Course of Studies

for

1 Year Master of Philosophy (M.Phil.)

in

Chemistry

(Session 2016 – 2017 Onward)

Department of Chemistry
Veer Surendra Sai University of Technology (VSSUT)
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Course Structure of 1 Year Integrated M.Phil. (Chemistry)

First Semester				
Sl. No.	**Course Code**	**Name of the Course**	**L–T–P**	**Credit**
1	MPCH-101	Research Methodology	4–0–0	04
2	MPCH-102	Advanced Chemistry	4–0–0	04
3	MPCH-103	Advanced Materials	4–0–0	04
4	MPCH-104	Experimental Advanced Chemistry	0–0–6	04
5	MPCH-105	Review of Journal Papers	0–0–6	02
6		Seminar–I	0–0–4	02
			Total Credits	**20**
Second Semester				
1	MPCH-201	Dissertation	0–0–24	16
2	MPCH-202	Seminar–II	0–0–4	04
3		Comprehensive Viva		
			Total Credits	**20**

SEMESTER: 1st

Code: **MPCH-101** Subject: **RESEARCH METHODOLOGY** Credits: **4 [4-0-0]**

Course objective:

- The course has the objective to accumulate introductory and basic knowledge of research and its methodology to impact quality and comparative study of the literature for investigation of new area of research
- First two modulus give the philosophy of research with general aptitude whereas last two modulus impact the numerical and computational aptitude of the course.

Course outcome:

- The main outcome of the course shall be the gain of knowledge and expertise for impacting quality research.
- General terminology including various methods for the research shall be the outcome of the course.
- To improve the numerical aptitude and computational knowledge in the basic of collection and presentation of data.

Module I: (10 Classes)

Application of statistical concepts/procedures, Data, Diagrammatic representation data, Probability, Measures of central tendency, Measures of dispersion, Skewness and Kurtosis, Normal distribution: Simple correlation, Multiple correlations, regression analysis; Sampling: Simple random sampling, Stratified random sampling, Systematic sampling.

Module II: (10 Classes)

Testing of Hypothesis tests, χ (Chi-square), 1 and F-tests, Analysis of variance, Covariance, Principal component analysis, Experimental design: Completely randomized block design, Randomized block design, Latin square design. One-way analysis of variance, Two-way analysis of variance, Follow up tests, Non-parametric procedures, Writing of research reports.

Module III: (10 Classes)

Windows and/or Linux operating system, Programming fundamentals, Basics of high level programming language-C: Editing, Compilation and running a programme, storing data, Elementary numerical methods (as per requirement of the subject), Plotting graph: Preparing paper or report using Latex.

Module IV: (10 Classes)

Computational Aspects in Chemistry*:* Flow Chart & Programme: Compute pressure and constants from van der Waal's equation, Calculate pH of a solution, Calculate energy of a quanta using Einstein's equation, Compute order, half life and rate constants of zero order and first order reactions, Calculate percentage by weight of a solute, Calculate molarity of a solution.

Books Recommended:

1. D.K. Bhattacharyya, Research Methodology, Excel Books, New 'Delhi, 2nd Edition, 2006.

2. C.R. Kothari, Research Methodology.

3. S.C. Gupta, and V.K. Kapoor, Fundamentals of Mathematical Statistics. S. Chand, New Delhi.

4. E. Balguruswamy, Programming in C.

5. P.K. Sinha and Priti Sinha, Computer Fundamentals, BPB Publication.

6. P. Richard, Linux; The complete reference, McGraw HiII.

Code: **MPCH-102** Subject: **ADVANCED CHEMISTRY** Credits: **4 [4-0-0]**

Course objective:

- The objective of the course are to impact advance knowledge of chemistry in different subjects which are required to understanding philosophy of chemistry.
- Green chemistry is the new branch of chemistry with high environmental aspect of the chemical reactions whereas supramolecular chemistry given the biological aspects of high molecular weight compounds.
- Characterization of polymers by analytical techniques is essential for the student at the Doctorate level.
- Further the knowledge of the statistical thermodynamics shall be an advance area of physical chemistry.

Course outcome:

- To know the organic synthesis by low cost non-toxic, non-hazardous of product for ideal application.
- Characterization of macromolecular and study of supramolecular chemistry will impact the interest for the research.
- Study of statistical thermodynamics shall expose the advance learning of physical chemistry.

Module I: (10 Classes)

Green Chemistry: Introduction, Principles, Need for green chemistry, Evaluation of the type of reactions: rearrangement and addition (100% atom economic) and Pericyclic reaction (no byproduct). Selection of solvent: Aqueous phase reactions and solvent free reactions (solid phase reaction), Application in organic synthesis: microwave synthesis, microwave assisted organic synthesis (Claisen rearrangement, Michael addition, Pinacol-Pinacolone, Reformatsky, Hoffmann elimination, Perkins reaction and Beckmann rearrangement). Green methods in material synthesis.

Module II: (10 Classes)

Supramolecular Chemistry: Concept of supramolecular chemistry, Different types of non-covalent interactions, Molecular receptors for neutral, cationic and anionic substrates, Co-receptor and multiple recognition. Introduction to self-assembly with examples. Applications of Supramolecular chemistry in transport processes and Catalysis.

Module III: (10 Classes)

Characterisation of macromolecules Structural characterization (UV, IR and XRD). Thermal characterization – TGA, DTA, DMA and DMTA. Mechanical properties of polymers: Glass transition temperature (Tg), measurement of Tg and relationship with Tg and Tm. Viscosity and average molecular weight of polymers.

Module IV: (10 Classes)

Statistical and Non-equilibrium Thermodynamics: Thermodynamics of Living Systems, Onsager's reciprocity relations, electrokinetics phenomena, diffusion, electric conduction, irreversible thermodynamics for biological systems, coupled reactions.

Books Recommended:

1. Supramolecular Chemistry, Paul D. Beer, Philip A. Gale, David K. Smith, Oxford Press.

2. Supramolecular Chemistry, Jonathan W. Steed and Jerry I. Atwood, Second edition, Wiley.

3. Biorganic, Bioinorganic, and Supramolecular Chemistry, PS Kalsi, JP Kalsi, New Age.

4. Supramolecular Chemistry, JM Lehn, VCH.

5. Material Science and Engineering, An Introduction, WD Callister, Wiley

6. Principles of Solid State, HV Keer, Wiley Eastern.

7. Material Scinece, JC Anderson, KD Leaver, I Alexander and RD Rawlings, ELBS.

8. Priniciples of Biochemistry; A I Lehninger, Worth Publishers

Code: **MPCH-103** Subject: **ADVANCED MATERIALS** Credits: **4 [4-0-0]**

Course objective:

- The main objective of the present course to expose the interest regarding various smart materials like nano materials, composite materials and bio materials for their applications in making of devices.
- Micellar chemistry in the last part of the course which has the objective to explore new technology for the preparation of advance materials.

Course outcome:

- Characterization and identification of nano materials, bio materials, and composite materials will impact new idea to start research in emerging area of material sciences.
- The study of micellar chemistry shall give a new exposure to developed synthetic process of various advance materials.

Module I: (10 Classes)

Nanomaterials: Nanoscale regime and its importance, chemistry of nanomaterials, Size dependent physico-chemical properties, Forms of nanomaterials (e.g. powder, film/coating, composite, nanowires, nanotubes, nanoporous, nanocluster etc.), General physico-chemical methods of synthesis of nanomaterials (Plasma, electrodeposition, evaporation condensation, coprecipitation, sol-gle, microemulsion method) with examples, General applications of nanomaterials.

Module II: (10 Classes)

Composite Materials: Basic idea of composites, alloys, blending, matrixes and reinforcement materials, carbon-carbon composites, biocomposites, nanocomposites, fabrication of polymer composites, Processing of composites, interfaces and inter-phases in composites, environmental effect on composites, application of composites.

Module III: (10 Classes)

Biomaterials: Introduction to biomaterials, types of biomaterials and their applications, Biomineralization: concept and mineralization processes, biogenic minerals (like carbonate, phosphate and oxalate) with special reference to calcium.

Module IV: (10 Classes)

Micellar Chemistry: Micelle formation and structure, Thermodynamics and theories of

micellization, Solubilization in aqueous micellar solutions, Available solubilization sites, Principles of micellar catalysis in aqueous solutions and Experimental techniques and treatment of data, General features of micellar catalysis, Structure and formation of micelles in non-aqueous solvents.

Books Recommended

1. Polymer composites: Gupta and Gupta, New Age Publications.

2. Nanochemistry: A Chemical approach to nanomaterials, RSC Publication, GA Ozin and AC Arsenault.

3. Chemistry of nanomaterials, CNR Rao.

4. Prinicples of Nanotechnology, G Ali Mansoori, World Scientific (2005)

5. Catalysis in Micellar and Macromolecular Systems, J. H. Fendler & E. J. Fendler, Academic Press.

6. Surfactants in solutions Vol.9 (pp.1-25) Ed. K. L. Mittal, Plenum Press, New York.

Code: **MPCH-104** Subject: Experimental Advanced Chemistry Credits: **6 [0-0-6]**

Course Objective:

Objective of the course for impacting experimental knowledge regarding various area of advance chemistry.

Course Outcome:

All experiments in the course are designed to gives special learning of physical chemistry, in environmental chemistry, polymer chemistry other than those students have studiedin P.G level.

1. Determination of rate of base hydrolysis or oxalatopentamine cobalt (III) ion at varying concentration of alkali by titrimetric and spectrophotometric methods.
2. Preparation of N, N'-bis (salicylaldehyde) ethylene diamine (Salen H2) and Co (Salan).
3. Determination of molecular weight of polymer by Ubbelhood Viscometer.
4. Determination of pH of a given solution by spectrophotometry method.
5. Synthesis of organic compounds involving two to three steps and various techniques like steam and vaccum distillation.
6. Isolation and purification of organic compounds by TLC and PC.
7. Determination of indicator constant of methyl red spectrophotometrically.
8. Determination of solubility product of silver chloride.
9. Determination of Phosphate ion in solution by spectrophotometric method.

Books Recommended

1. A Text Book of Quantitative Inorganic Analysis- AI Vogel, ELBS.
2. A Text Book of Quantitative Organic Analysis- AI Vogel, ELBS.

Code: **MPCH-105** Subject: **REVIEW OF JOURNAL PAPER** Credits: **2 [0-0-6]**

Course objective:

The objective of the course is to accumulate the knowledge regarding a particular subject from the previous reported publications.

Outcome:

MPhil Scholar shall get a new idea which is senty in literature for starting of his/her dissertation work.

Subject: **SEMINAR-I** Credits: **2 [0-0-4]**

Course objective:

Objective of the seminar to explore the teaching ability and understanding of the subject through presentation in the open audience.

Course Outcome:

- The self-confidence and improvement in subject knowledge will be the outcome of the seminar.
- To know the style of presentation may be another outcome of this course.

SEMESTER: 2nd

Code: **MPCH-201** Subject: **DISSERTATION** Credits: **16 [0-0-24]**

Course objective:

- Objective of the dissertation is to prepared a thesis either from the experimental or review of the reported publication.
- Major objective of this course is to impact the interest for the research before the Doctoral programme.
- Scholars are required to submit a thesis at the end of the semester has the objective to create the idea regarding accumulation and presentation of data in the form of report

Course Outcome:

- Gain of environmental knowledge in specific area of chemical sciences
- Representation of data in the form of figure and table with explanation logics with evidences.
- Outcome of the review shall expose a special interest of the scholar towards some emerging topics of the chemistry in present scenario.
- Students are required to appear a comprehensive viva with presentations of their work in open seminar for justifying the dissertation report in particular area of chemistry.

Code: **MPCH-202** Subject: **SEMINAR-II** Credits: **4 [0-0-4]**

Subject: **COMPREHENSIVE VIVA**