UNIVERSITY OF PANNONIA

COURSE DATASHEET

Semester:	2014/15/2
Course:	Catalytic Processes in the Hydrocarbon Industry and Up-to-Date Fuels
Code:	VEMKMOL458E
Responsible department:	Department of Hydrocarbon and Coal Processing
Department code:	MKOL
Responsible instructor:	Dr. Jenő Hancsók

Course objectives:

To give a summary of the theoretical and practical knowledge of chemical engineering on the catalytic processes of hydrocarbon processing.To give an overview about the production, standards, blending components, additives, logistic and life cycle assessment of energetic products of the hydrocarbon processing (gasoline, diesel fuel, JET, heating and fuel oils) and give similar information about the alternative fuels, enviromental protection aspects.

Course content:

1. Relationships of energetic products. The role of mobility in sustainable development. Devices of the mobility and their characterization. Characterization and classification of internal combustion engines. Classification of fuels. Flexible refinery for fuel production.

2. Hungarian and international standards and other international regulations (WWFC) of gasolines. Production of gasoline blending components. Types of gasoline additives. Analytical and performance properties.

3. Blending and additivition of gasolines. Standards, production and additivition of aviation gasolines.

4. Production and additivition of Jet fuels. Hungarian and international standards and other international regulations (WWFC) of diesel fuels. Production of diesel fuel blending components. Analytical and performance properties.

5. Types of diesel fuel additives. Production and blending of diesel fuels.

6. Production and additivation of fuel and heating oils. Life cycle assessment (LCA) of the energetic products of hydrocarbon industry

7. Logistic of energetic products (including fuel stations). Energetic products of hydrocarbon industry and the environment.

8. The role of mobility in sustainable development. Definition, importance and classification of alternative fuels. Fuel purpose production and application of light hydrocarbons (CNG, LPG). Production and application of biogas.

UNIVERSITY OF PANNONIA

COURSE DATASHEET

Semester:	2014/15/2
Course:	Catalytic Processes in the Hydrocarbon Industry and Up-to-Date Fuels
Code:	VEMKMOL458E
Responsible department:	Department of Hydrocarbon and Coal Processing
Department code:	MKOL
Responsible instructor:	Dr. Jenő Hancsók

Course content:

9. The production of synthetic liquid hydrocarbons from synthesis gas (based on natural gas, coal, biomass, etc.). Oxygenates. Natural triglycerides and their derivatives (bio-diesel, bio gas oil, bioJET, etc.).

10. Hydrogen. Electricity. Mixtures/emulsions of alternative and traditional fuels. Comparison of alternative and traditional fuels. Major alternative powertrains. Development tendency of powertrains and fuels.

11. The role and importance of catalytic processes in hydrocarbon processing. The history of industrial catalysis Classification of catalytic processes. Homogeneous, heterogeneous enzyme catalysis. Classification, design and selection of catalysts Heterogeneous catalysts in hydrocarbon processing I.

12. Heterogeneous catalysts in hydrocarbon processing. The role of the support(s), the metal component(s), and the promoter(s). Shape selective catalysis. A few examples of the production of catalysts. Overview of catalytic reactors and reactor systems. Criteria for the selection and layout of the reactor.

13. The operation of catalytic reactors: control the activity before the catalyst loading, installation of various catalysts (drying, activation, etc), continuous monitoring of operational parameters of reactor(s), catalyst sampling, etc.).

14. Regeneration of catalysts ("in situ" és "ex situ"), draining of reactors. Review of the hydrocarbon catalytic systems. Catalytic processes in hydrocarbon industry, and environmental protection I.- II.

1. Production of motor gasoline components with high octane number by catalytic isomerization.
2. Production of reduced sulphur- and aromatic containing diesel fuel by hydrodesulphurization
3. Production of reduced aromatic containing JET fuel by catalytic hydrogenation
4. Hydrogenation of triglycerides to fuel
5. Formulation of modern motor oils by using base-oils and additives
6. Production of synthetic crude oil by cracking of waste plastics

Requirements, evaluation and grading:

Requirements:

UNIVERSITY OF PANNONIA

COURSE DATASHEET

Semester:	2014/15/2
Course:	Catalytic Processes in the Hydrocarbon Industry and Up-to-Date Fuels
Code:	VEMKMOL458E
Responsible department:	Department of Hydrocarbon and Coal Processing
Department code:	MKOL
Responsible instructor:	Dr. Jenő Hancsók

Requirements, evaluation and grading:

Examination paper.
Examlpes of Examination Questions are in annex. (<50% = 1; >85%=5)

Possibilities for repeating the subject:-

Accepted equivalent subjects:-

Learning efforts necessary to satisfy the requirements of the subject:
Presentation of a catalyst used in oil industry, and petroleum, a critical presentation of a selected technology of fuel production from crude oil, from the raw materials over the consumption to the recovery of metal components; and presentation of the chemistry and technology, and the properties of an alternative motor fuels.
Total: 104 hour:

- Contact time: 52 hour
- Self preparation: 26 hour.
- Presentation: 26 hour.

Required and recommended readings:

Required and suggested references:
1-7th International Colloquium on Fuels, 1997, 1999, 2001, 2003, 2005, 2007, 2009, 2011, 2013, Edited by Bartz, W.J. Technische Akademie Esslingen.
Carley, A.F., Davies, P.R., Hutchings, G.J., Spencer, M.S.: "Surface Chemistry and Catalysis", 2002, 381 oldal
Auerbach, S.M:, Carrado, K.A, Dutta, P.K.: …Handbook of Zeolite Science and Technology", Marcel Dekker Inc., 2003, New York, Basel, ISBN: 0-8247-4020-3.
Viswanathan, B. Sivasanker, S., Ramaswamy, A. V.: "Catalysis Principles and Applications", 2002, 412 oldal, ISBN: 81-7319-375-4.
Becker, E.R., Pereira, C.J.: …Computer-Aided Design of Catalysts", Marcel Dekker Inc., 1993, 620 oldal (2 kötet)
Berty, J.M.: "Experiments in Catalytic Reaction Engineering", Elsevier, 1999, Amsterdam,……..,Tokyo, ISBN: 0 444 82823 0. (VZ)
Cammack, R., Frey, M., Robson, R.: …Hydrogen as a Fuel", Taylor & Francis, 2001, London, New York.
Chen, N.Y. et al.: Shape Selective Catalysis in Industrial Applications 2.edition, Marcel Dekker Inc., N.Y. Basel Hong Kong, 1996.
Chunshan Song, Juan M. Garcés and Yoshihiro Sugi: …Shape - Selective Catalysis", 2001, 408 oldal (2 kötet)
Davison, B.H., Lee, J.W.: "Biotechnology for Fuels and Chemicals", Twenty-Fourth Symposium on Applied

UNIVERSITY OF PANNONIA

COURSE DATASHEET

Semester:	2014/15/2
Course:	Catalytic Processes in the Hydrocarbon Industry and Up-to-Date Fuels
Code:	VEMKMOL458E
Responsible department:	Department of Hydrocarbon and Coal Processing
Department code:	MKOL
Responsible instructor:	Dr. Jenő Hancsók

Required and recommended readings:

Biochemistry and Biotechnology, Human Press, Totowa, New Jersey, 2003.
Delannay, F.: Characterization of Heterogeneous Catalysts, Marcel Dekker, N.Y., 1984.
Essers, U.: Dieselmotorentechnik'98, Expert Verlag, Renningen, 1998
Fogler, H.S.: …Elements of Chemical Reaction Engineering", Prentice Hall International, 1992, 838 oldal
Gates, B.C., Katzer, J.R., Schuit, G.C.A.: …Chemistry of Catalytic Processes", McGraw-Hill, 1979, 387 oldal
Hagelüken, Ch. Et al: Autoabgaskatalizatoren, Expert Verlag, Renningen, 2001
Hamid, H., Ali, M. A.,: …Handbook of MTBE and Other Gasoline Oxygenates", Marcel Dekker Inc., New York, 2004.
Hancsók J.: Korszerű motor- és sugárhajtómű üzemanyagok, I. MOTORBENZINEK, Veszprémi Egyetemi Kiadó, Veszprém, 1997.
Hancsók J.: Korszerű motor- és sugárhajtómű üzemanyagok, II. DÍZELGÁZOLAJOK, Veszprémi Egyetemi Kiadó, Veszprém, 1999
Hancsók J.: Korszerű motor- és sugárhajtómű üzemanyagok, III. ALTERNATÍV MOTORHAJTÓANYAGOK, Veszprémi Egyetemi Kiadó, Veszprém, 2004.
Hancsók J. és mtsai.: Üzemanyagok és felhasználásuk, Tribotechnik Kft., Budapest, 1998.
Hancsók Jenő, Baladincz Jenő, Magyar János: …Mobilitás és környezet" cikksorozat gyűjteményes kiadványa, Pannon Egyetemi Kiadó, Veszprém, 2009.
Haycock, R.F., és Thatcher, R.G.F.: Fuel Additives and Environment, ATC,(The technical Committee of Petroleum Additive Manufactures in Europe), Document 52, 1992
Hobson, G.D.: Modern Petroleum Technology, J. Wiley, 1986.
Imelik, B., Vedrine, J.C.: …Catalyst Characterization – Physical techniques for Solid Materials", Plenum Press, 702 oldal (5 kötet)????
International Energy Agency: …Biofuels for Transport An International Perspective", OECD.
Jacques, K.A., Lyons, T.P., Kelsall, D.R.: "The Alcohol Textbook", Nottingham University Press, Nottingham, 1999.
Jones, T.C.: Diesel Plant Operations Handbook, McGrow-Hill Inc., N.Y., 1991.
Leach, B.E.: Applied Industrial Catalysis, Vol. 1-3. Academic Press, New York, 1983.
Le Page, J.-F. et al.: Applied Heterogenous Catalysis. Éditions Technip. Paris, 1987.
Masel, R.I.: Chemical kinetics and catalysis, John Wiley and Sons, Inc., 2001.
Meyers, R.A.: Handbook of petroleum Refining Processes, McGraw-Hill Inc., New York, 2007.
Michiels, P., De Herdt, O.C.E.: …Molecular Sieve Catalysts", Pergamon Press, 1987, 381 oldal
Mittelbach, M., Remschmidt, C.: "Biodiesel the comprehensive handbook", Martin Mittelbach Publisher, Graz, 2004.
Moffat, J.B.: Theoretical Aspects of heterogenous Catalysis, Van Nostrand Reinhold, N.Y., 1990.
Oláh, Gy., Molnár, Á.: …Hydrocarbon Chemistry", John Wiley & Sons Inc., second edition, 2003

UNIVERSITY OF PANNONIA

COURSE DATASHEET

Semester:	2014/15/2
Course:	Catalytic Processes in the Hydrocarbon Industry and Up-to-Date Fuels
Code:	VEMKMOL458E
Responsible department:	Department of Hydrocarbon and Coal Processing
Department code:	MKOL
Responsible instructor:	Dr. Jenő Hancsók

Required and recommended readings:

Peake, S.: Vehicle and Fuel Challange Beyond 2000, FT Automotive Publishing, London, 1997
Quaschning, V.: "Undestanding Renewable Energy System", Earthscan, London, 2005.
Rase, H.F.: Fixed Bed Reactor Design and Diagnostics, Butterworths, Boston, 1990.
Satterfield, C.N.: Heterogenous Catalysis in Industrial Practice, McGraw-Hill Inc., N.Y., 1991.
Schobert, H.H:: The Chemistry of Hydrocarbon Fuels, Butterworths, London, 1990.
Serge Raseev: …Termal and Catalytic Processes in Petroleum Refining", 2003, 920 oldal (2 kötet)
Seymour, A.: Refining and Reformulation: The challenge of green motor fuels, Oxford Institute for E nergy Studies, Oxford, 1992.
Shah, R.K., Kandlikar, S.G.: "Fuel Cell Science and Technology", The American Society of Mechanical Engineers, 2003.
Somorjai, G.A.: …Introduction to Surface Chemistry and Catalysis", John Wiley & Sons Inc., 1994, 617 oldal (4 kötet)
Speight, J.G.: Fuel Science and Technology Handbook, Marcel Dekker Inc., N.Y., 1999.
Speight,J.G.: The chemistry and technology of petroleum 3rd . Marcell Dekker, 1998.
Speight,J.G.: Petroleum Chemistry and Refining, Taylor and Francis 2006.
Stiles, A.B., Koch, T.A.: …Catalyst Manufacture", Marcel dekker Inc., 1995, 288 oldal
Szostak, R.: Molecular Sieves, Van Nostrand Reinhold, N.Y., 1989.
Trimm, D.l. et al.: Catalysis in Petroleum Refining, 1989 Elsevier, Amsterdam, Tokyo, 1990.
Tschöke, H. et al: Diesel – und Benzindirekteinspriztung, Expert Verlag, Renningen, 2001
Weitkamp, J. : …Catalysis and Zeolites", Springer, 1999 Hong Kong, 1993.