PERIYAR UNIVERSITY

PERIYAR PALKALAI NAGAR

SALEM – 636011

DEGREE OF MASTER OF PHILOSOPHY

CHOICE BASED CREDIT SYSTEM

SYLLABUS FOR

M.PHIL. CHEMISTRY

(SEMESTER PATTERN)

(For Candidates admitted in the Colleges affiliated to
Periyar University from 2017-2018 onwards)

REGULATIONS

1. **OBJECTIVES OF THE COURSE:**

   It is a pre-research degree in Chemistry

   The objectives of this course are the following:

   (a) To impart research - level knowledge in advanced concepts and its applications in various fields.

   (b) To provide wide and updated knowledge in the new areas of various branches of Chemistry to all students.

2. **COMMENCEMENT OF THIS REGULATION:**

   These regulations shall take effect from the academic year 2017-2018, that is, for students who are admitted to the first year of the course during the academic year 2017-2018 and thereafter.

3. **ELIGIBILITY:**

   Candidates who have passed M.Sc. Chemistry of this University or any other University recognized by the Syndicate as equivalent thereto shall be eligible to register for the Degree of Master of Philosophy (M.Phil.) in Chemistry and to undergo the prescribed course of study in an approved institution or department of this University.

   Candidates who have passed their Post-graduate Degree in Chemistry on or after 1st January 1991 shall be required to have obtained a minimum of 55% of marks to become eligible to register for the Degree of Master of Philosophy (M.Phil.) and to undergo the prescribed course of study in an approved Institution or department of this University.

   For the candidates belonging to SC/ST community and those who have qualified their Master's Degree after 01.01.1991 the minimum eligibility marks shall be 50% in their Master's Degree.

4. **DURATION**

   The M.Phil. Programme spans over a period of one year from the commencement of the Programme comprising of two semesters.

5. **COURSE OF STUDY**

   There are three courses for semester I and Dissertation and viva-voce for semester II. The third course in the first semester shall be a specialization related to the Dissertation. The student in consultation with the research supervisor must select the third course and the research supervisor should frame the syllabus.

COURSE OF STUDY AND SCHEME OF EXAMINATION

S.No.	Course (Paper)	Paper Code	Subject Title	Hours	University Examination		Total	Credits
					Internal (25%)	External (75%)		
I SEMESTER								
1	Paper- I		Scientific Research and Methodology	3	25	75	100	4
2	Paper - II		Spectroscopic and Instrumental Methods in Chemical Investigations	3	25	75	100	4
3	Paper - III		Background Research Paper (Guide Paper)	3	25	75	100	4
II SEMESTER								
4	Dissertation/ Project Work		Dissertation	-	*50	#150	200	12
			Total				**500**	**24**

Scheme of Examinations

Paper I, II and III conducted at the end of the first semester
Paper III Conducted in the Department

Max.Marks: 100 Marks   Passing Minimum: 50 Marks
Dissertation / Project work: Second Semester
Viva voce: Conducted by the Department by the External & Internal Examiners.

Question paper Pattern for University Examination

Time: 3 Hours   Max.Marks - 75

PART-A: 5x5=25

(Answer all questions)

(One question from each unit with internal choice)

1. (a) or (b)

2. (a) or (b)

3. (a) or (b)

4. (a) or (b)

5. (a) or (b)

PART-B: 5x10=50

(Answer all questions)

(One question from each unit with internal choice)

1. (a) or (b)

2. (a) or (b)

3. (a) or (b)

4. (a) or (b)

5. (a) or (b)

M.PHIL. CHEMISTRY
PART -I
PAPER-I SCIENTIFIC RESEARCH AND METHODOLOGY

Hours	L	T	P	C
72	4	0	0	4

UNIT-I Survey of Literature

Primary sources – Journals, Papers, reviews, communications, notes, patents, Journals of different fields of Chemistry (Organic, Inorganic, Physical, Polymer, Pharmaceutical, Industrial and Analytical)

Secondary Sources –Titles, importance of categorization and their importance, Abbreviations of names, Nomenclature of compounds and their usage.

Abstracts –Types (Chemical, Physical, Analytical), Survey of abstract indexes (substance index, author index, general technique index, collective and comprehensive indices), Beiestein compounds and tables of information. Chemical abstract search through loaded CDS. Aids of Computer devices in literature survey.

Selection of topic and facilities - Selection of specific topics of research laboratory and instrumental facilities –location of journals, e-mail address, specific articles of science citation cards and indices, summerisation of works already done and published in the chosen field.

UNIT-II Proposal, Paper and Thesis Writing

Assignments and test papers, Thesis and dissertations, style and conventions in writing, selection of topic.

Rough drafting of the article – Title, Abstract, Introduction, Literature review problem and time limitation, Experimental methods, Results and discussions, Foot notes, Figures, Data presentations, Tables, Sign convention followed – Biblography, Conclusions and recommendations.

The general format – page and chapter format – use of quotations – foot note – tables and figures. Results and discussions – applicability of the findings to common usage – referencing – abbreviations used etc.

UNIT III Statistical Analysis of Data

Various types of errors – precision and accuracy – significant figures, various statistical tests on the accuracy of results, positive and negative deviation from accurate results - the Gaussian distribution – the normal distribution of random errors, mean value, variance and standard deviation, reliability interval, deviations from the Gaussian law of error distribution, t-tests-comparison of the mean with the expected value, comparison of the results of two different methods, comparison of the precision of two methods by F-test, Gross errors and elimination of outlying results, graphical methods – Linear regression, regression line, standard deviation, correlation coefficient – Multiple Linear regression (one variable with two other variables)

UNIT IV Introduction to Computing and Networking

Introduction to computers and computing – hardware, Basic organization of a computer, CPU, Main memory, Secondary storage, I/O device, Software, System and application software, High and low level languages, Compilers, Algorithms and Flow charts.

Introduction to networking – Computer networks, Network components, Hubs, switches, repeaters, routers, bridges and gateways – LAN, WAN, internet and internet worldwide web, internet for chemists – online search of chemistry databases, e-journals, search engines for chemistry, chemweb.

UNIT V C – Programming

Structure of a C program – Data types, Constants and Variables, Keywords, Operators and Expression.

Control structure – if, if-else, nested if-else, while, while-do, for, nested for, goto, continue, break, switch case statements.

REFERENCE BOOKS

1. J.Anderson, B.H.Durston and M.Poole, "Thesis and Assignment Writing", John Wiley, Sydney 1970.

2. R. Berry, "How to Write a Research Paper", Pergamon, 1969

3. Ralph Berry , "The Research Project: How to Write It", Fourth Edition Routledge (UK), 2000.

4. W.G. Campbell, "Form and Style in thesis writing", Boston M.A; Houghton Mifflin Co., 1970.

5. J.Anderson, "Thesis and Assignment Writing", Wilely, 1970.

6. Jerry March, "Advanced Organic Chemistry: Reactions, Mechanisms And Structure," 5th ed., Wiley, 1996

7. A.I. Vogel, "Quantitative Inorganic Analysis", 3rd Ed., ELBS Longman London.

8. D.A.Skoog and D.M.West, Fundamentals of Analytical Chemistry, Holt Rinehart and Winston Publications, IV Edn, 1982.

9. W.L. Cochran, "Statistical Methods", Oxford and IBH Publication, New Delhi, (1967).

10. K. Balagurusamy, "Fortran for Beginners", Tata McGraw Hill, New Delhi, 1990.

11. K.V. Raman, "Computer in Chemistry", Tata McGraw Hill, New Delhi, 1993.

12. K. Balagurusamy C++, Tata McGraw Hill, New Delhi, 1995.

13. Sanjay Saxena, MS OFFICE 2000

14. Manual of MS Office Microsoft inc.

M.PHIL. CHEMISTRY
PART -I
PAPER II -SPECTROSCOPIC AND INSTRUMENTAL METHODS IN CHEMICAL INVESTIGATIONS

Hours	L	T	P	C
72	4	0	0	4

UNIT-I Absorption Spectroscopy

UV-Visible Spectroscopy- Electronic excitation –Origin of different bands-Intensity of bands-Selection rules-Correlation of electronic absorption with   molecular Structure – Woodward Fieser rules – Applications.

Microwave or Rotational Spectroscopy- Molecular rotations , Nuclear Quadruple effects, Stark effect , selection rules , Instrumentation , Applications.

Vibrational Spectroscopy – Molecular vibrations - IR and Raman Techniques – Selection rules - Vibrational Spectra and Symmetry - Assignment of bands - Structural informations - Group frequencies - use of isotopes - Resonance Raman spectroscopy

UNIT-II Resonance Spectroscopy -I

1H and 13C Nuclear Magnetic Resonance Spectroscopy – Theory, AB, ABC, AB2, ABX Systems.Pulsed Fourier transform techniques, Homonuclear and Heteronuclear decoupling, Proton decoupling techniques – INDOR & NOE, 2D NMR - COSY, HETCOR, NOESY, ROESY,DEPT,INADEQUATE.

Electron Spin Resonance Spectroscopy – Principle, Instrumentation, Hyperfine splitting, Zero field splitting and Kramers degeneracy. Interpretation of spectra of solid, liquid and solution states. Anisotropic system – the triplet state, theory of G-tensor, ESR of transition metal ions and complexes; Endor and Eldor techniques.

UNIT-III Resonance Spectroscopy –II

Nuclear Quadrupole Resonance Spectroscopy – Principle, Instrumentation, experimental detection of NQR frequencies , interpretations, chemical applications and solid state applications.

Mossbauer Spectroscopy – The Mossbauer effect, experimental methods, isomer shift, quadrupole interaction. Hyperfine interaction, parameters for Mossbauer spectra, applications, molecular and electronic structures. Solid state chemistry – electron Mossbauer Spectrocopy.

UNIT IV Atomic Absorption and Diffraction Spectroscopy

Atomic absorption Spectroscopy –Theory, Forbidden transitions, space quantisation, Zeeman effect, the Paschen-Back effect, the Stark effect, spectral line width, the Back-Goudsmith effect, applications.

Photoelectron Spectroscopy – Excitation and ejection of electrons, electronic energy levels, core n level PES, Symmetry of molecular orbitals, valence levels PES, Applications - transition metal complexes.

X-ray Spectroscopy – Principle, instrumentation, X-ray fluorescence, absorption and diffraction methods. The electron microscope – non-dispersive X-ray absorption.

X-ray diffraction methods – Polymerization characteristics, Particle size determination.

UNIT V Electroanalytical Techniques

Polarography – Theory, DME - importance, Current Voltage curves, Diffusion current and its theory, factors affecting it. Oscillographic Polarography, Square wave polarography, Tensimetry.

Chronopotentiometry – Linear sweep voltametry, Square wave voltametry, Difference pulse voltametry, Cyclic Voltametry, Amperometry, theoretical principles, applications in chemical investigations.

Electrogravimetry – Principle and applications.

REFERENCE BOOKS:

1. William Kemp, NMR in Chemistry, Mac Millan, 1986.
2. A.Carrington, A.D. Melahlam, Introduction to Magnetic Resonance, Harper and Row, New York, 1967.
3. E.A.V.Ebsworth, David, W.H.Ranklin and Stephen Cradock, Structural methods in inorganic chemistry, Black well Scientific Publ., 1987.
4. R. Drago, Physical methods in chemistry, Reinhold, New York, 1968.
5. Donald L.Pavia & Gary M Lampman, Introduction to Spectroscopy, Cengage Learning India Pvt Ltd, New Delhi, 5th Edition.
6. C.N.Banwell, Fundamentals of molecular spectroscopy, McGraw Hill, New York,1966.
7. J.R.Dyer, Applications of absorption spectroscopy of organic compounds, Prentice Hall of India Pvt. Ltd., New Delhi, 1974.
8. G.W.Ewing, Instrumental methods of chemical analysis, McGraw Hill Pub, 1975.
9. Doughlas. A.Skoog, Principles of instrumental analysis, Saunders College Pub.Co, III Edn., 1985
10. R.C. Kappor and B.S. Agarwal, Principles of polarography, Wiley Eastern Ltd., 1991.
11. J.R.Lackowicz, Fluorescence Spectroscopy
12. Fundamental of Photochemistry by K.K.Rohatgi – Mukherjet.

M.PHIL. CHEMISTRY
PART -I
PAPER III - (GUIDE PAPER)

BACKGROUND RESEARCH PAPER

This background paper should be related to the proposed research work towards the dissertation. The Guide will give the syllabus.

M.PHIL. CHEMISTRY
PART -II
DISSERTATION

Candidates shall carry out research work in consultation with the guide/supervisor and submit the dissertation to the University through the Supervisor and Head of the Department at the end of the year from the commencement of the course which shall be valued by internal examiner (supervisor) and one external examiner appointed by the University from a panel of four names sent by the Supervisor through the Head of the Department at the time of submitting the dissertation.

DISSERTATION / PROJECT WORK

DISSERTATION   :   150 Marks

VIVA VOCE   :   50 Marks

TOTAL   :   200 Marks

Model Question Paper

M.Phil., Chemistry (For the candidates admitted from 2017-2018 onwards)

SCIENTIFIC RESEARCH AND METHODOLOGY

Time: 3 Hours   Maximum: 75 Marks

PART - A (5X5=25 Marks)

Answer all the questions

1. a) Describe how chemical abstract is useful in literature survey of your research work. (Or)

   b) "If the subject index is proper, the weightages given to substance index and formula index can be reduced" – Justify this statement with an example

2. a) Write an account of selection of topic for a research work (Or)

   b) Describe the principles of research work .

3. a) Explain the Gaussian distribution with a suitable diagram. (Or)

   b) The amount of oxalic acid present in a given solution was determined by two different methods, one standard and the other new, when the following results were obtained:
   Sample Number Amount of oxalic acid (g/lit) determined by

	Standard Method	New Method
1.	8.65	9.35
2.	4.70	11.06
3.	7.35	8.90
4.	13.95	12.58
5.	17.26	18.99
6.	12.80	11.72

   show that is no significant difference between the two methods.

4. a) Write a note on high and low level languages. (Or)

   b) Give a brief note on network compounds.

5. a) Explain the structure of a c program. (Or)

   b) Discuss the syntax of switch case statement.

Part-B (5x10=50 Marks)

6. a) Describe the manuscript preparation, formats used to publish a research paper in Indian journal of Chemistry. (Or)

   b) Discuss about the aids of computer devices in literature survey.

7. a) Give an account of the general format of a thesis. (Or)

    b) i) How will you prepare a manuscript entitled "Photoreduced election transfer reactions of Ruthenium – Polypyridine complexes with aromatic amines"(5)

    ii)Explain the format for the journal, tetrahedron and differentiate the samefrom that of Indian Journal of Chemistry.(

8. a) i) Write short notes on multiple linear regression.(5)

    ii) What is meant by correlation coefficient? How is it calculated? Discuss its Importance (5) (Or)

    b) i) Write down the differences between precision and accuracy.(4)

    ii) Explain the normal distribution of random errors.(6)

9. a) With a neat diagram explain the basic organization of a computer. (Or)

    b) Write a short note on the following
          i) W W W(5)   ii) Online search of chemistry databases.(5)

10. a) Explain with an example the data types supported by C language. (5) (Or)

    b) Write a short note on the following

          i)While(3)   ii) While-do(3)   iii) for(4)

Model Question Paper

M.Phil., Chemistry (For the candidates admitted from 2017-2018 onwards)

SPECTROSCOPIC AND INSTRUMENTAL METHODS IN

CHEMICAL INVESTIGATIONS

Time: 3 Hours   **Maximum: 75 Marks**

PART - A (5X5=25 Marks)

Answer all the questions / All Questions carry equal marks

1. a) Give a short account of the selection rules of UV-visible spectroscopy. (Or)

   b) Explain how Fermi Resonance is used in the prediction of frequencies in IR spectroscopy.

2. a) Discuss the principle of spin decoupling technique in 1H NMR spectroscopy. (Or)

   b) What is meant by Hyperfine splitting? How is it used in the predictions of ESR results?

3. a) Write notes on the applications of NQR spectroscopy. (Or)

   b) Write notes on the isomer shift and quadrupole interaction in Mossbauer spectroscopy.

4. a) Discuss Zeeman effect. (Or)

   b) Discuss the excitation and ejection process in PES

5. a) What are the two parameters derived from polarograms? Explain their significances. (Or)

   b) Give the theoretical principles of electrogravimetry

Part-B (5x10=50 Marks)

6. a) i) State whether the following pairs of compounds can be distinguished by theirIR spectra.(2x2=4)

   (A) C_6H_5-NH_2 and $(C_6H_5)_2$ NH

   (B) H_2N-C_6H_4-CO_2 Me and Me-C_6H_4-$CONH_2$

   ii) What is Raman Effect? Give an account on the applications of it. (6) (Or)

   b) Discuss the theory, instrumentation and applications of Rotational spectroscopy.

7. a) Discuss the principle of 13C NMR and explain how the peak assignments are made. (Or)

   b) Predict the ESR spectra of the Naphthalene radical anion, Pyrazine anion radical and Cyclopentadienyl radical and discuss.

8. a) Discuss how the Mossbauer spectroscopy is used to study the spin states of Complexes. (Or)

   b) Write a note on the principle and instrumentation of NQR spectroscopy.

9. a) (i) How will you ascertain the structure and orientation of a compound   u s i n g XRD? (Or)

   b) Discuss the theory of AAS and enumerate its applications

10. a) How are amperometric titrations carried out? Discuss the principles involved. Give their merits and demerits. (Or)

    b) Discuss the theory and applications of cyclic voltammetry.