

Advanced Fuel Technology

CHE-446	Advanced Fuel Technology	2CH	
		Theory (2)	
Pre-	Nil	Category	Elective
Course Contents as per PEC Guidelines 2023-2024			
Advanced Fuel Technologies: Sustainability, recycling, carbon free fuels, next generation fuels. Methanol & Ethanol: Historical development of Methanol & Production of methanol Reactions and applications of methanol & Future opportunities and challenges Storage and handling aspects, Pure methanol & Methanol containing system Toxicity, Occupational health, and environmental concerns. Production of methanol: Thermodynamics and kinetics of methanol synthesis & Syngas preparation process Steam reforming of natural gas to methanol & Conversion of methanol to gasoline. Conversion of methanol to olefins, Methanol fuel & Methanol as a fuel, Methanol vehicle exhaust emissions & Future methanol engine and vehicles Methanol in heavy duty engines & Outlook for fuel methanol Hydrogen: An energy dependent world & The basics of hydrogen History and development, why hydrogen as a fuel & Pros and cons into the future Production Hydrogen from fossil electrolysis, Hydrogen from coal Hydrogen from methane & Hydrogen from Biomass pyrolysis/steam reforming Modeling of hydrogen separation & Storage and handling aspects Membrane for enhanced hydrogen production from Water Gas shift reaction, Hydrogen-metal systems & Mass storage of hydrogen Hydrogen storage for future energy systems: Fuel cell system model Transportation of gaseous hydrogen by pipelines & Hydrogen fuel Transportation of liquid hydrogen by truck or ship & Analysis and simulations. Fuel cells, Progress in PEM fuel cell development & Hydrogen fueled transportation Fuel cell vehicles Hydrazine: Introduction & Physical properties of hydrazine chemistry, Production of hydrazine & Hydrazine handling aspects Decomposition and combustion of hydrazine & Hydrazine applications			

Weekly plan

Week /Lecture	Topic
1-2	Advanced Fuel Technologies: Sustainability, recycling, carbon free fuels, next generation fuels.
3-5	Methanol & Ethanol: Historical development of Methanol & Production of methanol Reactions and applications of methanol & Future opportunities and challenges Storage and handling aspects, Pure methanol & Methanol containing system Toxicity, Occupational health, and environmental concerns.
6-8	Production of methanol: Thermodynamics and kinetics of methanol synthesis & Syngas preparation process Steam reforming of natural gas to methanol & Conversion of methanol to gasoline. Conversion of methanol to olefins, Methanol fuel & Methanol as a fuel, Methanol vehicle exhaust emissions & Future methanol engine and vehicles Methanol in heavy duty engines & outlook for fuel methanol
9	MID TERM EXAM
10-12	Hydrogen: An energy dependent world & The basics of hydrogen History and development, why hydrogen as a fuel & Pros and cons into the future Production Hydrogen from fossil electrolysis, Hydrogen from coal Hydrogen from methane & Hydrogen from Biomass pyrolysis/steam reforming Modeling of hydrogen separation & Storage and handling aspects Membrane for enhanced hydrogen production from Water Gas shift reaction, Hydrogen-metal systems & Mass storage of hydrogen
13-14	Hydrogen storage for future energy systems: Fuel cell system model Transportation of gaseous hydrogen by pipelines & Hydrogen fuel Transportation of liquid hydrogen by truck or ship & Analysis and simulations. Fuel cells, Progress in PEM fuel cell development & Hydrogen fueled transportation Fuel cell vehicles
15-16	Hydrazine: Introduction & Physical properties of hydrazine chemistry, Production of hydrazine & Hydrazine handling aspects Decomposition and combustion of hydrazine & Hydrazine applications
17	Revision
18	End Semester Exam
TEXT AND REFERENCE BOOKS: - Chris Hayhurst Hydrogen Power: New Ways of Turning Fuel Cells into Energy, Rosen Publishing Group,2003. - Wu-Hun Cheng, H.H. Kung, Methanol production and use, Marcel Dekker,1994 - Schmidt "Hydrazine & its derivatives: Preparation, Properties, Applications", Wiley,2001 G. Padro, F. Lau "Advances in Hydrogen energy", Springer,2013 - Pukrushpau, Awa G., HueiPeng "Control of Fuel Cell Power Systems: Principles, Modeling, Analysis and Feedback Design", Springer, 2004	

