

<b>Course Code</b>	CHE401M3		
<b>Course Title</b>	Advanced Coordination and Organometallic Chemistry		
<b>Credit Value</b>	03		
<b>Hourly Breakdown</b>	Theory	Practical	Independent Learning
	45	-	105
<b>Objective/s</b>	<ul style="list-style-type: none"> <li>• Discuss the bonding and electronic spectra of coordination complexes</li> <li>• Provide the concepts and applications of magneto chemistry</li> <li>• Describe the principles of organometallic chemistry</li> <li>• Illustrate reaction mechanisms of reactions in coordination compounds</li> </ul>		
<b>Intended Learning Outcomes</b>	<ul style="list-style-type: none"> <li>• Interpret the electronic spectra in transition metal complexes</li> <li>• Construct the energy level diagram of metal ligand complexes</li> <li>• Evaluate the magnetic moments of the coordination compounds</li> <li>• Elaborate the concepts of <math>\sigma</math> and <math>\pi</math> ligands in organometallic chemistry</li> <li>• Identify the appropriate organometallic catalysts in inorganic synthesis</li> <li>• Determine the reaction mechanisms in coordination complexes</li> <li>• Discuss photochemical reactions in coordination complexes</li> </ul>		
<b>Course Content</b>	<p><b>Advanced Coordination Chemistry</b></p> <ul style="list-style-type: none"> <li>• Review of coordination chemistry, ligand field theory, ligand field stabilization energy, Jahn-Teller effect, spectrochemical series, Nephelauxetic series, angular overlap method</li> <li>• Quantum numbers of multi electron atoms, terms, microstates of configuration, coupling of spin angular momentum, ground state terms symbol for transition metal ions, selection rules for electronic transition, correlation diagram, Orgal diagram for <math>d^1</math> -<math>d^9</math> complexes, interpretation of spectra of transition metal complexes using Orgal diagrams and Tanabe–Sugano diagrams, applications of Tanabe–Sugano diagrams</li> <li>• Charge transfer spectra: ligand to metal charge transfer spectra, metal to ligand charge transfer spectra</li> </ul>		

### **Reaction Mechanisms and Photochemistry**

- Types of reactions, inert and labile complexes, classification of reaction mechanism, rate laws and interpretation, experimental investigation of mechanism, factors affect the rate of the reaction
- Ligand substitution in square planar and octahedral complexes, acid and base hydrolysis, stereochemical change, isomerization reaction, oxidative-addition, reductive-elimination, oxidation reduction reaction: classification, theory and mechanism.
- Prompt and delayed reactions quantum yield, photochemical reaction of Co(III), Rh(III), Ru(II) and Cr(III) complexes

### **Magnetochemistry**

- Review of magneto chemistry, classification of magnetic substances, magnetic susceptibility, measurement of magnetic susceptibility, corrected magnetic susceptibility, paramagnetism,
- Curie's law, Curie-Weiss law, trend of paramagnetic behaviour with energy separation, quenching of orbital contribution, spin-orbit coupling, temperature independent paramagnetism, magnetic properties of lanthanide and first transition series elements
- Applications of paramagnetic behavior, diamagnetism, ferromagnetism, antiferromagnetism.

### **Advanced organometallic Chemistry**

- Review of organometallic chemistry, preparation and reactions of organometallic compounds transition metals:  $\sigma$  donor ligands,  $\sigma$  donor/ $\pi$  acceptor ligands,  $\sigma$ ,  $\pi$ - donor/ $\pi$  acceptor ligands,
- Organometallic chemistry of Lanthanoids and Actinoids
- Organometallic Catalyst in synthesis.

<b>Teaching and Learning Methods / Activities</b>	Lectures, tutorial discussion, small group assignment and home-work assignments, e-learning, online learning	
<b>Evaluation/Assessment Strategy</b>	In course assessment	End of course examination
	30%	70%
<b>Recommended References</b>	<ul style="list-style-type: none"> <li>• Overton, T. L., Rourke, J. P., Weller, M. T., and Armstrong, F. A., “Inorganic Chemistry”, 7<sup>th</sup> Edition Oxford University Press, 2018.</li> <li>• Miessler, G., Fischer, P. J., Tarr, D. A., “Inorganic Chemistry”, 5<sup>th</sup> Edition Pearson Education, 2014.</li> <li>• Atkins, P., Rourke, T. O. J., Weller, M. and Armstrong, F., “Inorganic Chemistry”, 5<sup>th</sup> Edition, Oxford University Press, 2010.</li> <li>• James E. House, “Inorganic Chemistry”, 1st Edition, Elsevier, 2008.</li> <li>• Albert Cotton, F., Geoffrey Wilkinson., Carlos A. Murillo., Manfred Bochmann., “Advanced Inorganic Chemistry”, 6th edition, Wiley-Inter science, 1999.</li> <li>• Lee, J. D., “Concise of Inorganic chemistry”, 5<sup>th</sup> Edition, Blackwell Science Press, 1999.</li> <li>• Jordan R. B., “Reaction mechanisms of inorganic and organometallic systems”, 3<sup>rd</sup> Edition Oxford University Press, 2007.</li> </ul>	