MANONMANIAM SUNDARANAR UNIVERSITY, TIRUNELVELI-12
DEPARTMENT OF CHEMISTRY
M.Phil CHEMISTRY
(EFFECTIVE FROM July 2019)

STRUCTURE & SYLLABUS OF THE COURSE

Preamble

M.Phil is a research oriented program. After completing their Master degree in Chemistry or equivalent will opt for pursuing research either directly or after completing the above program. The program is useful for research students to evaluate and identify the research problems which is related to social and economical valuable issues to the society.

Necessity

It is a platform to learn the basic research methodology and it is easy to identify the current research trends in chemistry.

Importance

This programme helps the students to carry out the literature survey. Based on the literature survey, the students identify the need of research, related to social and industrial needs.

Objectives

After studying the M.Phil. programme, the students will be able to

i. Introduce the purpose and importance of research for future development.
ii. Know the different types of literature search and indexes.
iii. Understand the error analysis, correlation methods and computer application.
iv. Enrich the knowledge in various types of spectral techniques and scientific analysis.
v. Develop their skills for carryout the project.
vi. Make awareness in social and industrial relevant issues.
vii. Expose to present their findings in national and international seminars and conferences.

Outcome

After completing the M.Phil programme, the students will be able to

i. Pursue research programme.
ii. Qualify as Chemist/Scientist in various industries and research institutions

Eligibility Norms

55% of marks in M.Sc. degree in Chemistry or any other equivalent Master Degree. For SC/ST candidates there will be 5% relaxation in marks.

Department of Chemistry

Manonmaniam Sundaranar University

M.Phil Chemistry Program

The credit and teaching norms of the program is distributed as under.

Semester	**Papers**	**Teaching / contact hours per week**	**Credits**
Semester I			
Paper I	Scientific Research and Teaching Methodology	4	4
Paper II	Advanced Spectroscopy	4	4
Paper III	Project oriented Paper	4	4
Semester II			
Paper IV	**Project & Viva voce**	12	12
	Total Credits		24

Admission Procedure:

Admission will be based on (i) the total marks obtained in the entrance test (50%) and the qualifying M.Sc. degree examination (50%) (merit list for a Total of 100 marks) and (ii) by following the govt. norms of reservation.

Evaluation:

The evaluation for Papers I, II, III& IV consists of two components viz. internal and external.

Internal : External = 25 : 75

25 marks for the internal component has been divided as follows:

3 tests, out of which average of the best two tests : 15 marks

Seminar : 5 marks

Assignment : 5 marks

There is no internal passing minimum. There is a passing minimum of 50% for external and overall components.

<u>Question Paper Pattern</u>

For Papers I, II & III : (Max : 75 marks)

Question paper consists of Section A 5 questions each from one unit (5 x 5 = 25 marks) and Section B 5 questions each from one unit (5 x 10 = 50 marks) with internal choice (either a OR b) in each unit. For Paper III the 10 research publications shall be divided equally into 5 units.

Paper I –Scientific Research and Teaching Methodology

L (hrs)	Credits
60	4

Objectives

1. To know about the selection of research topic and preparation , presentation of dissertation.
2. To study the literature search and know about online journals.
3. To study the error analysis.
4. To know the teaching methods and Later adolescent Psychology,

Unit –I : Scientific Research

Introduction to Research, Selection of a research topic, reviewing the literature, preparing the proposal and design of study Experimentation and interpretation of results. Formation, testing and rejection of hypothesis. Preparation and presentation of reports, dissertation and thesis writing.

Unit-II : Chemical Literature

Primary and secondary literature: Journals, Patents, Reviews, Chemical abstracts, treatises, monographs and online journals. Web browsing for Research. ASAP alerts, CA Alerts, Scifinder, Chemport, Science direct, STN international, Journal home pages. Impact factor, citations and h-index. Scopus, Web of Science and Google scholar.

Unit-III: Error Analysis

Limitation of analytical methods, accuracy, precision & minimization of errors – systematic and random errors and reliability of results – Mode – Median – Mean – Standard deviation- Variance & Covariance, normal distribution and the normal probability curve.

Unit-IV: Correlation methods & Non-parametric tests

Scatter diagram and linear regression line: Spearman rank order correlation, Pearson's product moment correlation - Correlation co-efficient. Non-parametric tests - $\chi 2$ test, Median test, Mann-Whitney test, Sign test, Wilcox on matched-pairs signed ranks test.

Unit-V: Methodology of Teaching

Teaching- Objectives of Teaching, Phases of Teaching – Teaching methods: Lecture Method, Discussion Method, Discovery Learning, Inquiry, Problem Solving Method, Project method, Seminar – Integrating ICT in Teaching: Individualized Instruction, Ways for Effective Presentation with Power Point- Documentation – Evaluation: Formative, Summative &

Continuous and comprehensive Evaluation- Later Adolescent Psychology: Meaning, Physical, Cognitive, Emotional, Social and Moral Development – Teaching Later Adolescents.

References:

1. Rajammal P. Devadas, A Handbook of Methodology of Research, S.R.K. Vidyalaya Press, Chennai, 1976.
2. J. Anderson, B.H. Durstan and M. Poole, Thesis and assignment writing, Wiley Eastern, New Delhi, 1977.
3. R.O. Butlet, Preparing thesis and other manuscript.
4. R. L. Dominoswki, Research Methods, Prentice Hall, 1981.
5. J. W.Best, Research in Education, 4th ed. Prentice Hall of India, New Delhi, 1981.
6. H. F. Ebel, C. Bliefert and W.E. Russey, The Art of Scientific Writing, VCH, Weinheim, 1988.
7. Joseph, A. Methodology for Research; Theological Publications: Bangalore, 1986.
8. Sampath, K., Panneerselvam, A. &Santhanam, S. (1984). Introduction to educational technology. (2nd revised ed.). New Delhi: Sterling Publishers.
9. Sharma, S.R. (2003). Effective classroom teaching modern methods, tools & Techniques. Jaipur: Mangal Deep
10. Vedanayagam, E.G. (1989). Teaching technology for college teachers. NewYork: Sterling Publishers.

Paper II – Advanced Spectroscopy

L (hrs)	Credits
60	4

Objectives

1. To study about the principles, applications of IR, Raman and two dimensional NMR spectroscopy.
2. To understand the NQR, EPR and Mossbauer spectroscopy.
3. To know about the instrumentation and applications of XRD, SEM, AFM.
4. To know about the instrumentation and applications of electrochemical techniques.

Unit –I : Absorption Spectroscopy

Infrared and Raman Spectroscopy: FT-IR, basic principles, quantitative IR, resonance Raman and laser Raman spectroscopy, applications of IR and Raman spectroscopy to organic and inorganic compounds. Electronic Spectroscopy: term symbols, spin-orbit coupling in free ions, electronic spectra of Oh and Td complexes, charge transfer transition, structural evidence from electronic spectra.

Unit II: Applications of Advanced Organic Spectroscopy NMR:

Basic principles of two-dimensional NMR spectroscopy – HOMOCOSY, HETCOSY and NOESY spectra and their applications – use of INEPT and DEPT methods and their applications. Mass: Molecular ions, isotope peaks, fragmentation pattern – McLafferty rearrangement - measurement techniques (EI, CI FI, FD, FAB, SIMS, MALDI) – M + 1 and M + 2 ions – calculation of molecular formula from PM+1 and PM+2 Road-map problems covering UV, IR, 1H-NMR, 13C-NMR and mass spectral data.

Unit-III: Spectroscopy

Nuclear Quadruple Resonance Spectroscopy:

Effect of magnetic field on the spectra, electric field gradient and molecular structure, structural elucidation of inorganic and coordination compounds.

Electron Paramagnetic Resonance Spectroscopy:

Hyperfine splitting in isotropic systems; epr spectra of systems with more than one unpaired electrons-Kramer's degeneracy, zero field splitting, epr of triplet states, anisotropy in g-value, anisotropy in hyperfine splitting, nuclear quadruple interaction; applications of EPR to organic and inorganic compounds.

Mossbauer Spectroscopy:

Interpretation of isomer shifts, quadruple and magnetic interactions, Mossbauer emission spectroscopy, structural elucidation.

Unit IV: Diffraction & Surface Techniques:

Principles and applications of XRD, Neutron and electron diffraction – Scanning electron microscopy (SEM)- Instrumentation – applications – surface area analysis, particle size determination – Scanning Probe Microscopes – Scanning Tunneling Microscopes – Atomic force microscopes (AFM) – Principle &applications.

Unit V: Electrochemical Techniques

Polarography – Chronopotentiometry – Chronoamperometry – chronocontometry- Linear Potential Sweep voltametry – Cyclic Voltametry – Impendence Measurements – AC Voltametry – Principles and their applications.

References:

1. Introduction to Nanoscience- Gabor. L, Hornyak. Joydeep Dutta CRC Press 2008.
2. L. Antropov, Theoretical Electrochemistry, Mir Publication, Moscow, 1972.
3. D.A. Skoog and J.J. Leary, Principles of Instrumental Analysis, 4th Edn., Saunders College Publishing, 1992.
4. D.A. Skoog, F.S.Holler, S.R.Crouch, Principles of Instrumental Analysis, 6th Edn., Thomson Brooks/cole, 2007.
5. A.K. Cheetham, P.Day, Solid State Chemistry: Techniques, Oxford University Press, Oxford, 1987.
6. G. E. Bacon, Neutron diffraction, Oxford Universtiy Press, Oxford, 1975.
7. R.S. Drago, Physical Methods in Chemistry, Saunders, 1999.
8. Spectrometric Identification of Organic Comounds – Silverstein, Bassler and Morril, 1962.
9. Organic Spectroscopy – William Kemp, 1991.

L (hrs)	Credits
60	4

Project Oriented Paper
Paper I Advanced topics in Organic Chemistry

Objectives

1. To study the reagents in organic synthesis
2. To know the disconnection methods and pericyclic reactions.
3. To understand the LFER.
4. To study the structure and properties of Amino acids and Proteins.
5. To study the structure and functions of DNA and RNA.

Unit I : **Organic Reagents**

Gilman's reagents – DCC – Grignard reagents – crown ethers – NBS – BF3 complexes – SeO2 – 1, 3-dithiane, tri-n-butyl tin hydride – phase transfer catalysts – Wilkinson's catalyst.

Unit II: **Retro synthetic Analysis**

Introduction to disconnections – one group disconnections – two group disconnections – peri cyclic reactions – Heteroatoms and heterocyclic compounds – small rings: three membered, four membered, and five membered.

Unit III: **Advances in Linear Free-Energy Relationships**

An introduction to linear free-energy relationships (LFER) – the Hammett equation – the duality of substituent constants and the Yukawa-Tasumo equation – the general validity of the Hammett equation – deviations from the Hammett equation in its various forms; the separation of polar, steric and resonance effects – Taft's equations; the ortho-effect; application of LFER to organic reactions; Influence of solvent on organic reactivity; the reactivity-selectivity principle.

Unit IV: **Amino Acids and Proteins**

Structure and Classification – abbreviated names (1 letter and 3 letter) – Physical properties of amino acids – chemical properties – codons – Structure and importance of simple peptides like glutathione, Carnosine, anserine, vasopressin – Peptide antibiotics – gramicidin, bacitracine, actinomycin D - Peptide synthesis – Acid chloride method – DCC method – Determination of primary structure of peptide – Identification of N-terminal amino acid – Barger's method – the DNP method – identification of C-terminal amino acid – Hierarchial representation of protein Primary, Secondary, tertiary and quaternary structures – Ramachandran plot.

Unit V: Purine, Pyrimidine and Nucleic Acids

Structure of Purines, Pyrimidines – Nucleoside – ribonucleoside, deoxyribonucleosides – nucleotides – ribonucleotides – deoxyribonucleotides – structure and functions of DNA - Watson and Crick model of DNA- Structure of types of RNA (m-RNA, t-RNA and r-RNA) – Nucleases – structure and function of DNA and RNA – polynucleotide – cyclic nucleotide – structure and function of cAMP, cGMP nucleoprotein – Types of DNA (A-DNA, B-DNA, Z-DNA)

References:

1. Reaction Mechanism and Reagents in Organic Chemistry – Gurdeep R. Chatwal, 2014.
2. Designing Organic Synthesis: A Programmed Introduction to the Synthon Approach – Stuart Warren, 1978.
3. N.B. Chapman and J. Shorter, Eds., Advances in Linear Free-Energy Relationships, Plenum Press, London, 1972.
4. J. Shorter, Correlation Analysis in Organic Chemistry – An Introduction to Linear FreeEnergy Relationships, Clarendon Press, Oxford, 1973.
5. N.B. Chapman and J. Shorter, Eds., Correlation Analysis in Chemistry-Recent Advances, Plenum Press, New York, 1978.
6. J. Shorter, Correlation Analysis of Organic Reactivity, Research Studies Press, England, 1982.
7. Biochemistry, Lehinger J.CB S.Publishers,1993.
8. Biochemistry, U. Satyanarayana & U. Chakrapani, Books & Allied Pvt. Ltd, 1999.
9. Biochemistry — LubertStryer – W. H. Freeman and company, 4th Edn., New York, 1995.

Paper II Chromatography

L (hrs)	Credits
60	4

Objectives

1. To study the fundamentals of chromatography.
2. To know the principles, experimental procedure and applications of TLC, ion exchange , HPLC and gas chromatography**.**

UNIT I: **Chromatography**

Classification of Chromatography methods. Column Chromatography- Principles, experimental procedures, stationary and mobile phases, Choice of Solvent Systems, Separation techniques. Applications. Rf values, Factors affecting Rf values, Experimental procedures, Choice of paper and solvent systems, developments of chromatogram. Detection of the spots. Ascending, Descending and Radial Paper Chromatography, Two Dimensional Chromatography –Applications.

UNIT II: **Thin layer Chromatography**

Principles, factors affecting Rf values. Experimental Procedures, Choice of adsorbents and Solvents. Preparation of plates, development of the Chromatogram. Detection of the spots, advantages of thin Layer Chromatography over paper chromatography and Applications.

UNIT III: **Ion Exchange Chromatography**

Principle, ion exchange resins and their types- cation exchange resins, anion exchange resins, ion exchange equilibria, properties of ion exchange resins, ion exchange capacity and techniques – applications.

UNIT IV: High Performance Liquid Chromatography

Introduction, instrumentation, stationary and mobile Phases. Mobile Phase – Composition. Column – Preparation, Cleaning –regeneration and Storage Conditions. Retention time- Types of HPLC. Applications.

UNIT V: **Gas Chromatography**

Principle, instrumentation choice of injectors, column and detectors - Programmed temperature chromatography, flow programming chromatography, gas-solid chromatography, and hyphenated techniques in chromatography- Applications of Gas chromatography.

REFERENCES:

1. Fundamentals of Analytical Chemistry – D.A.Skoog, D.M. West, F.J. Holler and S.R. Crouch – 2004; Thompson Asia Private Ltd., Bangalore.
2. Instrumental Methods of Analysis – B. K. Sharma, 2003; Goel publishing House, Meerut.
3. Contemporary Chemical Analysis - Judith F. Rubinson, Prentice Hall (India), 1998.
4. Instrumental Methods of Analysis Hobart H. Willard, Lynne L. Merritt Jr, John Dean, Wadsworth Publishing Co Inc; 7th Edn., 1988.
5. Thin Layer Chromatography- A laboratory Handbook, Ashworth, Stahl. E., 1st Edn., Springer-Verlag, 1969.
6. Dynamics of Chromatography - Principles and Theory, J. Calvin Giddings, CRC Press, 2002.
7. Principles of Instrumental Analysis, Douglas A. Skoog, F. James Holler, Stanley R. Crouch, 2006.

Paper III Advanced topics in Physical Chemistry

L (hrs)	Credits
60	4

Objectives

1. To understand the solar energy conversion and fluorescence sensing mechanism.
2. To know about the experimental methods for fast reactions
3. To learn about the Prigogine's principles.
4. To study the concept of Analytical techniques.

Unit I: Advanced Photochemistry

Artificial photosynthesis and solar energy conversion – Photo electrochemical cells – dynamics of excited state processes (excited state energy, redox properties, emission lifetime and its temperature dependence) in micelles, reverse micelles and biomembranes – Fluorescence – quenching and anisotropy concepts; fluorescence sensing – mechanism and applications; Radioactive decay engineering – metal-enhanced fluorescence and surface Plasmon-coupled emission.

Unit – II: Advanced chemical kinetics

Experimental methods for fast reactions- temperature jump, pressure jump stopped flow and flash photolysis – pulse technique – short tube kinetics. NMR studies in rate process - Enzyme kinetics of complicated systems – theory of diffusion controlled reactions.

Unit – III: Irreversible thermodynamics

Internal heat & entropy production – relation of entropy production with flux & forces – phenomenological equation – Prigogine's principle of minimum entropy production at nonequilibrium stationary state.

Unit – IV: Biophysical chemistry

Biomembranes (structure & function) – Active transport & passive transport – multiple equilibria – specific examples of multiple equilibria – Transport processes – general features of transport processes optical systems of rht e study of transport processes – self organizing systems – (Micelles, lipids, cyclodextrins, liquid crystals, reverse micelles) their interactions and solutions properties.

Unit – V: Analytical techniques

Thermal methods: TGA, DTA, DSC, Thermometric titration - Adsorption/desorption techniques: BET and EGME methods of determination of external and total surface area.

References:

1. K. Kalyanasundaram, Photochemistry in Microheterogeneous Systems, Academic Press, Orlando, 1987.
2. Extended irreversible thermodynamics – David Jon, Jose casas Vazques, 2012
3. Understanding Non-equilibrium Thermodynamics – GeogyLebon, David Jon- 2008
4. Chemical kinetics: Fundamentals & New developments, E.T. Densov, Ergeniitinofeerich, 2003
5. Chemical Kinetics, Laidler, 1987.
6. Biophysical chemistry Alan Cooper – 2011
7. Biophysical chemistry, James P. Allen – 2008
8. Fundamentals of Analytical chemistry – Douglas A. Skoog Donal M. west 2013.

L (hrs)	Credits

Paper IV Adsorption and Catalysis	60	4

Objectives

1. To study the concept of adsorption and catalysis.
2. To know about the methods of preparation of aluminosilicates and aluminophosphates.
3. To learn about the spectral studies on adsorbent.
4. To understand the concept of liquid phase reactions and regeneration of catalysts.
5. To study about the product selectivity and interpretation of adsorption parameters.

Unit: I Adsorption & Catalysis

Concept of adsorption – types of adsorption, monolayer and multilayer adsorption. Adsorption - activation energy and temperature relationships, different between adsorption and catalysis, catalysis - homogeneous catalysis, heterogeneous catalysis, Acid -- base catalysis.

Unit: II Methods of preparation

Adsorbent - adsorbent preparation from plant materials, activated carbon preparation, synthetic adsorbent/catalyst - Molecular sieves – microporous&mesoporous molecular sieves – silicates, Aluminosilicates, Aluminophosphates – structure, acidic and basic sites.

Unit: III Spectral studies on Adsorbent

Characterization of adsorbent and catalyst - X-Ray Diffraction (XRD), Fourier transform infrared spectroscopy (FT-IR), Differential thermal analysis(DTA) , Nuclear magnetic resonance spectroscopy (NMR), Temperature programmed desorption (TPD), Electron spin resonance spectroscopy(ESR) Scanning electron microscopy(SEM), BET Surface Area, pore size analysis.

Unit: IV Reactions & Factors

Liquid phase - heterogeneous reaction conditions optimization - Temperature, pH, time and molar ratios. Vapor phase reaction, Regeneration of catalyst. Adsorption – adsorption of dye molecules, metal ions, sugar molecules and other suitable molecules, conditions optimization – time, temperature, PH, concentration and adsorbent dosage.

Unit: V Techniques

Product analysis in catalysis reactions – Gas chromatographic technique, conversion and product selectivity.Interpretation of adsorption parameters - Adsorption kinetics, adsorption isotherms and adsorption thermodynamics.

References:

1. Environmentally stable adsorbent of tetrahedral silica and non tetrahedral alumina for removal and recovery of malachite green dye from aqueous solution, J.Hazardous materials, 157 (2008) 137-145.
2. Plant poisoning organic dyes adsorption on tomato plant root and green carbon from aqueous solution, Desalination, 249 (2009)1132-1138.
3. Film and pore diffusion modeling for the adsorption of direct red 81 on activated carbon prepared from balsamodendroncaudatum wood waste, Digest Journal of Nanomaterials and Biostructures, Vol. 5, No 3, July 2010, p. 911 – 919
4. Plant toxic and non-toxic nature of organic dyes through adsorption mechanism on cellulose surface, Journal of Hazardous materials,189 (2011) 294–300.
5. Adsorption of cationic and anionic organic dyes from aqueous solution using Silica, J. Environmental Science and Engineering, volume 52, No.4 (2010) 361-366
6. Hazardous dyes removal from aqueous solution over mesoporousaluminophosphate molecular sieves with textural porosity by adsorption, Journal of Hazardous Materials 244- 245 (2013) 10 -20.
7. A Simple Method for the Synthesis of Thermally Stable Large Pore Meso porous Alumino phosphate Molecular Sieves, Materials letters, 113 (2013) 93–95.
8. Aniline methylation over AFI and AEL type molecular sieves, App. Catal., Vol. 174, 1998, 213.
9. Adsorptive removal of metanyl yellow on mesoporous Nickel aluminophosphate molecular sieves from aqueous solution, Asian J. of chemistry, vol. 24, no.12(2012), 5775-5778
10. Recent trends in catalysis, Narosa publication, 1st edition 2000.

Paper V Nanomaterials and their applications to solar energy conversion

L (hrs)	Credits
60	4

Objectives

1. To study about the Classification & Synthesis of Nanomaterials
2. To learn about the DSSCs.
3. To study the review of published literature relevant to the project work.

Unit I: Nanomaterials

Introduction- definition of Nanoscience, nanochemistry- classification of the nanomaterials Synthesis of nanomaterials: Precipitative methods – hydrothermal and solvothermal methods - chemical methods - reduction methods – colloidal and micellar approach - sol-gel method - chemical vapor deposition method. Specialized Nanomaterials: Metal oxide nanoparticles, semiconductor nanoparticles and core/shell nanoparticles.

Unit II: Dye-sensitized solar cells

Solar energy conversion and storage – photo electrochemical cells – dye-sensitized solar cells – design and fabrication - power conversion efficiency Use of metal and metal-free dye sensitizers in photovoltaic devices.

Unit III: Semiconductor and microemulsion (quantum dots)

Review of published literature – Water-soluble silica-coated semiconductor quantum dots – synthesis, characterization and properties. Thickness-controllable silica coating of quantum dots – synthesis by micro emulsion method and application in the growth of rice.

Unit IV: Photochemistry and corrosion

Review of published literature – Silica coated cadmium sulfide nanocomposites – synthesis, structure, optic and its photo catalytic properties. Zirconia-coated carbonyl iron particles – synthesis and corrosion study.

Unit V : Solar cell

Review of published literature – Ruthenium (II) sensitizer in dye-sensitized solar cells using an organic dye as co-sensitizer – Fabrication and device characterization - photovoltaic performance. Dye-sensitized solar cells - Co-sensitization strategy – electrochemical properties – Photo electrochemical performances – Electrochemical impedance spectroscopy – dark current measurement – Open-circuit voltage decay.

References

1. H. R. Allcock, Introduction to Materials Chemistry, John Wiley & Sons, Inc. Publication, 2008.

2. T. Pradeep, Nano: The Essentials, Tata McGraw-Hill, 2007.
3. A. Hagfeldt, et al. Chem. Rev., 2010, 110, pp. 6595–6663.
4. J. Gong, J. Liang, K. Sumathy, Renewable and Sustainable Energy Reviews, 2012, 16, 8, 5848-5860.
5. X. Chen, F. Liu, Q. Jiang, L. Sun, Q. Wang, J. Inorg. Organomet. Polym, 2012, 22:6-11.
6. A. Wang, Y. Zheng, F. Peng, J. Spectros. 2014, Article ID 169245, 1-5.
7. N. Gupta, B. Pal, J. Colloid and Int. Sci., 2010, 368, 250-256.
8. R. Chen et al. J. Colloid and Int. Sci., 2010, 342, 49-56.
9. U. Mehmood, I. A. Hussein, K. Harrabi, N. Tabet, G. R. Berdiyorov, RSC Adv., 2016, 6, 7897-7901.
10. L. Wei, Y. Na, Y. Yang, R. Fan, P. Wang, L. Li, Phys. Chem. Chem. Phys., 2015, 17, 1273-1280.

Paper VI Phyto- Biosynthesis and Applications of Metal nanoparticles

L (hrs)	Credits
60	4

Objectives

1. To study about the Extraction and Isolation of Medicianl plants
2. To learn about the Biosynthesis of Metal Nanoparticles
3. To study about the characterization, Biological Applications and Catalytic activity of Nanoparticles.

Unit I - Extraction and Isolation of some Indian Medicinal plants

i) Solid-Phase Extraction and LC–MS analysis of Pyrrolizidine Alkaloids in Honeys. ii) Comparative study of phytochemical screening, antioxidant and antimicrobial capacities of fresh and dry leaves crude plant extracts of Daturametel L.

Unit II - Biosynthesis of Metal Nanoparticles

i) Green synthesis of silver nanoparticles using Ixoracoccinea leaves extract. ii) Ultrasmall Copper Nanoparticles Synthesized with a Plant Tea Reducing Agent.

Unit III - Characterization of Nanoparticles

i) Phytosynthesis of silver nanoparticles using Cocciniagrandis leaf extract and its application in the photocatalytic degradation ii) A facile synthesis of high optical quality silver nanoparticles by ascorbic acid reduction in reverse micelles at room temperature.

Unit IV - Biological Applications of Nanoparticles

i) The green synthesis, characterization and evaluation of the biological activities of silver nanoparticles synthesized from Iresineherbstii leaf aqueous extracts ii) In vitro evaluation of antioxidant and anticancer potential of Morindapubescens synthesized silver nanoparticles.

Unit V - Green catalytic activity of Nanoparticles

i) Catalytic Reduction of 4-Nitrophenol using Biogenic Gold and Silver Nanoparticles Derived from Breyniarhamnoides. ii) Catalytic degradation of organic dyes using biosynthesized silver nanoparticles.

References

1. K. A. Beales, K. Betteridge, S.M. Colegate, J.A. Edgar. Journal of Agric. Food Chem. 2015, 63, 7421−7427

2. Tahiya Hilal Ali Alabri, Amira Hamood Salim Al Musalami, Mohammad Amzad Hossain, Afaf Mohammed Weli, Qasim Al-Riyami. Journal of King Saud University – Science 2014, 26, 237–243
3. Muthu Karuppiah, Rangasamy Rajmohan. Materials Letters, 97, (2013) 141–143.
4. Aaron D. Brumbaugh, Katelyn A. Cohen, and Sarah K. St. Angelo. ACS Sustainable Chem. Eng. 2014, 2, 1933−1939.
5. Rajeswari Arunachalam, Sujatha Dhanasingh, Bala saraswathi Kalimuthu, Mani Uthirappan, Chellan Rose, Asit Baran Mandal. Colloids and Surfaces B: Biointerfaces 94, 2012, 226-230
6. Debabrata Singha, Nabajeet Barman, Kalyanasis Sahu. Journal of Colloid and Interface Science, 413 (2014), 37–42.
7. C. Dipankar, S. Murugan, Colloids and Surfaces B: Biointerfaces, 98 (2012), 112– 119
8. L. Inbathamizh, T. Mekalai Ponnu, E. Jancy Mary. Journal of pharmacy research, 6 (2013) 32-38.
9. AbilashGangula, Ramakrishna Podila, Ramakrishna M, Lohith Karanam, Chelli Janardhana, and Apparao M. Rao. Langmuir 2011, 27, 15268 P– 15274.
10. V.K. Vidhu, D. Philip. Micron 56 (2014) 54–62.

Paper VII Photocatalysis

L (hrs)	Credits
60	4

Objectives

1. To study the Zeolite based photocatalysts
2. To learn about the concept of Photocatalytic acticity of Nanoparticles
3. To study the review of published literature relevant to the project

Unit I Zeolite based Photocatalysts

Zeolites and molecular sieves acting as hosts for photoactive guests - Electron donor photosensitisers - organic dye - electron acceptor photosensitisers - Zeolites encapsulating clusters of semiconductor oxides - Zeolites having photocatalytically active framework.

Efficient photocatalytic degradation of organics diluted in water and air using TiO_2 designed with zeolites and mesoporous silica materials.

Unit II Photocatalytic activity of Nanoparticles

Effect of metal-doping of TiO_2 nanoparticles on their photocatalytic activities toward removal of organic dyes.

Solar photocatalytic degradation of phenol using nanosized ZnO and α-Fe_2O_3.

Unit III Review of published literature – I

Network Structured SnO_2/ZnO Heterojunction Nanocatalyst with High Photocatalytic Activity.

Green synthesis of copper nanoparticles for the efficient removal (degradation) of dye from aqueous phase.

Unit IV Review of published literature –II

Visible Light Photodegradation of Phenol Using Nanoscale TiO_2 and ZnO Impregnated with Merbromin Dye: A Mechanistic Investigation.

Fe(III)/TiO_2-Montmorillonite Photocatalyst in Photo-Fenton-Like Degradation of Methylene Blue.

Unit V Review of published literature –III

TiO_2 nanoparticles immobilized on carbon nanotubes for enhanced visible-light photo-induced activity.

Preparation of a Titania/X-Zeolite/Porous Glass Composite Photocatalyst Using Hydrothermal and Drop Coating Processes.

References

1. Chem. Commun., **2004 ,**1443-1459.
2. J. Mater. Chem., **2011**, 21, 2407–2416 .
3. Egyptian Journal of Petroleum (**2014)** 23, 419–426.
4. Journal of Chemical Engineering and Materials Science**,** Vol. 4(7), pp. 87-92, November **2013**
5. Inorganic Chemistry**,** Vol. 48, No. 5, **20091819-1825**
6. Environmental Science and Pollution research. August, **2015**, DOI 10.1007/s11356-015-5223-y
7. Iran. J. Chem. Chem. Eng, Vol. 33, No. 2, **2014.**
8. International Journal of Chemical Engineering, Volume **2015**, Article ID 485463.
9. J. Mater . Res. Technol .**2015; 4(2)**:126–132.
10. Molecules **2015**, *20*, 2349-2363; doi:10.3390/molecules20022349

Paper VIII – Bio materials and corrosion

L (hrs)	Credits
60	4

Objectives

1. To learn about the concept, Applications and properties of Biomaterials
2. To know the review of published literature relevant to the project work

UNIT I Introduction of Biomaterials

Basic biomaterial and biomedical device knowledge, to identify the material properties that are critical for metallic, polymer and ceramic biomaterials, or their combination.

UNIT II Application of Biomaterials

Application areas for different types of biomaterials, biomedical devices and their failure analysis

UNIT III Properties of Biomaterials

Basic properties of physical, chemical and mechanical and coating processes that may occur on biomaterials in use.

UNIT IV Review of published literature - I

Analysis and evaluation of corrosion degradation reactions that occur for different biomaterials and their consequences.

UNIT V Review of published literature - II

Suggest proper type of biomaterial for given applications, taking into account function, health risk and economic aspects.

References:

1. Monika Saini, Yashpal Singh, Pooja Arora, Vipin Arora, and Krati JainImplant biomaterials: A comprehensive review ,World J Clin Cases. 2015 Jan 16; 3(1): 52–57.

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