

**GUJARAT VIDYAPITH: AHMEDABAD**

**Syllabus of M. Phil (Chemistry)**

**(In force from June 2013)**



**Department of Microbiology,  
M. D. Gramseva Mahavidyalaya,  
Sadra**

**Dist: Gandhinagar 382 320**

**Gujarat Vidyapeeth: Ahmedabad**  
**Structure of M.phil.(Chemistry) Course**  
**In force from June-2013**

<b>Semester-1</b>				
<b>Subject</b>	<b>Hours</b>		<b>Credits</b>	<b>Marks</b>
	<b>Theory</b>	<b>Practical</b>		
CHEM-101: Research Methodology	60	-	4	100(T)
COMP-102: Computer Application in Research (Compulsory for all subjects)	15	30	2	25(T) + 25(P)
CHEM-103: Reviews of Literatures in Specific Research Area of Chemistry	-	60	2	50(P)
CHEM-104: Current Trends in Chemistry	60	-	4	100(T)
<b>Dissertation</b> [Selection of the research problem, preparation of research design and list out the laboratory requirements(chemicals, glass wares, miscellaneous items ) for respective research work and primary practical work]	225		(5 Credits but it is included in semester-2)	-
<b>Total</b>	<b>450</b>		<b>12</b>	<b>300</b>
<b>Semester-2</b>				
<b>Dissertation</b> (Practical work, dissertation writing, dissertation submission )	450		10 (sem-2) + 5( sem-1)	Satisfactory report from referee
<b>Total</b>	<b>450</b>		<b>15</b>	-

**T= Theory P=Practical**

**Note:**

- Available time for each semester=15 weeks ( excluding examination, public holidays, other activities, vacation etc.)
  - 1 day=5 hours(excluding prayer and recess)
  - 1 week=6days(excluding Sunday)
- Therefore **1week=30 hours (It is available for direct teaching)**

**Available time for each semester=15 weeks ×30hours=450 hours**

→ **Relation between credit and hours:**

- For theory **1 credit=15 hours**
- For practical work **1credit=30 hours**
- For dissertation work **1credit=45 hours**

**M.D.GRAMSEVA MAHAVIDYALAYA: SADRA**  
**Syllabus of Course work for M.Phil. (Chemistry)**  
**In force from June-2013**  
**CHEM-101: Research Methodology**  
**(Total Teaching Hours=60, Credits=4, 100 Marks)**

**Unit-1(A) Fundamental Laboratory Techniques** (8 hours) (15 Marks)  
(Ref. 1. Chapters 1 to 7 : pages 03 to 62)

1(A).1 Basic principles (1 hour)

1(A).2 Health and safety (general safety, explosives and fire hazards, reactive reagents, toxic chemicals, electric and UV safety) (2 hours)

1(A).3 Basic laboratory procedures (distillation, crystallization, drying, solvent extraction) (2 hours)

1(A).4 Preparation of standard solutions (2 hours)

1(A).5 Basics of pH and buffer solutions (1 hour)

**(B) The investigative approach** (7 hours) (10 Marks)  
(Ref. 1. Chapters 8 to 11 : pages 65 to 83)

1(B).1 Making and recording measurements (2 hours)

1(B).2 SI units and their use (1 hour)

1(B).3 Statistics (Accuracy, Precision, comparison correlation and regression) (4 hours)

**Unit-2 Information technology and library resources** (15 hours) (25 Marks)  
(Ref. 1. Chapters 45 to 49 : pages 299 to 321)

2.1 The Internet and World Wide Web (2 hours)

2.2 Internet resources for chemistry (CAS, STN, Science direct etc.) (4 hours)

2.3 Information and Library Network Centre (INFLIBNET) as a library resource (1 hour)

2.4 Use of spreadsheets, word processors, databases and other packages (CHEMDRAW) (5 hours)

2.5 Finding and citing information (3 hours)

**Unit-3 (A) Research problem** (15 hours) (25 Marks)  
(Ref. 2. Chapters 1 to 2 : pages 1 to 29)

3(A).1 Meaning of research problems (1 hour)

3(A).2 Sources of research problems (2 hours)

3(A).3 Criteria / characteristics of a good research problem (2 hours)

3(A).4 Errors in selecting a research problem (1 hour)

**(B) Hypothesis**

(Ref. 2. Chapter 9 : pages 184 to190)

3(B).1 Meaning of hypothesis (1 hour)

3(B).2 Types of hypothesis (2 hours)

**(C) Research Proposal and Research Report**

(Ref. 2. Chapter 14 : pages 344 to360)

3(C).1 General format of the research proposal and research report (2 hours)

3(C).2 Individual research proposal and Institutional proposal (2 hours)

3(C).3 Style of writing the report (1hour)

3(C).4 References and bibliography (1 hour)

**Unit-4 (A) Communicating information** (Ref. 8)

(10 hours) (15 Marks)

4(A).1 General aspects of scientific writing (2 hours)

4(A).2 Essay (General article) writing (1 hour)

4(A).3 Research paper writing (2 hours)

4(A).4 Writing of literature surveys and reviews (2 hours)

4(A).5 Skill of poster and oral presentation (3 hours)

**(B) Disaster Management**

(5 hours) (10 Marks)

(Ref. 3. Chapter 1,2)

4 (B) .1 **Emergency responses:** chemical spills, radiation spills, biohazard spills, leaking compressed gas cylinders, fires, medical emergency accident reporting (2 hours)

4(B).2 **Safety measurements:** General safety and operational rules, safety equipments, personal protective equipments, compressed gas safety, safety practices for disposal of broken glass wares, centrifuge safety, treated biomedical wastes and scientific ethics (3 hours).

**References**

1. Practical Skills in Chemistry, J. R. Dean, A. M. Jones, D. Holmes, R. Reed, J. Weyers and A Jones, Pearson Education Ltd. [ Prentice Hall] (2002)
2. Research Methodology. Methods and Techniques : C. R. Kothari
3. OSU(Oklahoma State University)Laboratory Safety Manual 1.01(1999).
4. Tests, Measurements and Research Methods in Behavioural Sciences : A. K.Singh.
5. Vogel's Textbook of Quantitative chemical Analysis, G.H.Jeffery, J Bassett, J Mendham and R C Denney, LongmanScientific and Technical Ltd.
6. Quantitative Chemical Analysis, Daniel C. Harris, W.H. Freeman and Company, New York (2003)
7. Experimental Organic Chemistry, John C. Gilbert, Stephen F. Martin, Harcourt College Publishers (1998)
8. Scientific Papers and Presentations, Martha Davis, A Harcourt Science and Technology Company,USA(1997)

**સૈદ્ધાંતિક કાર્ય**

<b>એકમ-૧</b>	<b>સંશોધનમાં શબ્દ પ્રક્રિયન(Word Processing)નો ઉપયોગ</b>	<b>ગુણ - ૧૦</b>
૧.૧	ડોક્યુમેન્ટ ક્રિએટીંગ એન્ડ ફોર્મેટીંગ : પેરેગ્રાફ, ફોન્ટ, બ્રેકાઈન્ટ, લાઈન સ્પેસિંગ, પેજ સેટઅપ,	
૧.૨	એડિટીંગ : કટ, કોપી, પેસ્ટ, ઇન્ડન્ટ, રીપ્લેસ	
૧.૩	ઈન્સર્ટ ઓબ્જેક્ટ	
<b>એકમ-૨</b>	<b>સંશોધનમાં અંક પ્રક્રિયન(Numeric Processing)નો ઉપયોગ</b>	<b>ગુણ - ૧૦</b>
૨.૧	ક્રિએટ વર્કશીટ	
૨.૨	માફિતી વિશ્લેષણ : ડેટા બેનાલિસીસ પાર્ક (વર્ણનાત્મક અંકશાસ્ત્રીય ગણતરીઓ, આવૃત્તિ વિતરણ અને કોષ્ટકીકરણ (Tabulation) T - ગુણોત્તર અને એકમાર્ગી વિચરણ વિશ્લેષણ (One Way ANOVA)	
૨.૩	આલેખાત્મક રજૂઆત : લાઈન, કોલમબાર, પાઈ આલેખની રચના રીતિ	
<b>એકમ-૩</b>	<b>સંશોધનમાં ઇન્ટરનેટનો ઉપયોગ</b>	<b>ગુણ - ૦૫</b>
૩.૧	ઓનલાઈન અને ઓફલાઈન માફિતી શોધની રીતો	
૩.૨	ઈ-જર્નલ્સ અને ઈ-બુક્સનો ઉપયોગ	
૩.૩	કમ્પ્યુટર આધારિત પ્રત્યાયનનો સંશોધનમાં ઉપયોગ (ઈ-મેઈલ)	

**પ્રાયોગિક કાર્ય****ગુણ - ૨૫**

૧. એક પેજ ડોક્યુમેન્ટ (One Page Document) તૈયાર કરી સૂચવેલા પેજ સેટ અપ કરે.
૨. એક પેજ ડોક્યુમેન્ટ(One Page Document)માં સૂચના મુજબ પેરેગ્રાફ, ટાઈટલ, ફોન્ટ અને લાઈન સ્પેસિંગ ફોર્મેટ કરે.
૩. એક પેજ ડોક્યુમેન્ટ(One Page Document)માં સૂચના મુજબ કટ, કોપી, પેસ્ટ અને સ્પેલ ચેક કરે.
૪. વર્ક શીટ તૈયાર કરી વર્ણનાત્મક અંકશાસ્ત્રીય ગણતરીઓ કરે. (મધ્યક, મધ્યસ્થ, પ્રમાણવિચલન, વિરૂપતા, કક્ષતા)
૫. વર્ક શીટમાં ડેટા ડ્રીડ કરી તેના આધારે આલેખ રચના કરે.
૬. આલેખ રચનામાં આલેખનો પ્રકાર, આલેખ અને ધરીના શીર્ષક, રેંજમાં પરિવર્તન કરે.
૭. Excelની સામગ્રી(વર્કશીટ, આલેખ)ને Word Documentમાં ઈન્સર્ટ કરે.
૮. પાવર પોઈન્ટનો ઉપયોગ કરી ૧૦ સ્લાઈડવાળું પ્રેઝન્ટેશન તૈયાર કરે.
૯. પોતાની સંશોધન સમસ્યા આધારિત સંબંધિત સાહિત્યની શોધ કરે.
૧૦. E-mail ડ્રાફ્ટ કરે.

નોંધ : ઉપરોક્ત પ્રાયોગિક કાર્યોમાંથી કોઈપણ બે પ્રાયોગિક કાર્યો કરવાના રહેશે.

અનુપારંગત અભ્યાસક્રમ  
COMP-102: સંશોધનમાં કમ્પ્યુટરનું ઉપયોજન ગુણ - ૫૦

સમય : ૧ કલાક સૈદ્ધાંતિક કાર્ય ગુણ - ૨૫

પ્રશ્ન ૧	બહુવિકલ્પ પ્રકારના પ્રશ્નો	ગુણ ૧૦
પ્રશ્ન ૨	ટૂંક જવાબી પ્રશ્નો (સાતમાંથી પાંચ)	ગુણ ૧૦
પ્રશ્ન ૩	નિબંધલક્ષી પ્રશ્નો (બેમાંથી એક)	ગુણ ૫

સમય : ૨ કલાક પ્રાયોગિક કાર્ય ગુણ - ૨૫

પ્રાયોગિક કાર્ય - ૧	ગુણ - ૧૫
પ્રાયોગિક કાર્ય - ૨	
મૌખિક	ગુણ - ૧૦

**M.D.GRAMSEVA MAHAVIDYALAYA: SADRA**  
**Syllabus of Course work for M.Phil.(Chemistry)**  
**In force from June-2013**  
**CHEM-103: Reviews of Literatures in Specific Research Area of Chemistry**  
**(Total Teaching Hours=60, Credits=2, 50 Marks)**

Students must deeply review the literatures in specific research area of chemistry and submit the summary of the same to the department through proper channel for evaluation.

**M.D.GRAMSEVA MAHAVIDYALAYA: SADRA**  
**Syllabus of Course work for M.Phil.(Chemistry)**  
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**CHEM-104: Current Trends in Chemistry**  
**(Total Teaching Hours=60, Credits=4, 100 Marks)**

**Unit-1 Green Chemistry**

**(15 hours) (25 Marks)**

- 1.1 Introduction **(1 hour)**
- 1.2 Basic principles(twelve) of green chemistry**(2 hours)**
- 1.3 Designing a green synthesis**(4 hours)**
  - Choice of starting materials
  - Choice of reagents
  - Choice of catalysts
  - choice of solvents
- 1.4 Ultrasound assisted and Microwave assisted green synthesis **(2 hours)**
- 1.5 Biocatalysts in organic synthesis **(2 hours)**
  - Biochemical (Microbial) oxidations
  - Biochemical (Microbial) reductions
- 1.6Aqueous phase reactions **(2 hours)**
  - Diels-Alder reaction
  - Epoxidation
  - Reduction of carbon-carbon double bonds
  - Synthesis of polycarbonates
- 1.7 Green chemistry in sustainable development **(2 hours)**

**Unit-2 Nanomaterials and nanostructures**

**(15 hours) (25 Marks)**

- 2.1Introduction **(1 hour)**
- 2.2 History of Nanomaterials **(1 hour)**
  - The Lycurgus cup
  - Michael Faraday's colloids
  - The story of the Damascus sword
- 2.3 Beginning of nanoscience **(1 hour)**
  - Feynman's predictions
- 2.4 Types of nanomaterials **(1 hour)**
  - One dimensional materials (Single or multi walled carbon nanotubes)
  - Two dimensional materials (nanofilms, nanosheets, Nanowalls)
- 2.5 Synthesis of nanomaterials **(2 hours)**
  - Top-down approach
  - Bottom-up approach



## 2.6 Characterization techniques for nanomaterials (7 hours)

- Particle Size Analysis (zeta potential)
- Spectroscopy
  - Raman spectroscopy
  - Ultra-violet visible spectroscopy
- Microscopy through,
  - Transmission Electron Microscope (TEM)
  - Scanning Electron Microscope (SEM)
  - Scanning Tunnelling Microscope (STM)
  - Atomic Force Microscope (AFM)
- X-ray diffraction (XRD)

## 2.7 Applications of nanomaterials (2 hours)

- Nanocosmetic
- Textiles
- Nanosensors
- Drug delivery
- Cancer therapy
- Silver nanoparticles and water purification
- Magnetic Resonance imaging (MRI) with magnetic nanoparticles
- Nanoporous solids and nanocatalysis

### Unit-3 Advance Analytical Techniques

(15 hours) (25 Marks)

#### 3.1 Combined Application of spectroscopy (10 hours)

Fourier Transform Infra Red (FTIR), Nuclear Magnetic Resonance (NMR) ( $^1\text{H}$ NMR,  $^{13}\text{C}$ NMR), Ultra Violet (UV) and Mass spectroscopy

#### 3.2 Thermal methods (2 hours)

- Differential Scanning Calorimeter (DSC)
- Differential thermal analysis (DTA)
- Thermal Gravimetric Analysis (TGA)

#### 3.3 Chromatography (3 hours)

- HPLC (High Performance Liquid Chromatography)
- HPTLC (High Performance Thin Layer Chromatography)
- LC-MS (Liquid Chromatography Mass Spectrometry)
- GC-MS (Gas Chromatography Mass Spectrometry)

### Unit-4 Central role of chemistry among the sciences

(15 hours) (25 Marks)

#### 4.1 Role of chemistry in Ecology (2hours)

#### 4.2 Role of chemistry in Biology (2hours)

#### 4.3 Role of chemistry in Agriculture (2hours)

- 4.4 Role of chemistry in Geology (**1hour**)
- 4.5 Role of chemistry in Genetics (**1hour**)
- 4.6 Role of chemistry in Physiology (**1hour**)
- 4.7 Role of chemistry in Pharmacology (**2hours**)
- 4.8 Role of chemistry in Medical science (**1hour**)
- 4.9 Role of chemistry in Archeology (**1hour**)
- 4.10 Role of chemistry in Physics and Electronics (**2hours**)

## References

1. Green Chemistry- Theory and Practice, Paul T. Anastas and John C. Warner ,Oxford University Press (2000)
2. New Trends in Green Chemistry, V.K.Ahluwalia, M.Kidwai, Anamaya Publishers, Second edition (2007)
3. Nanostructures and Nanomaterials: Synthesis, Properties, and Applications ,Guozhong Cao, Ying Wang, World Scientific (2011)
4. Nanomaterials and Nanostructures, Laura Costlow, April Feter, Dominant Publishers (2007)
5. High Performance liquid chromatography : Principles and Methods, Elena D. Katz, John Wiley & Sons Ltd.( 2009)
6. GC/MS, A Practical User Guide : Marvin McMaster & Christopher McMaster, Wiley – VCH (1998)
7. Introduction Raman Spectroscopy (2<sup>nd</sup> Edition) John R. Ferraro, Kazuo Nakamoto & Chris W. Brown (Academic Press, Elsevier, 2005)
8. Chemistry for changing Times, John W.Hill, Doris K.Kolb, Prentice Hall Inc.(1998)
9. Vogel's Textbook of Quantitative chemical Analysis, G.H.Jeffery, J Bassett, J Mendham and R C Denney, LongmanScientific and Technical Ltd.
10. Quantitative Chemical Analysis, Daniel C. Harris, W.H. Freeman and Company, New York (2003)
11. Experimental Organic Chemistry, John C. Gilbert, Stephen F. Martin, Harcourt College Publishers (1998)