and extent of absorption. From there take out the requirements on materials, techniques, appropriate manufacturing method.

CH4512 Spectroscopic Identification of Organic Compounds 2 (2-1-0-4)
Prerequisites: CH3220 (Organic Chemistry)

Objectives: Theoretical knowledge on infrared, visible-ultraviolet, mass, and nuclear magnetic spectroscopy and its application in structure elucidation of organic compounds. Practice on structure determination based on the four spectroscopic methods. Principles and experiments of recording spectra.

Contents: Basic knowledge on infrared, visible-ultraviolet, mass and 1D and 2D nuclear magnetic resonance spectroscopy. The application of spectroscopic methods in structure determination of organic compounds in natural products, organic synthesis, pharmaceutical chemistry, petrochemistry, pesticides, essential oils, flavourings, etc.

CH4486 Plant Protection Chemistry (Pesticide Chemistry) 3 (3-1-0-6)
Prerequisites: CH4480 (Basic processes of Organic synthesis)

Content: Refers to the toxicological basis of pesticides, including: toxic, toxicity; Conditions for the toxins to take effect and the factors that affect them; Pesticide residue; The harmful effects of toxins on the environment and how to overcome... BVTV that are currently being used in the world such as pesticides, herbicides, fungicides, plant pesticides, growth regulators regulator … Principles of synthesis of some major compounds in each group, their mechanisms of metabolism and their effect on organisms; The impact of pesticides on the environment.

Objectives: Plant Protection Chemistry help students master the basic concepts of poisons used in pesticides, their great role in the development of forestry and agriculture; How to be safe and effective with pesticides, and as a result, prevent environment pollution caused by pesticides. Understand the most important and most basic pesticides: Insecticide; Pesticides; Herbicide; Plant growth regulator. From there, propose a plan to reduce environmental pollution.

CH4510 General pharmaceutical chemistry 2  
(2-1-0-4)
Prerequisites: CH4480 (Basic Processes of Organic synthesis), CH4484 (Basic Processes of Pharmaceutical chemistry synthesis)

Objectives: Students are provided with the basic knowledge of the drugs, researching, finding and discovering new drugs, the process of researching a new drug into use, issues related to pharmaco-chemical production; the knowledge of major diseases existing to humans, the basic drug classes using in such disease prevention and treatment.
Contents: Some general knowledge of the drugs (the drug’s fate in the body, the drug’s effects, the factors affecting the drug’s effect); researching, finding and discovering new drugs (the physical and chemical factors affecting a compound’s biological effect, the relationship between structure and biological activity, pharmacological, drug and pharmacokinetics concept); the process of researching a new drug into use (research in chemistry, biological activity trials, toxicity test, pharmacological effects, mechanism of action, dosage, dosage forms, preclinical, circulation license and clinical trials); issues related to pharmaco-chemical production (raw materials for pharmaco-chemical production, key steps in the medicines’ production). Several knowledge of basic human diseases and major drug classes using to treat such diseases as: antimalarial drugs, analgesic, sulfamid drugs and other popular drug classes…

CH4508  Specialized project  2 (0-0-4-4)

Pre-requisites: CH4480 (Basic processes of organic synthesis), CH4484 (Basic processes of pharmaceutical chemistry synthesis)

Objectives: Students are provided with the skills in reviewing specialized literatures, in designing, synthesizing, and calculating technology and equipment for the production of bioactive ingredients in pharmaceutical chemistry and plant protection.

Contents: Students are instructed how to find, translate, and review the specialised literatures. Students are guided to master the method of designing and calculating an optimal production line of a chemical product for pharmaceutical and plant protection chemistry.

CH5608  Good Manufacturing Practice (GMP)  2 (2-0-0-4)

Prerequisites: CH4490 (Pharmaceutics’s formulation technology)

Objectives: Theoretical knowledge on the basic concepts, principles, regulations need to adhere to the drug product as registered standard.

Contents: Basic knowledge on good manufacturing practice. In each chapter are part of the concept, the regulations need to follow to ensure the drugs produce safe, effective therapeutic effects as the original design. The drugs produced may authorise in the region and the world.

CH5609  Chemical medicinal plants and Extraction Techniques  2 (2-0-0-4)

Pre-requisites: CH4482 (Chemistry of natural compounds).

Objectives: Students are provided with more knowledge about the extraction of biologically active compounds in nature, to give students an in-depth look at the bioactive compounds in the plants, from the natural source.

Contents: Students are provided with the basic knowledge of techniques for extracting bioactive compounds from active plant sources. Provides basic knowledge on the isolation and identification of biologically active substances. Provides knowledge of the most common biological active substances in nature.

CH5600  Pharmaceutical chemistry synthesis 1  2 (2-1-0-4)

Pre-requisites: CH4510 (General Pharmaceutical Chemistry)
Objectives: Students are provided with the knowledge of main drugs for the treatment of common diseases, preparation and use of these diseases.

Contents: The basic knowledge of the drugs affecting the central nervous system such as: central nervous system inhibitors (anesthetic, sedative, epileptic, analgesic, psychiatric drugs, muscle relaxants, Parkinson’s medicine); drugs stimulating the central nervous system (emergency resuscitation, narotic drugs, antidepressants, mental disorders); the drugs having an effect on organs and parts of the body such as: drugs affecting the heart, blood pressure drug, drug affecting blood-forming organ and blood, respiratory medicine, diuretics, gastrointestinal drugs, inflammatory drugs, immune drugs, sterilants, antiparasitic (antimalarial, drug treatment amip dysentery, diarrhea, anti-worm, syphilis medicine), cancer drug…

CH5601  Pharmaceutical chemistry synthesis 2  2 (2-1-0-4)
Pre-requisites: CH4510 (General Pharmaceutical Chemistry)
Objectives: Students are provided with the understanding of the role and effects of vitamins, hormones and antibiotics on the body, as well as the preparation, production and use of them in disease prevention and treatment.

Contents: Students are provided with the basic knowledge of the vitamins (A, D, E, K, B1, B2, B3, B5, B6, B7, H, I, B10, B12, B15, C, P, U, Vitagen); hormones (pituitary, thyroid, parathyroid gland, pancreas, adrenal glands); the natural survival, production, and use in disease prevention and treatment; major antibiotic groups, general methods of preparation, production of antibiotic groups, and several representative antibiotics.

CH5610  Synthesis of biologically active compounds  2 (2-1-0-4)
Pre-requisites: Fundamental process for synthesis of Organic Chemistry (CH4480), Fundamental process for synthesis of Pharmaceutical Chemistry (CH4484)
Objectives: To help students understand the synthesis process of some complex structured drug compounds with a synthetic process, which are containing a lot of steps (from ten or more step. Equip students with research thinking, research methods of a drug compounds.

Contents: Through the technical synthesis of some biologically active compounds, there are various frames compound which were used in medicine (such as synthesis of cephalosporin antibiotics, emetine, reserpine, vitamins, aspidospermine frame compounds, bisindole and quinolone antibiotics) to introduce students to how to think, the pre-deployment approach deals with research on a topic, introduces participants to the methodology and way of conducting research into the synthesis of a complex chemical drug substance, through a process include dozens of intermittent steps, preliminary identification of intermediate compounds as well as products prepared.

CH5602  Synthesis of pesticide  2 (2-1-0-4)
Pre-requisites: CH4486 (Pesticide chemistry)
Objectives: Students are provided with the basic knowledge on the field of pest prevention, the features, effects, specially the methods and synthesis technology of pesticides. Thereby, students are also aware of environmental risk in the production and use of pesticides. In addition, students and teacher will discuss to build the production methods in industry based on the latest scientific literature.
Contents: Including 3 parts, 13 chapters refers to insecticide, fungicide and herbicide use in agriculture, breeding and household sterilization. Each chapter mentions the object prevention, classification, biological activity, application, physical and chemical properties of active ingredients, and synthesis methods of them in laboratory and industry. For each pesticide, the textbook updates the latest published information in the world and application in Vietnam, pay attention to effect of pesticide on the environment and community.

CH5603 Pesticide formulation 2 (2-0-0-4)
Pre-requisites: Pesticide chemistry (CH4486)
Objectives: Students are provided with the basic knowledge of pesticide formulation. Students can distinguish the different formulations and process technology of them. Students will be also design a formulation workshop and discuss about it together.

Contents: Including 6 chapters refer to basic components, physical and chemical properties and use of pesticide formulation. The most important is surfactants. In addition, the method for production of formulation that widely use in the world. For each formulation, the textbook updates the latest published information in the world and application in Vietnam, pay attention to effect of pesticide on the environment and community.

CH5604 Specialized experiments 3 (0-0-6-4)
Pre-requisites: CH3232 (Organic chemistry experiment), CH4510 (General pharmaceutical chemistry)
Objectives: The last year students of the pharmaceutical chemistry specialization are provided with basic knowledge of the theory and experimental skills of synthesis of pharmaceutical chemistry, and do some basic experiments for the preparation of some simple ingredients used as medicine.

Contents: There are 11 experiments on the synthesis of some simple ingredients used as medicine.

CH5808 Graduation practice 3(0-0-6-6)
Pre-requisites: Basic and specialised subjects in the program
Objectives: Students are provided with overall view of the pharmaceutical industry of the country, and knowledge of international standards in the production of drugs (eg GMP, GLP, GSP). Students can approach international standard drug production lines.

Contents: Students learn about the development of past, present and future drug companies for overall view of the pharmaceutical industry of the country. Students also learn to understand international standards in the production of drugs (GMP, GLP, GSP) and learn about the production lines of some drugs currently circulating on the Vietnamese market (pills, injectables, ointments, etc.), and to approach some capsule machines, blisters, injection machines, syringes welding ...). Students learn about drug testing laboratories, one of the important steps that determine whether a drug is manufactured.
2.10. CHEMICAL AND PETRO-CHEMICAL PROCESS EQUIPMENT

KỸ SƯ MÁY VÀ THIẾT BỊ CN HÓA CHẤT – DÀU KHÍ

ME3061 Nguyễn lý máy (Theory of Mechanisms and Machinery) 2 (2-1-0-4)

Objectives: Introduction to fundamental concepts of general machines regarding the kinematic and dynamic structures, principles in which mechanisms are formed and their key elements. Methods that can be used for analysing and synthesising machines and mechanisms in terms of kinetics, kinematics and dynamics.

Content: Structure of mechanisms; Kinetic, Kinematic and Dynamic Analysis; Cam mechanism; Gear mechanism and Gear Trains.

ME3091 Chi tiết máy (Machine Elements) 3 (3-0-1-6)

Objective: Providing basic knowledge about operating, structure and design methods of general machines and machine elements; Enhancing skills on analysing mechanical power transmission systems; Applying insight knowledges from other fundamental engineering sciences.

Content: Key problems in designing machine elements; Load, Stress, Failure theory; Fatigue Failure Theory; Couplings and Clutch; Keys, Bolts and nuts; Mechanical Power transmission systems: Chain Drive, Belt drive, Gear drive, Wormgear drive; Shaft; Sliding and rolling element bearings.

ME3131 Đồ án chi tiết máy (Project of Machine Element Design) 2 (2-0-0-4)

Objectives: Applying knowledge from basic sciences and fundamental technical subjects in designing machines and machine elements; Consolidating knowledge on the principle of operation, anatomy and design methods of whole machines and of each machine element; Practising generating technical drawing and documentation.

Content: Analysing power transmission system, and on that basis, select kinetic parameters for a certain machine; Designing all transmission sub-systems; Designing shafts, bearings and couplings. Designing machine frame and other elements; Documentating.

ME2012 Đồ họa kỹ thuật 2 (Engineering Graphics 2) 3 (3-1-0-6)

Objectives: Providing basic knowledge and skills in order to generating industrial drawings (assembly and part drawings). Creating assembly drawings and part drawings with hands and/or using AutoCAD.

Content: Creating assembly drawings, reading and depicting parts properly with dimensions and tolerances. CAD 2D.

CH4640 Cơ sở tính toán thiết bị hóa chất (Fundamentals of Chemical Engineering Equipment Design) 3 (3-1-0-6)
Objectives: On successful completion of this module, students will be able to mechanically design equipments especially high-pressure equipments used in chemical and petroleum industries. Students also will be able to do R&D, innovation, new product development and product design.

Content: The syllabus will typically include basic knowledge of materials of construction and their mechanical properties, theoretical framework of material strengths, thin shell theory and its application into the calculation of internal and external pressure equipment, thick shell equipments (shell, bottom, cover, flanges, etc.), design and test of high-pressure equipments.

CH4642  Cơ sở tính toán máy hoá chất (Fundamentals of Chemical Engineering Machine Design)

2 (2-1-0-4)

Objectives: After finish this subject, students gain specialized knowledge they need to be able to design the details of equipments and machineries which use in the chemical and petroleum industries.

Content: Provides basic knowledge of calculations of technical fluctuations durability, stability to design the mechanical components of equipments and machineries. These components are high speed rotary axis, high speed rotary disks, rotary barrel, rotary kiln, etc. This knowledge will be the basis for the design of machines used in the chemical and petroleum industries (e.g. centrifuges, mixers, grinders, vibrators, rotary kilns, etc.).

CH4628  Đồ án chuyên ngành cử nhân Máy và Thiết bị công nghiệp hóa chất-dầu khí (Project of Chemical Process Equipment Design for Bachelors)

2 (0-0-4-4)

Objectives: Applying the background of the technical-basic and major-basic courses taken (especially, fundamentals of chemial engineering machine design, fundamentals of chemical engineering equipment design, mechanical separation operations, chemical reactors, solid materials processing, plastics engineering, design of heat exchangers, ...) in order to carry out process design calculation and mechanical design calculation of a specific machine/equipment in chemical engineering field.

Content: Analyzing process requirements of a specific machine/equipment and proposing a proper design procedure; carrying out calculations of design and operating parameters of the machine/equipment; conducting calculations of mechanical design of major elements of a machine/equipment; making installation of the designed machine/element on a A0-size techical drawing.

CH5650  Kỹ thuật phân riêng 1 (Separation Process Technology 1) 2 (2-1-0-4)

Objectives: The end of the course, students acquire the fundamental principles to select, calculate, and design of solid - liquid separation process and equipments.

Content: Provided fundamental principles of solid liquid separation process and equipments; data analysis; evaluate of separation efficiency; provided fundamental methods to select, calculate, and mechanical design of solid liquid separators.
CH5651  Kỹ thuật phân riêng 2 (Separation Process Technology 2)  2 (2-1-0-4)

Objectives: After finish this subject, students will have knowledge to calculate process technology, to design the separation equipments and machineris such as distillators, adsorption, extraction, crystallization equipments and dryers.

Content: Provides basic knowledge to calculate the separation process of the specific equipments by using distillation, adsorption, adsorption, extraction, crystallization and drying technology; Analysis of the technological and structural factors that directly affect the performance of the processes (hydrodynamic factors, resistance, flow); Detail design of mechanical components and detail structure of the equipments.

CH5652  Thiết bị phản ứng (Reactor Design)  3 (3-1-0-6)

Objectives: After finish this subject, students achieve special knowledges about chemical stoichiometry, kinetics of reaction systems (e.g., homogeneous, heterogeneous, non-catalytic heterogeneous, complicated heterogeneous...), mathematical models to describe, calculate and design typical reactors in chemical engineering.

Content: Providing fundamental knowledges about stoichiometry, solving stoichiometric problems to determine key components and key reactions for complicated reaction systems, kinetic theories of homogeneous and heterogeneous reactions, mass balance and heat balance equations to describe, calculate and design ideal batch stirred tank reactor, ideal plus flows reactor, continuos stirred tank reactor, cascade of stirred tank reactors, catalytic heterogeneous reactors, non-catalytic heterogeneous reactor...

CH5658  Máy gia công vật liệu rắn (Solid Materials Processing Machinery)  2 (2-1-0-4)

Objectives: At the end of the module students gain the necessary knowledge to: Calculate, select and make the basic equipment of the basic mechanical processing for Solid Materials (crusher, mixing, milling, sieving,...).

Content: Provides basic knowledge of particle aggregation, solid-state processing characteristics, basic knowledge of selection, calculation and process design and equipment. Processing of materials solid such as: crusher machines (jaw crusher, ice crusher, beetle crusher, hammers), mills machines (roller mills, ball mills, grinding mills) and sieving machines (Vibrating screen,...).

CH5659  Máy gia công vật liệu dẻo (Plastics Processing Machinery)  2 (2-1-0-4)

Objectives: After taking the course, students are capable of desin calculations of common plastics processing operations and machines (such as, extrusion, injection molding, injection blow molding, ect.).

Content: The course provides background of thermal and processing properties of plastic materials; operation of common plastics processing machines such as extruders, injection molding machines, injection blow molding machines, ect.; basic knowledge for process and mechanical design calculations of plastics processing machinery.

CH5653  Thiết kế thiết bị trao đổi nhiệt (Heat Exchanger Design)  2 (2-1-0-4)

Objectives: The purpose of this subject is that students learn basic principles of heat transfer to design industrial thermal systems, heat exchangers according to design standards, manufacturing standards and set up equipments.

Content: This subject is designed to introduce basic principles of heat transfer, analyze and select heat source or discharge heat (incinerators, boilers, thermal oil burners, cooling towers ...), design
industrial thermal network and heat transfer systems, introduce design standards (TEMA, ASME ...) and some application software.

CH5654 Đồ án 3 (Project of Chemical Engineering Equipment Design 3) 3 (0-0-6-6)

Objectives: Applying the background of the technical-basic and major-basic courses taken (especially, fundamentals of chemical engineering machine design, fundamentals of chemical engineering equipment design, mechanical separation operations, chemical reactors, solid materials processing, plastics engineering, design of heat exchangers, ...) in order to carry out process design calculation and mechanical design calculation of a specific machine/equipment in chemical engineering field.

Content: Analyzing process requirements of a specific machine/equipment and proposing a proper design procedure; Carrying out calculations of design and operating parameters of the machine/equipment; conducting calculations of mechanical design of major elements of a machine/equipment; making installation of the designed machine/element on a A0-size technical drawing.

CH5809 Thực tập cuối khóa (Graduation Internship) 3 (0-0-6-6)

Objectives: Based on the background obtained from courses of Chemical Engineering and Chemical Process Equipment belonged to heat and mass transfer, fluid mechanics, mechanical separation processes, solid materials processing and chemical engineering reactors, students apply and exploit for their practicing activities at a selected chemical manufacturing plants. Then, students will select a proper engineering topic for the graduation thesis.

Content: The content of the course is dependent on the plants being visited. However, the general content consists of:

- Organization and Administration of the Company/Plant
- Geographical location and infrastructure of the Company including: transportation system, sources of energy and raw material supplies.
- Basic Flowsheet Diagram of workshops and manufacturing enterprises of the company
- Description and explanation of manufacturing process of each workshop using Basic Flowsheet Diagram (BFD) or Process Flowsheet Diagram (PFD). For major equipment/mechinery, students are required to exploit process parameters, operating conditions, materials of construction, operation procedures and troubleshootings.
- Proposing a proper engineering topic closed to the field of the plant being internship for the graduation design task.

List of compulsory electives package A

CH4031 Additives for Petroleum Products (Phụ gia sản phẩm dầu mỏ) 2(2-1-0-4)

Pre-requisite CH4034 (Petroleum products)

Objectives: This course provides students the knowledge of the composition and properties of petroleum additives. In addition, it provides knowledge of petroleum products, their application and methods of preparation, production, technical specifications.

Content: The course consists of the classification of additives for petroleum products, including additives for oils, lubricant and fuels.
CH4046  Equipment in Oil refineries (Thiết bị nhà máy lọc hóa dầu) 2(2-1-0-4)
Course description: Students will have access to knowledge of the type of equipment, the size of the equipment, the characteristics of the equipment in the refinery. Moreover, after finishing this course, students can approach and improve the ability to practice, operate and operate the technology in the workshop or factory.

CH4011  Piping and Tank (Đường ống bể chứa) 2(2-0-1-6)
Pre-requisite: none
Course description: This course includes most basic knowledge for the design of component parts and assemblies of piping and tank systems. The design criteria includes applicable codes and standards, environmental requirements, and other parameters which may support the work. Engineering calculations included in the design analyses document the piping and tank system design, combined with the system design criteria, calculations define the process flow rates, system pressure, temperature, wall thickness and stress analysis. Computer-aided design programs, for example CAESARII, OLGA, Pipe Flow Expert, Tank..., can be used as personal software assistant in this course but are not a substitute for the student's understanding of the design process.

CH4009. Chemistry and Physico-chemistry of Polymers (Hóa học và Hóa lý Polyme) 2(2-0-0-4)
Course description: This course provides students concepts, chemical–mechanical properties of the synthestic polymers and synthetic methods in industry. This course also provides the basic chemical reactions during synthesyzing and modifying polymers.

CH4017  English for students of Petrochemical Technology. Tiếng Anh dành cho sinh viên ngành Hóa dầu 2(2-1-0-6)
This course is aimed at preparing students who intend to get a job in the oil and gas industry. It presents them with English from a wide variety of oil and gas industry fields and situations, develops their communication skills, and provides them with background in major oil and gas concepts.
At the end of the course, the students should be able to read major books in oil and gas fields, to communicate in major oil and gas concepts and could be able to write abstract for journals in chemistry.

CH5258 Hóa học polyme phân hủy sinh học (Biodegradable Polymer Chemistry) 2(2-0-0-4)
Course description: This course provides students the basic concept of biodegradable polymers: mechanizm of breakdown under the light, enzymatic, hydrolisys degradable. Natural and synthesys biodegradable plymers, testing methods and applications biodegradable polymers in the field of medical, agriculture industry.

CH5259 Hóa học polyme y sinh (Biomedical Polymer Chemistry) 2(2-0-0-4)
Pre-requisite: CH4092 (basic polymer chemistry); CH4090 (basic physical chemistry of polymer)
Course description: This course provides students the basic concept of polymer materials using in the field of medicine and biochemistry. The relationship between biomedical polymer and organisms.
CH5260  Hóa học silicon (Silicon Chemistry)  2(2-1-0-4)
Pre-requisite:  CH4092 (basic polymer chemistry); CH4090 (basic physical chemistry of polymer)
Course description: This course provide students the basic concept of synthesis monomer and silicone polymers, the applications of silicone polymers (silicone rubber, silicone in plastic type, silicone adhesive…)

CH5261  Công nghệ hóa học polymé blend (Polymer Blend Engineering)  2(2-0-0-4)
Pre-requisites:  CH3050 (Physical Chemistry 1); CH3060 (Physical Chemistry 2)
Course description: This course provide students the basic concept of structure and physical–mechanical properties of polymer blends and their applications.

CH5552  Improvement of paper printability  2 (2-1-0-4)
Objectives: The subject equips students with basic concepts about images and printing, modern printing methods, properties, structure of printing paper and the roles of paper in ink, methods to complete and enhance printability of paper. These are aimed to help students understand about printing techniques and complete paper technology to reach current demands on printing

Course description: Images in printing; Colors and color images; Printing principles; Printing methods; Properties of printing paper; Structure of printing paper and interaction between paper and ink; Methods to complete and improve printability of paper.

CH5555  Process control of Pulping and papermaking  2 (2-1-0-4)
Objectives: The subject equips students with basic knowledge about automation, techniques for specification measurement.
Course description: Basic concepts about automation in technical processes; Technical process analysis

CH4437  Paper properties and testing  2 (2-1-0-4)
Objectives: The subject equips students with deep knowledge about properties and methods to evaluate paper and carton quality; possibilities to choose technology for production of paper with desired properties.

After completion, students are able to:
- Present properties of paper and carton, factors influencing paper properties;
- Describe methods for paper and carton properties testing;
- Apply standard testing and evaluating methods for paper and carton in the world and Vietnam

Course description: Influences papermaking process on paper properties; Properties of paper and carton; Paper and carton testing methods.

CH5556  Carton and package engineering  2 (2-1-0-4)
Objectives: The subject equips students with basic knowledge about technology and equipment in production of carton and packaging paper; helps learners have knowledge and basic skills to work in the field of paper, carton, packaging paper and other related fields.

After completion, students are able to:
- Classify and present basic specifications of materials used in production of carton and industrial packaging paper.
Present concepts, technical processes and equipment used for the production of carton and industrial packaging paper.

Course description: Properties and utility of carton and industrial packaging paper; Raw materials for production of carton and industrial packaging paper; Technologies and equipment for production of carton and industrial packaging paper.

CH4433 Applications of biotechnology in pulp and paper processing 2 (2-1-0-4)
Objectives: This course equips students with expanded knowledge regarding advanced technologies applying enzyme in pulp and paper manufacturing in order to save energy, minimize impact on environment and improve the quality of product. In addition, the course provides learners with basic knowledge and skills to work in the field of pulp, paper and other relevant fields.
After completion, students are able to:

- Understand possibility and benefit of applying biological technology in pulp and papermaking;
- Classify microorganisms and enzymes using in pulp and papermaking;
- Present processes applied enzymes in pulp and papermaking.

Course description:
Biotechnology for tree improvement. Applications of microorganisms and enzymes for production of pulp and paper: biodebarking, biodepitching, biopulping, biobleaching, biodeinking, Fiber modification, shives removal, stickes control, enzymatic modification of starch for paper sizing.

CH5553 Tissue manufacturing technology 2 (2-1-0-4)
Objectives: The subject equips students with basic knowledge about technology and equipment in production of tissue paper, to work in the field of pulp and paper, quality control of paper products and other relevant fields.

- Classify and present properties, uses of tissue;
- Select materials for production of some types of tissue;
- Present technical process and equipment system for production of some tissue grades, complete and produce paper products from tissue such as napkin, toilet paper.

Course description: Raw materials for production of tissue; Technologies and equipment for tissue production; Paper product processing.

CH5554 Fundamentals of wood chemical refineries 2 (2-1-0-4)
Objectives: The course equips students with basic knowledge about wood chemical engineering

CH5605 Pharmaceutical testing 2(2-0-0-4)
Objectives: Train students with the basics of drug testing (including testing of active ingredients, raw materials and finished drugs) so that they can themselves check and evaluate the quality of drugs according to pharmaceutical standards.
Content: Provide students with basic knowledge in drug testing, introduce important aspects of drug testing such as quality and quality assurance, standardization, testing according to standard, testing by chemical, physical, biological methods, testing on drug preparation, stability, and age determination.

CH5606 Separation and purification techniques 2 (2-0-0-4)

Objectives: Equip students with knowledge about the separation, enrichment, refining of chemicals in general, pharmaceutical chemistry in particular, physicochemical basis and related techniques of some separation process, typical refining in the production of reagents, especially drug materials

Content: Provide students with general knowledge about the separation process, enrichment, typical refining methods include distillation, crystallization, precipitation, extraction, chromatography, adsorption, ion exchange,

CH5607 Flavors and Cosmetics (Hương liệu và mỹ phẩm) 2(2-0-0-4)

Pre-requisites: None

Objectives: Students are provided with basic knowledge of the basis of organic theorizing, the relationship between the structure and reactivity of organic compounds, the methods of preparation and purification of the most important organic compounds.

Contents: The basic concepts of aromas, cosmetics and basic chemical composition of the aroma-cosmetics; the research methods, separation, purification and quantification of organic compounds; and methods of preparation, synthesis of some basic organic compounds.

List of compulsory electives package B

CH5306 Surface finishing 2(2-1-0-4)

Prerequisites: CH4150 (Theoretical Electrochemistry)

Objective(s): To equip students with basic knowledge of electrochemical surface treatment technology for metals, and fabrication of membrane on the surface.

Brief course content(s):

Theoretical background, application, technology of several surface finishing for metals and alloys, membrane fabrication methods

CH5307 Atmospheric Corrosion 2 (2-1-0-4)

Prerequisites: CH4154 (Corrosion and Protection of Metals)

Objective(s): Students gain basic knowledge of corrosion in ambient environment, understand and have ability to apply protection methods for materials in ambient environment.

Brief course content: Common concepts. Factors affecting corrosion of materials in ambient environment, corrosion mechanism of metals in ambient environment.

Anti-corrosion performance of several popularly used metals, several coatings and several non-metals in ambient environment.

Corrosion prevention methods of metals against atmospheric corrosion, experimental tests of atmospheric corrosion.
CH5308  Electrochemical Materials 2 (2-1-0-4)
Prerequisites: CH4150 (Theoretical Electrochemistry)

Objective(s) To equip students with necessary knowledge of materials which are employed in research and production of Electrochemistry major. Accordingly, electrochemical students probably used the materials properly and effectively as well as develop new electrochemical materials.

Brief course content: Description of electrochemical systems. Components of an electrochemical system: electrode active materials, separator, electrolyte, solid electrolyte, current collectors, terminals, inactive materials. Electrochemical measurement methods.

CH5309  Electrochemical Measurement Techniques 2 (2-1-0-4)
Prerequisites: CH4150 (Theoretical Electrochemistry)

Objective(s) Students master basic electrochemical knowledge and measurement techniques used in electrochemistry and corrosion protection major.

Brief course content(s). Introduction and review of electrode processes, potential and kinetics of batteries, kinetics of electrode reactions, mass transportation through electrical immigration and diffusion, potential step measurement method, linear sweep voltammetry method, cyclic voltammetry method, electrochemical impedance spectroscopy method.

CH5310  Electrochemical Methods for Waste Water Treatment 2 (2-1-0-4)
Pre-requisites: CH4150 (Theoretical Electrochemistry)

Objective: Students gain fundamental knowledge of waste-compounds and wastewater by electrolysis processes and treatment technologies, electrochemical approaches to environmental treatment.

Brief course content: Concept of wastewater by electrolysis processes treatment technologies, electrochemical approaches to environmental treatment. Concept of green production in industrial electrolysis.

CH5311  Electrochemistry in non-aqueous electrolytes 2 (2-1-0-4)
Prerequisites: CH4150 (Theoretical Electrochemistry)

Objective(s): Students have ability to classify different non-aqueous solvents, and to determine redox reactions occurring in non-aqueous electrolyte systems. Students also have ability to proceed electrochemical measurement techniques in non-aqueous electrolytes as well as to know applications of non-aqueous electrolytes in modern electrochemical technologies.

Brief course content: Theoretical chemistry in non-aqueous electrolytes. Electrochemical technologies and applications of non-aqueous electrolyte systems. Electrochemistry in several special solvent systems

CH4192  Informatics and automation in silicate plants (Tín học và tự động hóa trong nhà máy silicat 1) 2(2-1-0-4)
Course description
Know how to operate the main operating mode in the silicate plant
Know how to read control charts and use technological knowledge to explain the main control loops (productivity, temperature ...)

**CH5359    Information and Automation in silicate industry  2(2-1-0-4)**
Know how to operate the main operating mode in the silicate plant
Know how to read control charts and use technological knowledge to explain the main control loops (productivity, temperature ...)

**CH5360    Technical English (Tiếng Anh dành cho sinh viên ngành Silicat)  2(2-1-0-4)**
Course description: Equipped with basic translation skills related to silicate industry and in particular chemistry in general.

**CH5361    Chemistry and physical process of silicate (Hóa lý silicat 2)  2(2-1-0-4)**
Course description: Gives students an understanding of the methods of composition studies, silicon structure and evolution of the reaction of silicate systems

**CH5351    Silicate plant equipment 2 (Thiết bị công nghiệp silicat 2)  2(2-1-0-4)**
Course specification
Understand the theory of transport, supply, agitation, shaping, packaging
Study the principle of composition, technical characteristics and scope of use of all the above facilities in silicate plants: cement, ceramics, refractory and glass
Select, calculate parameters, design the equipment system in the silicate plant according to the technological goals

**CH5362    Industrial silicate furnace 2 (Lò công nghiệp silicat 2)  2(2-1-0-4)**
Course description: How to design common kiln systems
The main control loop of the furnace system
Principles of the structure, operation of the experimental furnace

**CH5363    Advanced Ceramic Materials (Vật liệu ceramic tiên tiến)  2(2-1-0-4)**
The concept and new classification of advanced ceramics, theories and methods of assessment, and the specific characteristics of new ceramic materials.
In-depth research to exploit the problems of process and technological process of producing some advanced ceramic products.

**CH5364    AutoCAD for silicate factory design (AutoCAD cho thiết kế xây dựng nhà máy silicat)  2(2-0-0-4)**
Course description:
Basic knowledge of Autocad practical applications; Basic drawing commands; Object editing commands; File contents management, drawing printing techniques.

**CH5404    Uranium Technology (Công nghiệp URAN)  2 (2-1-0-4)**
Pre-requisites: CH3120 (Inorganic Chemistry), CH4272 (Separation and Purification)
Course description:
The course provides students the knowledge of the nature of uranium, techniques for the decomposition and extraction of uranium from ores, the production of UO2 and UO3, UF4 and UF6, uranium metal, alloys and uranium compounds.
CH5405. Chemistry and Technology of Rare Earth Materials (Hóa học và công nghệ đất hiếm) 2(2-1-0-4)
Pre-requisites: CH3120 (Inorganic Chemistry), CH4272 (Separation and Purification)
Course description: The module provides students the knowledge of Chemistry and Technology of Rare Earth Materials, the production of rare earth elements, the methods using to separate rare earth elements, the production of cerium and cerium compounds

CH5406 Chemistry of Nano Materials (Hóa học vật liệu nano) 2(2-1-0-4)
Course description: This module provides students the basic knowledge about the Chemistry of Nano Materials and application of nanomaterials in practice, fabrication techniques and methods of characterization of nanomaterials. Applying some methods for synthesising nanomaterials and determining the characteristics of the nanomaterials.

CH5407 Inorganic Coating (Màng phủ vô cơ) 2(2-1-0-4)
Pre-requisite: CH4276 (Inorganic Chemistry), CH4154 (Corrosion and Protection of Metals)
Course description: This module aims to provide students the knowledge of general coatings, characteristics of coatings and their applications, techniques for producing inorganic coatings and applications of the coatings. Coating quality test methods.

CH5456 Colloid chemistry (Hóa học chất keo) 2(2-0-1-4)
Goals: Students are provided with basic and modern knowledge that represents physical chemistry of surfaces of dispersion systems with microscopical substances as well as properties of the surface compounds applied for materials technology, chemical technology, food-biology technology, metallurgical technology, environmental treatment technology.
Course description: Surface and adsorption phenomena; Basic concepts of dispersion systems; The basic properties of the colloid system; methods for preparation and purification of colloid systems; Properties of semi-colloidal dispersion and coarse dispersion. Industrial applications of ultra-fine dispersion systems

CH5457 Conductive Polymer Materials (Vật liệu polyme dẫn) 2(2-0-1-4)
Prerequisite: MI1140 (Algebra), PH1120 (Physics II), CH1010 (General Chemistry)
Goals: The course provides basic and modern knowledge about the structure, properties, synthesis methods and applications of the conducting polymer materials.
Upon completion of this course, students should be able to:
- Understand the structural and behavioral characteristics of the conducting polymer materials as well as its applications.
- Understand some main methods for conducting polymer synthesis
- Know the trends in conducting polymer materials research
Course description: The concept of conducting polymers; Methods of preparation and application of conducting polymers; Prospects of conducting polymers in new technology.

CH5458 Application of Catalyst in New Technology and Environmental Protection 2(2-0-0-4)
Goals: The objectives of the course shall be to enable students to:
Understand and apply the knowledge of the science catalyst, especially complex catalysis, in contributing to solve the most urgent problem of the times: Waste treatment and recycle, environmental pollution, technological innovation, creating closed production lines with little or no waste

**Course description:**
- The seriousness and consequences of environmental pollution in the world and in Vietnam.
- Co-ordinate of physical, biological, chemical, catalytic, etc. methods in effective treatment of toxic wastes from different sources.
- The superiority of complex catalytic reactions may contribute to solving all three acute problems at the level of: Treatment of wastewater, decomposition of remaining organic toxins after treatment by the above methods; Improvement the current technological processes; Innovation of technological processes (clean technology)

**CH5459 Application of Complexes (Ứng dụng của các hợp chất phức)** 2(2-0-0-4)
Prerequisites: CH3050 (Physical chemistry 1), CH3060 (Physical chemistry 2)

**Goals:**
- Provide basic knowledge of composition, structure, coordination bond in complex compounds based on quantum mechanics.
- Introduce some methods of synthesis and characterization of complex compounds.
- Provide and up-to-date informations on the applications of complex compounds in many different sectors. From there, demonstrate the scientific significance and practical value of complex research.
- The objectives of the course shall be to enable students to:
  - Explain the relationship between structure and properties of complex compounds
  - Understand some basic applications of complex compounds in research and in industry

**Course description:** Basic concepts of central metal ions, ligands, complexes between metal ions and ligands; Coordination linkages in complex compounds and theory of ligan field. Methods of synthesis and investigation on properties and activities of the complex. Application of complex compounds in different field from biology, biomedicine, environment, supermolecular chemistry to analytical chemistry and substance extraction, new materials, storage and metabolism of energy, synthesis of gold nanoparticles and semiconducting films.

**CH5460 Materials for New Energy Sources (Vật liệu cho các nguồn NL mới)** 2(2-0-0-4)

**Goals:**
- Provide basic and advanced knowledges of materials and properties of inorganic semiconductor materials, organic materials and hybrid materials. Provide current informations and update the applications of materials in solar cell mode.
- The objectives of the course shall be to enable students to:
  - Understand some basic requirements for materials used in solar power conversion;
  - Have knowledges of some materials for solar cells;
  - Know the development trend of renewables energy.

**Course description:** The basics knowledge about solar cells and the process of converting solar energy into electricity: Basic concepts of photovoltaic effect, principles of composition and activities of solar cell and its features. Basic properties of semiconducting materials for solar cells. Inorganic, organic semiconductor materials, hybrid materials using photosensitive dyes. Advantages and disadvantages of materials. Some physical chemistry methods to characterize semiconducting materials for solar cells. Potential and development of solar cells in the future.
List of compulsory electives package C

CH4363  Particle technology (Lý thuyết tập hợp hạt) 2(2-1-0-4)

Pre-requisites: CH3400 (Quá trình & Thiết bị CNHH 1), CH3412 (Quá trình & thiết bị CN hóa học 2), CH3420 (Quá trình & Thiết bị CNHH 3)

Course description: Systematically introducing to the research area of particles, foam, droplets in mono- and poly-dispersed systems. Following topics will be dealt within the framework of this subject: Particle characterizations; Crystals in crystallization; Droplets in liquid-liquid extraction

CH4382  Industrial Waste Treatment 2(2-1-0-4)

Pre-requisites: CH3400 (Chemical engineering 1), CH3412 (Chemical engineering 2)

Goals: After the course, student can understand:
- Rules of environmental protection, the meaning of the waste treatment in industries.
- Methodologies of gas, wastewater and solid waste treatments and popular technologies.

Contents: The course includes 3 chapters: Gas, liquid, and solid treatment consist of:
- Pollution characterizations and harms of pollutants
- Methodologies of separation particles from wastewater
- Methodologies of separation, conversion soluble compounds in gas and wastewater phases.
- Solidwaste treatment

CH4380  Heat and Mass Transfer of Complex Systems 3(3-1-0-6)

Pre-requisites: CH3400 (Chemical engineering 1), CH3412 (Chemical engineering 2), CH3420 (Chemical engineering 3)

Goals: After understanding basic knowledge of mass and heat transfer in the courses CH3412 (Chemical engineering 2), CH3420 (Chemical engineering 3), student continues studying mass and heat transfer of complex systems, solve popular problems in chemical engineering. The course also presents theory of mass transfer of complex systems. Student has to understand basic characteristic of solid material, rules of mass and heat conduction in solid material and external phase.

Contents: In chemical and food industries, there are many processes that includes interaction between 2 phases gas and solid, simultaneously mass and heat transfer are avaiable such as: drying, soluble and solid-liquid extraction, adsorption, and multi-phase reaction. This course introduces knowledge of simultaneous mass and heat transfer. Those will be very useful for chemical engineer.

CH4368  Fluid Process and Mechanical Separation of Heterogenous Systems 3(3-1-0-6)

Pre-requisites: CH3400 (Chemical engineering 1), CH3412 (Chemical engineering 2), CH3420 (Chemical engineering 3)

Goals: The course introduces knowledge of flow and hydraulic of multi-phase systems in chemical industry, presents the mechanical separation techniques of heterogeneous systems to design and operate the industrial units.

Contents: including 3 parts:

Part 1: This part will introduce types of flow in chemical equipment

Part 2 và 3: Those parts will present contents and technical factors of mechanical separation of heterogeneous systems to calculation and design mechanical separator.
**CH5655  Bơm – quạt – máy nén (Pumps – Fans – Compressors)**

2(2-1-0-4)

**Objectives:** At the end of the module students gain the necessary knowledge to: Understand the principles computing, select typical: pumps, fans and compressors used in the equipment systems and processing plant of the industry and Chemical engineering.

**Content:** Provides basic knowledge of working principles, conditions of application, calculation, selection and installation of pumps (displacement pumps, axial pumps, centrifugal pumps,...), fans (low, medium and high pressure fans,...) and typical compressors in industry and Chemical engineering,....

**CH5656  Trường ống - bể chứa (Pipeline Engineering)**

2 TC (2-1-0-4)

**Objectives:** The end of the course, students acquire the fundamental principles to select, design, fabrication, operation, maintenance, and integrity of plant piping systems and pipelines. It applied to plant piping systems and pipelines in chemical process industry, as well as oil and gas pipelines and oil storage tanks.

**Content:** This course provides information on the piping system of chemical process industry and oil and gas pipelines; parts of piping systems such as pumps, valves, pipe flange, support of piping system, piping and equipment insulation, pipeline corrosion,...; structure of oil storage tanks, parts of tanks such as free vent, floating roof tank, fire system, lightning protection of tank,...; and calculate and design tanks such as cone roof tank, open floating roof tank, internal floating roof tank....

**CH5657  Thiết kế lắp đặt các công trình hóa chất (Design and Installation of Chemical Plants)**

2(2-1-0-4)

**Objectives:** On successful completion of this module, students will be able to

- Design site layout of chemical plants, structures of industrial plants
- Design and install chemical engineering equipments and machineries
- Design P&ID in chemical engineering

**Content:** The syllabus will typically include basic knowledge of chemical plant site design (location choice, supply of materials, energy, water...), site layout, structures of workshops, the design and install of specific chemical engineering equipments and machineries (high towers, super-long , super-heavy equipments, rotary equipments, lifting equipments...) and the design of foundations and P&ID in chemical engineering.

**CH5660  Kỹ thuật an toàn và môi trường (Safety and Environmental Engineering)**

2(2-1-0-4)

**Objectives:** At the end of the module students gain the necessary knowledge to: Students will have the necessary technical knowledge on safety techniques and industrial hygiene in industry and Chemical engineering, knowledge related to techniques and equipment for treating waste gas, wastewater, solid waste and hazardous waste,...

**Content:** Provides basic knowledge of law (chemical law,...), analyzes the risks posed to the hazards of the chemical industry, the criteria for assessing the safety of materials and chemicals, the safety and security measures in labor; Provide knowledge related to regulations on environmental
protection, norms for gas, wastewater and solid waste, techniques and equipment for gas emission
treatment and treatment of wastewater, solid waste and hazardous waste.

**CH3800 Basic theory of Industry Construction (Xây dựng công nghiệp) 2(2-1-0-4)**

**Objectives:** Student can gather basis theories about the field of construction and industry
construction; Understand the principle of manufacturer design, main structure frame (concrete
structure & metal structure), covering structure (walls, doors, windows, roof-light, etc); detail
pieces (foundations, bases, floors, stairs, etc.)

After this course, students should be able to:
- Readable and understandable construction drawings
- Design plans of workshop.
- Design sections of workshop.
- Draw more 2-5 structure details (base, foundation, gutter, roof-light, roof, bridge-crane, stair,
eaves, etc.)
- Designed and completed drawing must be satisfied rules of technical industry drawing
  (scale, line styles, symbol of materials, datum line system, dimensions, etc.)
- Student can hold core knowledge of industry designing, which could be used in designing
  activities a real factory and in Graduation thesis.

**Course description:**
Student can gather basis theories about the field of construction and industry construction:
- Basis of Industry construction and standards of industry works
- Detail structures of industry building, include: main structure frame (concrete structure &
  metal structure); covering structure (wall, door, window, roof-light, etc); detail pieces (foundation,
  base, floor, etc.)
- Defining and choosing location, square area and put lay-out master-plan.
- Basic theories of working space designing for production line in workshop and production
  process in whole factory, design plan and section of workshop.