Code: **QG980**

Name: **Combustíveis fósseis e novas formas de energia**

Name in English: **Fossil Fuels and New Forms of Energy**

Name in Spanish: **Combustibles fósiles y nuevas formas de energía**

Subject type: **Weekly**

Approval Type: **Grade e Frequency**

Characteristic: **Topics**

Frequency: **75%**

Period Type / Offering period: **Semestral / At the discretion of the Teaching Unit**

Exige Exame: **Yes**

Vectors

T	L	P	O	PE	OE	SL	WEEKS	CREDITS
2	**-**	**-**	**-**	**-**	**-**	**2**	**15**	**2**

Occurrence on curriculum:

Pre requirement: **QI245 + QO521**

Summary: This course aims at introducing the students to activities involving petroleum processing and refining for the production of fuels and inputs for petrochemical industry. Polymerization and petroleum-based polymers, and other energy sources and inputs (natural gas, synthesis-gas and methanol), are also addressed, always from the chemistry point of view.

Program:

1. Processing of crude oil and production of hydrocarbons
- Introduction to oil refining
- Physical separation processes (destilation at atmospheric and reduced pressures, absorption and adsorption processes, solvent extraction).
- Conversion processes
- Thermal conversion processes
- Catalytic conversion processes
- Fluid catalytic cracking (FCC)
- Paraffiin hydroisomerization
- Skeletal isomerization of olefins
- Olefin/paraffin alkylation
- Gasoline upgrading processes
- Middle destilates upgrading processes
- Catalytic dewaxing
- Hydrocracking
- Residue hydroprocessing
- Olefin production

2. Methane-based inputs
- Methane direct reactions (carbon disulfide, chloromethane, hydrocyanic acid).
- Synthesis-gas reactions (ammonia, methanol, aldehydes, ethylene glycol, alcohols) .

3. Ethane-based inputs and higher molecular weight homologues (propane, n- and i-butane, naphta,

etc.).

4. Ethylene-based inputs (ethylene oxide, acetaldehyde, ethylene oxidative cabonylation, vinyl chloride, perchloro and trichloroethylene, production of alfa olefins, linear alcohols, 1-butene, alkylation products).

5. Propylene-based inputs (acrolein, acrylic acid, isopropanol, propylene oxide, acrylation processes, chlorination, addition of organic acids, hydroformylation, disproportionation, alkylation).

6. C4-based and diolefins-based inputs
- n-butene (oxidation and oligomerization)
- i-butilene (oxidation, epoxidation, addition of alcohols, hydration, carbonylation, dimerization)
- butadiene (adiponitrile, hexamethylenediamine, adipic acid, butanediol, chloroprene, cyclic oligomers)

7. Inputs based on benzene, toluene and xilene (alkylation, dealkylation, chlorination, nitration, oxidation, hydrogenation, disproportionation, carbonylation, production of terephthalic acid, phthalic anhydride, isophthalic acid).

8. Polymerization (reactions and techniques)

9. Petroleum-based polymers (thermoplastics and thermosets, rubbers and synthetic fibers)

10. Other sources of energies and inputs
- Natural gas
- Introduction to conversion processes
- Synthesis-gas and gasoline
- Methanol to gasoline
- Methanol to light weight olefins
- Liquefied petroleum gas to aromatics.
- Solar energy
- Fuel cells

Basic Bibliography

1) SZKLO, A. S. **Fundamentos do Refino de Petróleo**. 1ª edição. Rio de Janeiro: Editora Interciência, 2005. 207 pp.
2) MATAR, S.; HATCH, L. F. **Chemistry of Petrochemical Processes**. 2ª Edição. Boston, USA: Gulf Professional Publishing, 2001. 392 pp.
3) GARY, J. H.; HANDWERK, G. E.; KAISER, M. J. **Petroleum Refining – Technology and Economics.** 5ª Edição. Boca Raton, USA: CRC Press, 2007. 463 pp.

Supplementary Bibliography

1) MARIANO, J. B. **Impactos Ambientais do Refino do Petróleo**. 1ª edição. Rio de Janeiro: Editora Interciência, 2005. 228 pp.
2) CAMPOS, A. F**. Industria do Petroleo – Reestruturação Sul-Americana nos Anos 90.** 1ª edição. Rio de Janeiro: Editora Interciência, 2007. 310 pp.
3) ARMSTRONG, FRASER, BLUNDELL, KATHERINE. **Energy… Beyond Oil**. 1ª edição. Oxford, UK: Editora Oxford 2007. 229 pp.
4) FAHIM, M. A., AL-SAHHAF, T. A., ELKILANI, A. S. **Fundamentals of Petroleum Refining**. 1ª edição. Amsterdan, Holanda: Editora Elsevier 2010. 496 pp.
5) OLAH, G. A.; GOEPPERT, A.; SURYA PRAKASH, G. K. **Beyond Oil and Gas: The Methanol Economy.** 1a. edição. Darmstadt, Alemanha: Editora Wiley-VCH 2006. 290 pp.