# ALAGAPPA UNIVERSITY

(A State University Established in 1985)

Karaikudi - 630003. Tamil Nadu, India

2017 Accredited with A+ Grade by NAAC (CGPA : 3.66)

2018 MHRD Govt. of India UGC Graded as Category - I Deemed Autonomy

2018 MHRD Swachh Campus Rank : 4

2021 nirf NATIONAL INSTITUTIONAL RANKING FRAMEWORK Rank : 33

2021 QS UNIVERSITY RANKINGS Asia Rank : 199

## FACULTY OF SCIENCE

## DEPARTMENT OF INDUSTRIAL CHEMISTRY


## M.Phil., CHEMISTRY

# REGULATIONS AND SYLLABUS

(For the candidates admitted from the Academic Year 2022 - 2023)

**DEPARTMENT OF INDUSTRIAL CHEMISTRY**

**M.PHIL. CHEMISTRY**

# REGULATIONS AND SYLLABUS

[For the candidates admitted from the Academic Year 2022 – 2023 onwards]


## ALAGAPPA UNIVERSITY

(A State University Accredited with "A+" grade by NAAC (CGPA: 3.64) in the Third Cycle andGraded as Category-I University by MHRD-UGC)

Karaikudi - 630003, Tamil Nadu

**Broad Based Board of Studies (BBBoS)**

**Panel of Members**

| No. | Capacity | Name & Address |
|---|---|---|
| 1 | Chairperson | Dr.H.Gurumallesh Prabu, Prof. & Head, Department of Industrial Chemistry, Alagappa University. |
| 2 | Foreign Expert | Dr. H. Radecka, Professor Emeritus, Laboratory of Bioelectroanalysis, Institute of Animal Reproduction and Food Research, Polish Academy of Sciences, Olsztyn, Poland. |
| 3 | Subject Expert | Dr.M.Jeganmohan, Professor, Department of Chemistry, Indian Institute of Technology-Madras, Chennai. |
| 4 | Subject Expert | Dr.R.Thangamuthu, Senior Principal Scientist, Electrochemical Materials Science Division, Central Electrochemical Research Institute, Karaikudi. |
| 5 | Industry Expert | Dr.U.P.Senthilkumar, Head-R&D, RECEPS Pharma, Hyderabad. |
| 6 | Student Alumni | Dr.C.Sivakumar, Principal Scientist, Central Electrochemical Research Institute, Karaikudi. |
| 7 | Internal Member | Dr.S.Thambidurai, Professor, Department of Industrial Chemistry, Alagappa University. |
| 8 | Internal Member | Dr.M.Sundrarajan, Assistant Professor, Department of Industrial Chemistry, Alagappa University. |
| 9 | Internal Member | Dr.T.Stalin, Assistant Professor, Department of Industrial Chemistry, Alagappa University. |
| 10 | Internal Member | Dr.G.Gopu, Assistant Professor, Department of Industrial Chemistry, Alagappa University. |
| 11 | Internal Member | Dr.S.Viswanathan, Assistant Professor, Department of Industrial Chemistry, Alagappa University. |
| 12 | Internal Member | Dr.S.Umadevi, UGC-Assistant Professor, Department of Industrial Chemistry, Alagappa University. |

**Programme General Objectives**

1. To impart the students more knowledge in Chemistry
2. To improve communication skills and computer skills

**Programme Specific Objectives**

1. To provide knowledge regarding research methodology in chemistry
2. To provide in-depth knowledge in area of specialization in chemistry
3. To provide knowledge and understanding of general skills in chemistry
4. Application of general and laboratory skills in chemistry through executing research in chemistry

**Programme outcome**

**1.** To prepare the scholars for Teaching /Research assignments in HEIs / R&D / Industry.

## Master of Philosophy (M.Phil) in CHEMISTRY

REGULATIONS

### 1. Eligibility

Candidates who have qualified for post graduate degree in Chemistry or Industrial Chemistry of this University or post graduate degree in Chemistry or Industrial / Applied / Organic / Inorganic / Physical / Analytical Chemistry of any other University recognized as equivalent thereto shall be eligible for admission to the Degree of Master of Philosophy (M.Phil) in Chemistry and undergo the prescribed programme of study in the Department of Industrial Chemistry of Alagappa University.

For securing admission to the M.Phil programme, candidates must have secured 55% of marks in the respective PG Degree or any equivalent programme in the case of inter-disciplinary subjects. (B grade in 7-point scale). However, the minimum marks for the SC/ST candidates would be 50%. For all the candidates, who have completed their PG Degree on or before 1991, the minimum eligible marks for admission to M. Phil. would be 50%.

### 2. Entrance test for admission to M.Phil programme

An Entrance test and Interview would be administered for all the applicants. The performance in that Entrance test would be taken into account along with the marks scored in the PG Programme. The written test would comprise objective questions for 75 marks and the interview would carry 25 marks. The marks secured in written test and interview will be added to the marks obtained in the PG Degree examinations and the rank list will be prepared accordingly.

### 3. Constitution of a selection committee

The Selection Committee would comprise of the Dean-Faculty of Science, HoD, Professor(s) and Associate Professor(s) of the Department of Industrial Chemistry nominated by the University. The committee would be responsible for admitting candidates as per the prescribed norms.

### 4. Duration of the Programme

The duration of the M.Phil programme shall extend over a period of one year from the commencement.

### 5. Framing course work

The M.Phil Course work will contain (a) Part I and (b) Part II (Dissertation). The candidates have to take three courses (1) Research Methodology (2) Area of Specialization (3) General skills for Chemistry in Part I. This is aimed at imparting and improving skills in the areas of (i) Computer Operation Skills, (ii) Communicative Skills and (iii) Educational Skills (Pedagogical Skill-it includes practical training in teaching). For each course, 25% of marks would be allotted for the Continuous Internal Assessment (CIA) evaluation and the remaining 75% would be allotted for the end-semester University Examination. There can be 3 components for continuous internal evaluation/assessment: (1) Two tests: 15 marks ($3^{rd}$/repeat test for special cases/absentees); (2) Seminar/Quiz: 5 marks; (3) Assignment: 5 marks. Total - 25 marks.

| Sem | Code | Course Title | Credit | Marks | | |
|---|---|---|---|---|---|---|
| | | | | CIA | ESE | Total |
| I | 596101 | Research Methodology in Chemistry | 4 | 25 | 75 | 100 |
| | 596102 | Area of Specialization in Chemistry | 4 | 25 | 75 | 100 |
| | 596103 | General Skills for Science | 4 | 75 | 25 | 100 |
| Total | | | **12** | **125** | **175** | **300** |
| II | 596201 | Topic of Research | 4 | 25 | 75 | 100 |
| | 596202 | Dissertation & Viva-voce | 8 | 50 | 100+50 | 200 |
| Total | | | **12** | **75** | **225** | **300** |
| Grand TOTAL | | | **24** | **200** | **400** | **600** |

## 6. Scheme of examinations

*Part I Written Examinations:*

- The examination of courses 596101, 596102 and 596103 shall be held at the end of the first semester. The duration of examination for each course shall be 3 hours.
- The examination of course 596201 shall be held at the end of the second semester. It will be conducted by the Department in a single session for all the students. Research Supervisor has to set the question paper confidentially and hand over to the HoD well in advance. The marks obtained by the candidate along with the syllabus, question paper and valued answer-scripts shall be sent to the Controller of Examinations.

*Part-II – Dissertation:*

- Candidates shall 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 the 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.

## 7. Eligibility of teacher to becomeM.Phil supervisor

For guiding M.Phil candidates, the supervisor should possess a Ph.D. Degree with three years of teaching experience and have published at least one paper in a reputed National / International Journal or one Monograph.

## 8. Maximum number of M.Phil candidates a supervisor can accommodate at a time

There will not be any restriction or compartmentalization in respect of full time and part time candidates.

I. Those who are Guiding M.Phil alone : 12 (M.Phil)

II. Those who are Guiding M.Phil and Ph.D. : 4 (M.Phil)

## 9. Evaluation of the Dissertation

M.Phil dissertation may be evaluated by an Indian Examiner. There should be a compulsory viva-voce examination for each candidate, which may be conducted by the HoD and faculty members with the supervisor as the Convener on the basis of favourable report received from the external examiner.

**10. Grading of the Courses**

The following table gives the marks, Grade points, Letter Grades and classifications meant to indicate the overall academic performance of the candidate.

Conversion of Marks to Grade Points and Letter Grade (Performance in Paper / Course)

| RANGE OF MARKS | GRADE POINTS | LETTER GRADE | DESCRIPTION |
|---|---|---|---|
| 90 - 100 | 9.0 – 10.0 | O | Outstanding |
| 80 - 89 | 8.0 – 8.9 | D+ | Excellent |
| 75 - 79 | 7.5 – 7.9 | D | Distinction |
| 70 - 74 | 7.0 – 7.4 | A+ | Very Good |
| 60 - 69 | 6.0 – 6.9 | A | Good |
| 50 - 59 | 5.0 – 5.9 | B | Average |
| 00 - 49 | 0.0 | U | Re-appear |
| ABSENT | 0.0 | AAA | ABSENT |

a) Successful candidates passing the examinations and earning GPA between 9.0 and 10.0 and marks from 90 – 100 shall be declared to have Outstanding (O).
b) Successful candidates passing the examinations and earning GPA between 8.0 and 8.9 and marks from 80 - 89 shall be declared to have Excellent (D+).
c) Successful candidates passing the examinations and earning GPA between 7.5 – 7.9 and marks from 75 - 79 shall be declared to have Distinction (D).
d) Successful candidates passing the examinations and earning GPA between 7.0 – 7.4 and marks from 70 - 74 shall be declared to have Very Good (A+).
e) Successful candidates passing the examinations and earning GPA between 6.0 – 6.9 and marks from 60 - 69 shall be declared to have Good (A).
f) Successful candidates passing the examinations and earning GPA between 5.0 – 5.9 and marks from 50 - 59 shall be declared to have Average (B).
g) Candidates earning GPA between 0.0 and marks from 00 - 49 shall be declared to have Re-appear (U).
h) Absence from an examination shall not be taken as an attempt.

From the second semester onwards the total performance within a semester and continuous performance starting from the first semester are indicated respectively **by Grade Point Average (GPA) and Cumulative Grade Point Average (CGPA).** These two are calculated by the following formulate

GRADE POINT AVERAGE (GPA) = $\Sigma_i C_i \ G_i / \Sigma_i C_i$

GPA = Sum of the multiplication of Grade Points by the credits of the courses
Sum of the credits of the courses in a Semester

**11. Classification of the final result**

| CGPA | Grade | Classification of Final Result |
|---|---|---|
| 9.5 – 10.0 | **O+** | First Class – Exemplary* |
| 9.0 and above but below 9.5 | **O** | |
| 8.5 and above but below 9.0 | **D++** | First Class with Distinction* |
| 8.0 and above but below 8.5 | **D+** | |
| 7.5 and above but below 8.0 | **D** | |
| 7.0 and above but below 7.5 | **A++** | First Class |
| 6.5 and above but below 7.0 | **A+** | |
| 6.0 and above but below 6.5 | **A** | |
| 5.5 and above but below 6.0 | **B+** | Second Class |
| 5.0 and above but below 5.5 | **B** | |
| 0.0 and above but below 5.0 | **U** | Re-appear |

The final result of the candidate shall be based only on the CGPA earned by the candidate.

a) Successful candidates passing the examinations and earning CGPA between 9.5 and 10.0 shall be given Letter Grade (O+), those who earned CGPA between 9.0 and 9.4 shall be given Letter Grade (O) and declared to have First Class –Exemplary*.
b) Successful candidates passing the examinations and earning CGPA between 7.5 and 7.9 shall be given Letter Grade (D), those who earned CGPA between 8.0 and 8.4 shall be given Letter Grade (D+), those who earned CGPA between 8.5 and 8.9 shall be given Letter Grade (D++) and declared to have First Class with Distinction*.
c) Successful candidates passing the examinations and earning CGPA between 6.0 and 6.4 shall be given Letter Grade (A), those who earned CGPA between 6.5 and 6.9 shall be given Letter Grade (A+), those who earned CGPA between 7.0 and 7.4 shall be given Letter Grade (A++) and declared to have First Class.
d) Successful candidates passing the examinations and earning CGPA between 5.0 and 5.4 shall be given Letter Grade (B), those who earned CGPA between 5.5 and 5.9 shall be given Letter Grade (B+) and declared to have passed in Second Class.
i) Candidates those who earned CGPA between 0.0 and 4.9 shall be given Letter Grade (U) and declared to have Re-appear.
e) Absence from an examination shall not be taken as an attempt.

CUMULATIVE GRADE POINT AVERAGE (CGPA) = $\Sigma_n \Sigma_i C_{ni} G_{ni} / \Sigma_n \Sigma_i C_{ni}$

CGPA = $\frac{\text{Sum of the multiplication of Grade Points by the credits of the entire Programme}}{\text{Sum of the credits of the courses for the entire Programme}}$

Where '**Ci**' is the Credit earned for Course i in any semester; '**Gi**' is the Grade Point obtained by the student for Course i and 'n' refers to the semester in which such courses were credited.

**CGPA** (Cumulative Grade Point Average) = Average Grade Point of all the Courses passed starting from the first semester to the current semester.

Note: * The candidates who have passed in the first appearance and within the prescribed Semesters of the PG Programme are alone eligible for this classification.

| SEMESTER -I | | | | |
|---|---|---|---|---|
| **Core** | **Course Code: 596101** | **Research methodology in Chemistry** | **Credits: 4** | **Hours: 90** |
| **Objectives** | To provide information regarding the literature search for the problem identified, To gain knowledge in purification and characterization techniques in chemistry | | | |
| **Unit-I** | **Literature Search**<br>Primary sources-journals, periodicals, patents, abstracts. Secondary sources-list of titles, reviews, annual reviews, treatises, serials, monographs, text books, encyclopedia, catalogue, index of tabulated data, Science citation index. Literature searching–location of journal article, materials on a given topic, information about specific compound- choosing a problem. Abstract of a research paper. Literature search online. The CA file–Registry file and other database. Popular websites in Chemistry: Scopus, Science direct, web of science, scifind, Google Scholar, Research Gate, Academic Blog, Academic edu. Plagiarism, grammarly software. | | | |
| **Unit-II** | **Purification and spectroanalytical techniques**<br>Separation Techniques - column, paper, thin layer and gas chromatography, high pressure liquid chromatography, Ion exchange chromatography. Spectroanalytical Techniques: Principle, instrumentation and applications of colourimertry, flame photometry, atomic absorption spectroscopy and atomic emission spectroscopy. | | | |
| **Unit-III** | **Spectroscopic techniques**<br>Principle, instrumentation and applications of UV-Visible spectroscopy, FT-IR spectroscopy, Mass spectroscopy, NMR ($H^1$ and $^{13}C$) spectroscopy, EPR spectroscopy, ESCA (XPS), Auger electron spectroscopy. Combined applications of UV-Vis, FT-IR, NMR, Mass leading to structural elucidation of unknown compounds. | | | |
| **Unit-IV** | **Advanced instrumentation techniques**<br>Principle, instrumentation and applications of XRD, DSC, TG/DTA, AFM, STM, SEM,TEM, Cyclic voltammetry, Electrochemical impedance spectroscopy, Electrochemical quartz crystal microbalance. | | | |
| **Unit-V** | **Error Analysis & Report Preparation**<br>Error Analysis, Minimization of Errors, Deviation from Accurate Results-the Binomial Distribution–the Gaussian Distribution–Mean-Median–Deviation from Mean and Median-student's t-test, F-test, Significant figures in multiplication-Division-Addition and Subtraction–Curve Fitting method of Least Squares-Linear Regression-Multiple Linear Regression-Slope-Intercept and Correlation Coefficient. True value-standard value-observed value–Error–Types of Errors–Accuracy–Precision.<br>Report writing, Plagiarism, grammarly software. Structure formatting software–Chemdraw-Chemsketch. PDB viewers–Chimera–Rasmol–Python.Data processing software–MS Excel, Origin, R, Math lab. | | | |

**Suggested Readings:**


March, J. (2000).*Advanced Organic Chemistry* (4th ed.). John Wiley & Sons, New Delhi

Robert E Maizil. (1989). *How to Find Chemical Information–A Guide for Practicing Teachers & Students.*

Geffery, H., Bassett, J., Mendham, J., Denney, R.C. (1989). *Vogel's Textbook of Quantitative Chemical Analysis*(5th ed.). ELBS, Longman, UK.

Vassos, B.H., Ewing, G.W. (1983).*Electroanalytical Chemistry*. John Wiley & Sons, New York.

Silverstein, R.M. (2004).*Spectrometric identification of organic compounds*(4th ed.). John Wiley & Sons,

Inc., New York.
William Kemp. (1991).*Organic spectroscopy* (3rd ed.). Palgrave, New York.
Allen J.Bard, Israel Rubinstein. (2004).*Electroanalytical Chemistry*. Marcel Dekker, Inc.
Sibilia, J.P. (1988). *A Guide to Materials Characterization*. VCH Publishers, New York.
SkoogD.A., West, D.M., Holler, F.J.Crouch, S.R. (1999*). Fundamentals of Analytical Chemistry* (7th ed.). Saunders College Publishing Co., New York.
Peter Kissinger and William R. Heinemann. (1996).*Laboratory Techniques in Electroanalytical Chemistry.* Taylor & Francis, Inc.
Yong-Cheng Ning, Richard R.Ernst. (2005).*Structural identification of organic compounds with spectroscopic techniques.* Wiley-VCH publishers.
Francis Rouessac and Annick Rouessac. (2007).*Chemical Analysis: Modern instrumentation methods and techniques* (2nd ed.).Wiley publishers.
Yang Leng. (2008). *Materials Characterization: Introduction to microscopic and spectroscopic methods.* Wiley.
Anderson, R.J., Bendell,D., Groundwater, P.W., Abel, E.W. (2004). *Organic Spectroscopic analysis.* Royal Society of Chemistry.
Chapra, S.C., Canale, P. (2002).*Numerical Methods for Engineers*(4th ed.) Tata McGrawHill.
Schilling, R.J. and Harris, S.L. (2000). *Applied Numerical Methods for Engineers: Using MATLAB and C*, Brooks/Cole Publishing Company.
Mathews, J.H. (2001).*Numerical Methods for Mathematics, Science, and Engineering* (2nded.). Prentice Hall of India.

| | |
|---|---|
| **Outcomes** | Students would be equipped with the information regarding literature search, gain knowledge regarding the characterization techniques in chemistry |

| SEMESTER -I | | | | |
|---|---|---|---|---|
| **Core** | **Course Code: 596102** | **Course Title: Area of specialization in chemistry** | **Credits: 4** | **Hours: 90** |
| **Objective** | to gain more knowledge in current interesting topics in chemistry | | | |
| **Unit-I** | **Photochemistry and solar cells**<br>Photochemical activation energies, Quantum yield, Photochemical processes, Molecular wave functions, electronic orbitals and electronic spin, Molecular orbitals (n, π, π*, σ, σ*). Harmonic oscillator, Anharmonic oscillator curves, Quantum mechanical formulation of the Franck-Condon principle, Energy level diagrams, Assignment of n,π*,π,π* configurations, Forbidden transitions, Fluorescence and Phosphorescence, Emission lifetimes, Mechanism of energy transfer. Measurement of fluorescence, phosphorescence lifetimes. Introduction to time-resolved techniques for absorption and emission measurements. Detection and kinetics of reactive intermediates.<br>Solar cells: The Solar Resource-Light Absorption and Optical Losses- Charge Excitation -Charge Separation-Charge Extraction-Device Models and fundamentals-Wafer Silicon-Based Solar Cells-Thin Films- Dye sensitized solar cells -Solar Cell Characterization, efficiency and measurements. | | | |
| **Unit-II** | **Polymers**<br>Molecular weights of polymers and polydispersity index; determination of molecular weights. Kinetic chain length. Glass Transition temperature of polymers. Thermodynamics of polymerization. Polymer surfactant interactions. Introduction to different controlled polymerization techniques. Smart polymer materials–conducting polymer, polymer electrolytes, fire retardant, thermally stable polymers, liquid crystalline polymers and Bio-degradable polymers. Molecular devices: Molecular electronic devices, molecular wires, molecular rectifiers, molecular switches and molecular logic. Introduction to molecular machines. | | | |
| **Unit-III** | **Supramolecules**<br>Introduction to supramolecules: crowns, cryptands, spherands, calixarenes, cyclophanes and cyclodextrin. Supramolecular Chemistry: key-lock principle and induced fit. Molecular Recognition: concept, definitions, receptor, design principles. Preorganization, self-assembly, template effects, allosterics, cooperativity, multivalency. Host-Guest interaction, pre organization and complimentary and lock and key analogy.<br>Supramolecular Interactions: Ion-ion interactions; Ion-dipole interactions; dipole-dipole interactions; hydrogen bonding and supramolecular synthons, halogen bonding; cation-π-interactions; π-π-interactions; van der Waals interactions; hydrophobic effect; metal-coordination bonds | | | |
| **Unit-IV** | **Synthesis of nanomaterials**<br>Introduction to nanotechnology and approaches (bottom-up, top-down) in the synthesis of nanomaterials: Sol-gel, Micro-emulsion, CVD, PVD, Molecular beam epitaxy, Vapor (solution)-liquid-solid growth, (VLS/SLS), Template based synthesis, Lithography. Various kinds of Nanostructures: Carbon fullerenes and CNT, Metal and metal oxide nanowires, Self assembly of nanostructures, Core-shell | | | |

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|---|---|
| | nanostructures, Nanocomposites. |
| **Unit-V** | **Characterization and applications of nanomaterials**<br>Particle size distribution by Static Light Scattering Technique, BET Accessible surface area, Electron Energy Loss Spectroscopy. Nano-electronics-Nano optics-Nanoscale chemical- and bio-sensing applications. Photovoltaic, fuel cells, batteries and energy-related applications High strength nanocomposites - Environmental care and cleaning. |

**Suggested Readings:**


Rohatgi - Mukherjee, K.K. (2014). *Fundamentals of Photochemistry* (3rd ed.) New Age International Pvt. Ltd.New Delhi.

Stephen J. Fonash. (2010).*Solar Cell Device Physics* (2nd ed.). Second Edition, Academic Press Kidlington, Oxford, OX5 1GB, UK.

Billmeyer, Jr, W.F. (1984).*Textbook of polymer science* (3rd ed.). Wiley-Interscience, New York.

Rao, C.N.R., Muller, A., Cheetham, A.K. (2004). *Chemistry of Nanomaterials*. Wiley-VCH Verlag GmbH & Co., Germany.

Lockwood, D.J. (2009) *Nanostructured Materials for Electrochemical Energy Productionand Storage.* Springer, 2009.

Cao, G., Wang, Y. (2010).*Nanostructures and nanomaterials: synthesis, properties andapplications.* World scientific publishers.

Merkoçi, A. (2009) *Biosensing using nanomaterials*, Wiley publications.

Caruta, B.M. (2006). *Focus on nanomaterials research.* Nova Science Publishers.

Jha, A.R. (2008). *MEMS and Nanotechnology based sensors and devices for communication, medical and aerospace applications.* CRC press, Taylor & Francis group.

VoDinh, T. (2007*). Nanotechnology in Biology and Medicine: Methods, Devices and Applications.*CRC Press.

Chaudry, Q., Castle, L., Watkins, R. (2010). *Nanotechnologies in Food.* RSC Publications.

Cragg, P.J. (2010). *Supramolecular Chemistry*:*From Biological Inspiration to Biomedical Applications.* Springer.

Ariga, K., Kunitake, T. (2006).*Supramolecular chemistry: fundamentals and applications*, Springer.


| | |
|---|---|
| **Outcome** | Student would be able to gain more knowledge in latest specialized fields in Chemistry |

| SEMESTER - I | | | | |
|---|---|---|---|---|
| **Core** | **Course Code: 596103** | **Course Title: General skills in Science** | **Credits: 4** | **Hours: 90** |
| **Objectives** | To impart the students with general skills in science | | | |
| **Unit-I** | **Introduction to computers**<br>Computer Hardware: input devices and media–magnetic device and media–output devices and media–storage device and media-computer architecture–system software: types, operating system, and translators–Application software: types of language–application packages–integrated software-Introduction to operating system-Working with windows Linux Operating system and office programs–Internet, Website and Email. | | | |
| **Unit-II** | **Computer operating skills**<br>Starting a program and opening a document, saving and naming the document. Create file and folders–deleting and un-deleting a document–closing a document–renaming and moving a document–finding a document-MS office: Word, Excel, Access, power point, out look and integrated office applications. C programming–Principles, classes and structure of $C^{++}$ and python programming - computing and chemistry. | | | |
| **Unit-III** | **Communication skills in English**<br>Understanding communication–greeting and introducing–making requests–asking for and giving permission–offering help–giving instruction and directions-art of small talk–participating in conversation–making a short formal speech–Describing the people, place, events and things. Telephone skill: understanding, handling calls, leaving message and making request. Written communication: report writing, note making-career skills: curriculum vitae and cover letters-Facing an interview and presentation skills–academic listening-dissertation writing. | | | |
| **Unit-IV** | **Pedagogical Skill For Chemistry Teachers**<br>Chemistry Teacher: Qualification, teacher competencies and professional growth. Theory and models of curriculum development: Concept and Technical scientific models of curriculum development-planning a chemistry library–Handling of practical classes. Educational technology and classroom pedagogy: Educational Technology–Concept, Emerging technologies-New technologies on methodology of teaching, learning experiences and curriculum development. Micro-teaching: Meaning, teaching, skill of stimulus variation, questioning, explanation, reacting, linking and benefits- Few examples of pedagogical skill in chemistry. | | | |
| **Unit-V** | **Practical Training**<br>Preparation of charts and models for handling classes of chemistry teacher - Creating management documents e.g. Curriculum Plan, Time Table scheduling, Evaluation-Strategies etc–Learning to write and draw on the blackboard-Preparation of over head projector presentations-Preparation of power point/LCD presentations–Preparation of micro-teaching skills-Preparation of teaching materials–seminar classes for PG students-Preparation of chemistry album. | | | |

**Suggested Readings:**


W.Joseph, Habraken. (2004). *Microsoft office 2003,*All in one, Que publishing.

Curtis Frye. (2004).*Microsoft office Excel 2003 step by step.* Microsoft press.

Greg Harvey. (2006). *Microsoft office Excel 2007 for dummies*.

Guy Hart-DEavis. (2007).*How to do everything with Microsoft office word 2007*. Mac Graw-Hill professional.

Jim Boyce. (2003).*Absolute beginner's guide to Microsoft office 2003*. Que publishing.

Benny Raphael, Smith, F.C. (2003).*Fundamentals of computer- aided engineering*. John wiley&sons.

Dietel, *An introduction to operating system*, Addision Wesley.

Ravi Sethi, *Principles of Programming Languages*. Addison Wesley

Balagurusamy, E. (1995).*$C^{++}$ programming*. Tata Mc Graw Hill, New Delhi.

Gottfried, B.S. (1990). *Theory and programming with C.* Mc Graw Hill publishers, New Yark.
Acklen, L. (1998). *Microsoft office 97 professional Essentials.* Prentice – Hall India.
Shelley O'Hara. (1997). *Discover Office 97*. Comdex computer publishing.
Harry chambers. (2001).*Communication skills for scientific and technical professional.*Perseus.
Alan Barker.(2000). *Improve your communication skills.* Kogan page.
Libby kumin. (2003).*Early communication skills for children with down syndrome.*Wood fine House.
Dutt. (2007). *A course in communication skills.* Ebek Public., Bangalore.
Ferguson, J.G. (2004).*Communication skills* Ferguson.
Elizabeth Arnold, Kathleen Underman Boggs. (2002). *Interpersonal Relationships, Professional Communication Skills For Nurses*. Saunders.
Steve Lewis. (2004). *Using ICT to Enhance Teaching and Learning in Chemistry*. Publishedby Royal Society of Chemistry.
Joan Gallagher-Bolos, Dennis Smithenry. (2004). *Teaching Inquiry-based Chemistry: Creating Student-led Scientific Communities.* Published by Heinemann, 2004
Linda D. Williams. (2003).*Chemistry Demystified: A Self-teaching Guide*. Published by McGraw-Hill Professional.
Robert Thomas Sanderson. (1962).*Teaching Chemistry with Models*. Published by Van Nostrand.
Cole, A. R. H., Alexander, R., Webb,J. M. (1979).*The Role of Laboratory Teaching inUniversity Chemistry Courses.*Published by Pergamon Press.
Raja Dan, Durga. Kash. U.(1982).*A Study of the International Influences in FunctionalContent on Curriculum Programme.*
Taba., Hilda. (1962).*Curriculum Development, Theory and Practice*. Harcourt Brace and World Inc.

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|---|---|
| **Outcome** | Students would be well equipped with general skills and hands on training on computational sills in science, particularly in the areas of chemistry |

| SEMESTER -II | | | | |
|---|---|---|---|---|
| **Core** | **Course Code: 596201** | **Topic of Research** | **Credits: 4** | **Hours: 90** |
| **Objectives**: | To impart students with deep knowledge in a specialized area of research, to get exposed to reading research articles, books, internet resources related to their Dissertation | | | |
| **Unit-I** | **Fundamental Concepts**<br>Identification of research problem. Fundamental information on the research topic selected. Significance of the research topic chosen. | | | |
| **Unit-II** | **Literature Survey-I**<br>Literature survey on the research problem. Use of text books, reference materials, journals, internet and specialized softwares for literature collection. | | | |
| **Unit-III** | **Literature Survey-II**<br>Indepth study of published papers, seminar/conference proceedings on the identified research problem. The period of literature search extended from the year 2010 to the current date. National and International status on the research topic. | | | |
| **Unit-IV** | **Preparatory Methods**<br>Procurement or synthesis of chemicals needed for the research problem. Database, storage and handling of specified chemicals. Preparatory methods to execute the experimental works. Details on the principle, instrumentation and working of instruments identified for the problem. | | | |
| **Unit-V** | **Characterization Techniques**<br>Types of instrumental techniques used for the identified research problem. Characterization of research materials, interpretation of results and preparation of manuscript. Writing of Research report / Dissertation. Presentation of research output in scientific seminar / conference. | | | |
| **Outcomes** | The students would gain more knowledge in a specialized area of research, to gain in-depth knowledge regarding the preparatory methods and characterization techniques | | | |

SCIENCE CAMPUS