



**DEPARTMENT OF CHEMISTRY**  
**NATIONAL INSTITUTE OF TECHNOLOGY: TIRUCHIRAPPALLI**

<b>COURSE PLAN</b>			
<b>Course title</b>	<b>CH-622-Catalysis</b>		
<b>Course code</b>	<b>CH-622</b>	<b>No. of Credits</b>	<b>3</b>
<b>Department</b>	<b>Chemistry</b>	<b>Faculty</b>	<b>Dr. Arivazhagan Chinnappa and Dr.Aranganathan V</b>
<b>Course type</b>	<b>Elective course</b>		
<b>Course Coordinator(s) (if, applicable)</b>		<b>Dr. Arivazhagan Chinnappa and Dr. Aranganathan V</b>	
<b>E-mail:</b>	<a href="mailto:azhagan@nitt.edu">azhagan@nitt.edu</a> and <a href="mailto:anathan@nitt.edu">anathan@nitt.edu</a>	<b>Phone:</b>	8056672406 and 9591959720
<b>COURSE OVERVIEW</b>			
This is an elective course offered for the M.Sc students (I-Semester). Three credits are awarded for the course. Three lectures will be conducted every week by a faculty member in Chemistry dept.			
<b>COURSE OBJECTIVES</b>			
1. To introduce the students to the fundamentals of catalysis and characterization techniques in catalysis. 2. To provide them a brief idea on the homogeneous, heterogeneous and photo catalysis.			
<b>COURSE OUTCOMES (CO)</b>			
CO1 learn about the fundamentals in catalysis and characterization techniques CO2 learn about the homogeneous catalysis CO3 learn about the heterogeneous catalysis CO4 learn about the photo catalysis			
<b>COURSE TEACHING AND LEARNING ACTIVITIES</b>			
<b>Sl.No.</b>	<b>Week</b>	<b>Topic</b>	<b>Mode of Delivery</b>
1	<b>I-week Sep/2021</b>	<b>Unit I:</b> Fundamentals: Catalyst - activation energy concept - types comparison of homogeneous & heterogeneous catalysis	<b>C&amp;T, PPT</b>
2	<b>II-week Sep/2021</b>	Enzyme catalysis - green catalysis - nano catalysis - autocatalysis - phase transfer catalysis - promoters - poisons	<b>C&amp;T, PPT</b>
3	<b>III-week</b>	<b>Unit II:</b>	<b>C&amp;T, PPT</b>



	Sep/2021	Noyori asymmetric hydrogenation -metal mediated C-C and C-X coupling reactions - Heck, Stille, Suzuki, Negishi and Sonogashira, Nozaki-Hiyama, Buchwald-Hartwig	
4	IV-week Sep/2021	Ullmann coupling reactions - directed orthometalation - metal (Rh, Ir) catalyzed C-H activation reactions and their synthetic utility -copper and rhodium based carbene and nitrene	C&T, PPT
5	I-week Oct/2021	Cyclopropanation - Rh catalyzed C-H insertion and aziridination reactions including asymmetric version - introduction to N-heterocyclic carbene metal complexes.	C&T, PPT
6	II-week Oct/2021	<u>UNIT III</u> Characterization of solid catalysts: Surface area - structure - surface morphology - porosity - diameter - particle size	C&T, PPT
7	III-week Oct/2021	X-ray diffraction - SEM, TEM, X-ray absorption spectroscopy, XPS and Auger spectroscopy to surface studies	C&T, PPT
8	IV-week Oct/2021	TPD, TPR for acidity and basicity of the catalysts - boundary layer theory -Wolkenstein theory -Balanding's approach	C&T, PPT
9	I-week Nov/2021	<u>Unit IV</u> Heterogeneous catalysis: Adsorption isotherms - surface area - pore size and acid strength measurements	C&T, PPT
10	II-week Nov/2021	Porous solids -catalysis by metals - semiconductors and solid acids -supported metal catalysts	C&T, PPT
11	III-week Nov/2021	Catalyst preparation - deactivation and regeneration -model catalysts - ammonia synthesis	C&T, PPT
12	IV-week Nov/2021	Hydrogenation of carbon monoxide -hydrocarbon conversion - selective catalytic reduction - polymerization.	
13	I-week Dec/2021	<u>Unit V</u> Porphyrins -phthalocyanines and semiconductor as photo catalysts in photolysis reactions	C&T, PPT
14	II-week Dec/2021	Generation of hydrogen by photo catalysts - photocatalytic break down of water and harnessing solar energy	C&T, PPT
15	III-week Dec/2021	Photocatalytic degradation of dyes - environmental applications.	C&T, PPT

#### COURSE ASSESSMENT METHODS

S. No.	Week/Date	Mode of assessment	Portions	Duration	% Weightage
1	I-week Oct/2021	Assignment I	Unit V	One week	10
2	III-week Oct/2021	Test I	Unit I and II	1 hour	25
3	I-week Nov/2021	Seminar	UNIT V	One week	10

4	III-week Nov/2021	Test II	Unit III and IV	1 hour	25
5	II-Week Dec/2021	Compensation exam	Unit I, II, III, and IV	1 hour	25*
6	IV-week Dec/2021	End semester	Unit I, II, III, IV and V	3 hours	30
<b>TOTAL</b>					<b>100</b>

#### ESSENTIAL READINGS

1. P. H. Emmet, Catalysis (Vol I and II), Reinhold, 1954.
2. M. Schlosser, Organometallics in Synthesis, A Manual, John Wiley, 1996.
3. L. S. Hegeudus, Transition Metals in the Synthesis of Complex Organic Molecules, University Science, 1999.
4. D. K. Chakrabarty and B. Viswanathan, Heterogeneous Catalysis, New Age, 2008.
5. B. Viswanathan, S. Kannan and R.C. Deka, Catalysts and Surfaces: Characterization Techniques, Narosa, 2010.
6. M. Kaneko and I. Okura, Photocatalysis: Science and Technology, Springer, 2003.

#### COURSE EXIT SURVEY (mention the ways in which the feedback about the course is assessed and indicate the attainment also)

1. Feedback from students during class committee meetings.
2. Anonymous feedback through questionnaire (as followed previously)

#### COURSE POLICY (including plagiarism, academic honesty, attendance, etc.)

1. 75% attendance is compulsory for writing the end semester exam.
2. \*Those who have failed to appear for Test I & Test II will have to attend the compensation exam, which will be conducted in the 2<sup>nd</sup> week of November and the compensation exam will cover the entire portions of unit I, II, III, IV and V
3. Those who have failed to acquire 75% attendance will have to attend the compensation evening classes which will be conducted in the 1<sup>st</sup> week of Nov in order to appear for the end semester examination

#### ADDITIONAL COURSE INFORMATION

The respective faculty will be available for consultation at times as per the intimation by the faculty. Location (OJAS-Chemistry)

Coordinator C. Arimshagan

CC-Chairperson 

HOD 

Dr. A. Sreekanth

09/09/2021