Dr. AMBEDKAR GOVERNMENT ARTS COLLEGE (AUTONOMOUS)
CHENNAI – 600039.

DEPARTMENT OF CHEMISTRY

Date : 12. 06. 2019, Wednesday **Time** :02.00 p.m.

AGENDA – M.Phil. CHEMISTRY

- To discuss the course content of the existing syllabus
- To suggest suitable modifications and
- To consider and approve the modified syllabus

C. Srinivasan
Chairman 12/6/19

University Nominee	- Mr.A.Gopalakrishnan	-
Subject Expert 1	- Dr.V.Sivamurugan	-
Subject Expert 2	- Dr.S.Balasubramanian	- 12.6.19
Industrial Nominee	- Mr.G.Chandrasekar	-
Alumni	- Mr.R.Giridharan	-
Dept Staff Members	- Dr.R.Ravichandran	-
	- Dr.R.Karthikeyan	- 12/6/19
	- Dr.S.Manivannan	- 12/6/19
	- Mr.K.Chandrasekaran	- 12/6/19
	- Mrs.T.Gayathri	- 12/6
	- Dr.P.Krishnamurthy	- 12/6/19
	- Mrs.S.Ananthi	- 12/6/19
	- Dr.T.K.Arumugam	- 12/6/19
	- Mrs.RevathySelvaraj	- 12/6/19
	- Dr.G.Ramesh	- 12/06/19
	- Dr.G.Ramachandran	- 12/6/19
	- Dr.S.Shanmugasundari	- 12/6/19
	- Dr.S.Vidya	- 12/6/19
	- Dr.L.Lakshmi	- 12/06/2019

Dr. AMBEDKAR GOVERNMENT ARTS COLLEGE (AUTONOMOUS)
CHENNAI – 600039.

DEPARTMENT OF CHEMISTRY

Minutes of the Meeting of Board of Studies in M.Phil. CHEMISTRY

Date : 12. 06. 2019, Wednesday **Time** :02.00 p.m.

- The Curriculum was revised based guidelines laid down by Tamilnadu State Council for Higher Education (TANSCHE)

- The members of the Board discussed the course content in details and incorporated necessary changes.

The following resolutions were adopted in the meeting

RESOLVED that the draft syllabi proposed for M.Phil. Chemistry by the Department of Chemistry awere discussed and approved and decided to implement the same for the students admitted from the academic year 2019-2020.

- Paper I Research Methodology
- Paper II Physical Methods in Chemistry
- Paper III optional papers offered
  1. Advanced Coordination Chemistry,
  2. Chemical kinetics, Catalysis and Photochemistry
  3. Electrochemistry and Corrosion
  4. Polymer Chemistry
  5. Organic synthetic Methodology and Conformational Analysis
  6. Environmental Chemistry

Recent topics were introduced and syllabus modified in all the above papers..

C. Srinivasa 12/6/19
CHAIRMAN

Dr. AMBEDKAR GOVERNMENT ARTS COLLEGE (AUTONOMOUS)
CHENNAI – 600039.

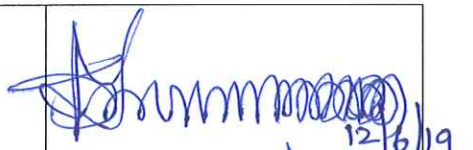
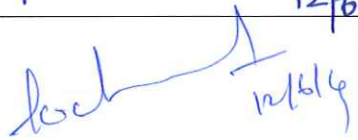
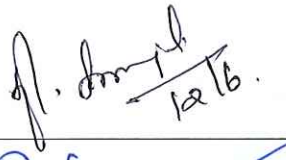
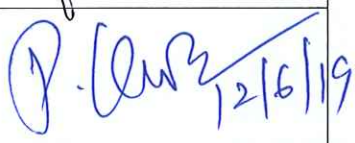
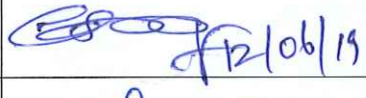
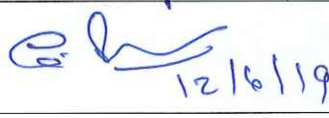
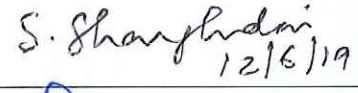
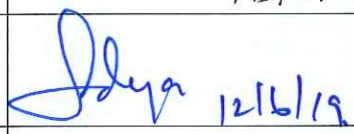
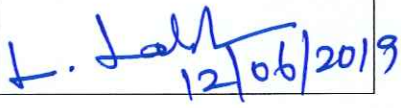
DEPARTMENT OF CHEMISTRY

Minutes of the Meeting of Board of Studies in M.Phil. CHEMISTRY

Date : 12. 06.2019, Wednesday **Time** : 02.00 p.m.

MEMBERS PRESENT

S.No	NAME	DESIGNATION	MEMBERSHIP	SIGNATURE
1	**Dr.C.Srinivasan**	Assistant Professor of Chemistry and Head i/c	CHAIRMAN	C. Srinivasan 12/6/19
2	**Mr.A.Gopalakrishnan**	Assistant Professor of Chemistry, D.G Vaishnav College, Arumbakkam, Chennai-106.	UNIVERSITY NOMINEE	
3	**Dr.V.Sivamurugan**	Assistant Professor of Chemistry Pachaiappa's College, Chennai-600 030	SUBJECT EXPERT -1	
4	**Dr.S.Balasubramanian**	Assistant Professor of Chemistry Presidency College,Chennai-600 005	SUBJECT EXPERT -2	12/6/19
5	**Mr.G.Chandrasekar**	General Manager, R & D / QA Raj Petro Specialties PvtLimited Manali,Chennai.	INDUSTRY NOMINEE	
6	**Mr.R.Giridharan**	B.Sc. Chemistry (2009-2012 Batch) .	ALUMNI	—
FACULTY MEMBERS OF THE CHEMISTRY DEPARTMENT				
7	**Dr. R. Ravichandran**	Assistant Professor	MEMBER	
8	**Dr. R. Karthikeyan**	Assistant Professor	MEMBER	12/6/19

9	**Dr.S.Manivannan**	Assistant Professor	MEMBER	
10	**Mr.K.Chandrasekaran**	Assistant Professor	MEMBER	
11	**Mrs.T.Gayathri**	Assistant Professor	MEMBER	
12	**Dr.P.Krishnamoorthy**	Assistant Professor	MEMBER	
13	**Mrs.S.Ananthi**	Assistant Professor	MEMBER	
14	**Dr.T.K.Arumugam**	Assistant Professor	MEMBER	
15	**Mrs.RevathySelvaraj**	Assistant Professor	MEMBER	
16	**Dr.G.Ramesh**	Assistant Professor	MEMBER	
17	**Dr.G.Ramachandran**	Assistant Professor	MEMBER	
18	**Dr.S.Shanmugasundari**	Assistant Professor	MEMBER	
19	**Dr.S.Vidya**	Assistant Professor	MEMBER	
20	**Dr.L.Lakshmi**	Assistant Professor	MEMBER	

DR.AMBEDKAR GOVERNMENT ARTS COLLEGE

(AUTONOMOUS)

VYASARPADI, CHENNAI – 600 039.

Accredited by NAAC at level B

Syllabus for M.Phil., Chemistry

Under CBCS

(Under Semester system with credits)

Effective from the academic year 2019-2020

POST GRADUATE AND RESEARCH DEPARTMENT OF CHEMISTRY

DR. AMBEDKAR GOVT. ARTS COLLEGE
(Autonomous)

POST GRADUATE & RESEARCH DEPARTMENT OF CHEMISTRY

M.Phil. – CHEMISTRY
(Effective from the Academic year 2019-2020)

1.OBJECTIVE OF THE PROGRAMME

It is a pre-research degree in Chemistry for Post Graduate in Chemistry or any other equivalent programme recognized by University of Madras. The aim of the course is to explore the various research areas in Chemistry.

2. ELIGIBILITY

The minimum marks for admission to Full-Time M.Phil Degree course shall be 50% for the candidates who have qualified for the Master's Degree in Chemistry or any other equivalent programme recognized by University of Madras, prior to 01-01-1991 and 55% for the candidates who have qualified for the Master's degree on or after 01-01-1991. There is no provision for rounding off of 54.5% and above marks to 55%. For candidates belong to SC/ST Community and Disabled(Physically and Visually challenged) candidates, who have qualified for a Master's Degree on or after 01-01- 1991, a concession of 5% of marks will be given in the minimum eligibility marks prescribed.

The conditions for admission prescribed under regulations in respect of M.Phil. Degree course should be strictly followed. All candidates should have passed two year P.G. Degree course after three year Degree course and Higher Secondary of 12 years duration or Pre-University under 11 year S.S.L.C +1 year or 10+2 Pattern. Candidates who have passed the P.G. Degree Examination with less than 17 years of total duration of the course are not eligible for admission to M.Phil degree course.

Eligibility certificate should be obtained from the Registrar of University of Madras, before giving admission to the candidates who have passed their qualifying examination from other Boards/Universities.

The selection of the candidates to the M.Phil degree in Chemistry is as per the reservation of Government of Tamil Nadu.

2.1 FULL-TIME M.PHIL COURSE:

The admission may be made on the basis of the marks obtained by the candidates in qualifying examination and marks scored in the Entrance Test. The Entrance Test may be conducted on the following lines:-

- The Entrance Test must be conducted for a maximum of 100 marks in respect of Full-time M.Phil candidates only. No Entrance Examination need to be held for Part-Time M.Phil.
- The Entrance Test should be held after the publication of P.G. results.
- The Entrance Test will be for 50 marks and the remaining marks will be for the qualifying examination in the subject concerned.
- In the case of candidates of University of Madras including those from autonomous colleges of this University both Internal and External marks have to be taken into account.

- In the case of candidates who have obtained their P.G. Degree from other Universities, the marks secured by them in the External Examination plus Entrance Test marks have to be taken into consideration to arrive the merit list.
- The Entrance Test has to be conducted by the Department of Chemistry.
- The Department concerned may design the question paper for the Entrance Test. The question paper has to be set and valued by the concerned department only.

2.2PART-TIME M.PHIL COURSE:

(i)Teacher candidates working in affiliated colleges and whose qualifications/appointments are approved by the University.

(ii)Teacher candidates working in the University Departments.

(iii)Teacher candidates working in Polytechnic approved by the Director of Technical Education or in Higher Secondary School and High Schools approved by the State Board or Central Board of Secondary Education or Education Instructors of I.A.F.(within University of Madras area) who possess Master's Degree.

Preference should be given to teachers working in the Colleges affiliated to this University and in the Departments of this University. Then teachers working in Polytechnics approved by the Directorate of Technical Education and in approved Higher Secondary Schools as well as High schools under State Board or Central Board and Education Instructors of I.A.F.(within University of Madras area) may be considered on merit basis, subject to reservation rules of the Government of Tamil Nadu.

It may be noted that only teachers whose appointment has been approved by the competent Authority should be selected.

Category of Candidates	**Competent Authority**
i) College Teachers:	University of Madras
ii)Teachers working in Polytechnics :	Director of Technical Edn
iii)Teachers working in Hr.Sec./High Schools :	D.E.O./Inspector of Matriculation Schools/Inspector of Anglo Indian Schools/ Secretary, CBSE etc.

The teacher candidates working at a reasonable distance (i.e.) the distance between the place of employment and the College where M.Phil, is conducted should be such that the candidates can travel every day and attend classes regularly on working days after finishing their teaching assignment may be selected.

While selecting the Part-time candidates, the following should also be verified:-

- The applications of the candidates should have been routed through the proper channel.
- The appointment of the candidates should have been approved by the Competent Authority.
- The candidates should have enclosed the Service Certificate along with the application form.
- The candidates should have enclosed the Certificate from the D.T.E./D.E.O that the Polytechnic/Higher Secondary /High School where the teachers are employed is recognized by the Government.

3.DURATION

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

The duration of M.Phil - Part-Time programme shall extend over a period of two academic years. Maximum period for completion (including extension period) of the M.Phil programme is two years in the case of Full-time candidates and three years in the case of Part-time candidates.

4. 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.

5. SCHEME OF EXAMINATIONS

Courses	Credits	Hours of Examination	Marks		
			CIA	EE	TOTAL
Semester I					
PAPER I - RESEARCH METHODOLOGY IN CHEMISTRY	6	3 Hours	40	60	100
PAPER-II PHYSICAL METHODS IN CHEMISTRY	6	3 Hours	40	60	100
PAPER III - SPECIAL PAPER	6	3 Hours	40	60	100
Semester II					
Dissertation and Viva-Voce	18	-	50	150 (Viva Voce)	200

Total of 36 credits

6. PASSING MINIMUM

A Candidate shall be declared to have passed if he/she secures not less than 50% of the marks in each course.

7.RESTRICTION IN NUMBER OF CHANCES

As per the University norms.

8.CONFERMENT OF DEGREE:

No Candidate shall be Eligible for conferment of the M.Phil Degree unless he/she is declared to have passed all the courses of the Examination as per the Regulations.

Classification of Successful Candidates

Successful candidates are classified as follows	Letter Grade	Class
75-100	O	Outstanding
65-74	A+	First
60-64	A	First
55-59	B+	Second
50-54	B	Second
0-49	F	Reappear

9.Eligibility for research supervisors conducting the M.Phil Programme:

As per the regulations of University of Madras.

10.NUMBER OF CANDIDATES UNDER A SUPERVISOR

A maximum of **FIVE** candidates be permitted to register under one supervisor at any point of time in addition to the permitted **EIGHT Ph.D.** candidates

11. ATTENDANCE

a) Candidate admitted to M.Phil. Full-time programme shall secure 75% attendance during the entire course, including short-term training programme, workshop, seminar, conference, etc. attended by them outside the College on the recommendation of the guide and with prior permission of the Head of the Department. The attendance may be calculated year-wise.

b) The Principal of affiliated college shall have the power to condone 10% of shortage of attendance and the condonation may be granted on the merit of the case. It cannot be claimed as a matter of right.

c) The Part-time candidates shall report to the guide at least thirty days in each year. This period may include holidays also.

d) Attendance for M.Phil part-time candidates shall be maintained by the respective guides and submitted to the HOD once in six months.

e) The Part- time candidates shall take part in Departmental Seminars at least twice in a year.

f) If there is a shortage in attendance, due to availing of leave on medical grounds, the candidate's minimum period of research shall be extended accordingly, within the prescribed maximum period.

12. SCHEME OF EXAMINATION

A) PART I – WRITTEN EXAMINATION

i) The candidates are required to appear for the written examination under Part-I of the programme, at the end of six months after joining the course in the case of Full-time candidates and at the end of one year after registration, in the case of Part-time candidates.

ii)The written examinations will normally be conducted twice in a calendar year in the months of March/April or October/November.

iii)The duration and the maximum marks for each written paper are 3 hours and 100 marks respectively.

The Examination for specialization course will be conducted by the controller of examination along with courses I and II. Two different sets of question papers should be sent to the controller of examinations for specialization course by the respective research supervisors and one question paper will be selected from the Controller office.

The question paper pattern for M.Phil. Part I - Written Examination

For each Course other than the Dissertation

Continuous Internal Assessment – 40 Marks
End Semester Examination – 60 Marks
Total – 100 Marks

Question Paper pattern for Course I to III

Part-A 5 Questions out of 6 = 5 X 4 = 20 marks
Part-B 4 Questions out of 6 = 4 X 10 = 40 marks (at least one question from each unit)
Total = 60 Marks

CIA components

Tests (2x10) - 20 Marks
Model Paper - 10 Marks Seminar - 10 Marks

B) PART II - DISSERTATION

The candidates shall be permitted to submit their dissertation only after successful completion of Part-I examinations. The candidates shall be required to submit four copies of the dissertation, under Part-II after 12 months from the month of admission in the case of Full-time candidates and 24 months from the month of admission in the case of Part-time candidates. However, in exceptional cases, extension of time for submission of M.Phil dissertation will be granted up to a maximum period of one year, on payment of the fees prescribed from time to time.

The supervisor should submit a panel of four examiners along with the dissertation for the evaluation of dissertation and to conduct the viva voce. The respective supervisors shall be an internal examiner. The viva board should consist of the research supervisor, head of the department and external examiner.

The Examiners who value the Dissertation shall report on the merit of Candidates as "Highly Commended"(75% and Above) or "Commended" (50% and Above and Below 75%) or "Not Commended" (Below 50%).

In case, the dissertation is assessed as "Not Commended", or recommended by the examiner for "revision and re-submission", the candidate will be permitted to resubmit his / her dissertation on a second occasion within a period of six months from the date of announcement of the result.

No candidate will normally be permitted to resubmit the dissertation on more than one occasion. Submission or re-submission of the dissertation will be allowed twice a year.

A candidate shall be declared to have qualified for M.Phil degree if he / she pass both Part I and Part II of the programme.

All the requirements for the award of M.Phil degree shall be completed within a total period of two years from the date of admission in the case of Full-time programme and within a period of three years from the date of admission, in the case of Part-time programme.

For Dissertation the components are

Continuous Internal Assessment – 40 Marks
Paper Presentation – 20

Viva Voce – 40
Dissertation – 100

Total – 200 Marks

CIA components for Dissertation

Two reviews must be conducted in the department 2 x 20 = 40, before the submission of the dissertation.

FORMAT OF THE DISSERTATION

The dissertation should be of the following format:

1. Front Wrapper Cover Page
   Title, Name of the Candidate (Enrolment No.), Name of the Guide, College Name (with emblem) and Place, Month and Year of submission.
2. Title Page
   (As in Sl. No. 1 just above)
3. Declaration of the Student Refer Annexure
4. Certificate of the Guide Refer Annexure
5. Acknowledgements
   The candidate may thank all those who helped in the preparation of dissertation.
6. Table of Contents In standard format.
7. List of Tables-Tables, if any, with Table No., Title of the Table and Page No. be given table-wise. The source of table be given at the bottom. (Refer the specimen).

8. List of Figures-Similar to List of tables.
9. Main Body of the Dissertation
   The main body of the dissertation may be divided into 4 to 5 Chapters with suitable title for each Chapter. The last chapter shall be invariably conclusion.The total number of pages of the Dissertation may be between 100 and 150 pages.
10. Reference Section - After all Chapters are presented, Appendices are included.
    Appendix I: Copy of the Questionnaire or Schedule
    (Give full copy of the Questionnaire or Schedule)
    Appendix II: Bibliography (Give full list of Books, Reports, Journals and Newspapers Referred in alphabetical order of authors under respective headings)

TYPING AND BINDING

1.The dissertation material should be neatly computerized in ***double space, on one side*** and in ***A4 size Bond Paper*** only. Times New Roman 14 or Arial 12 font be used.

2.The dissertation must be ***Card-board Bound*** with Laminated Wrapper Sheet. (Spiral binding and other forms of binding will not be accepted).

3.The dissertation in ***Four Copies*** must be prepared. One to the COE Office, One to the College Library, one for the Guide and one for the Candidate.

4.***Two Copies*** of dissertation duly forwarded by the Guide must be submitted for the viva voce examination.

DECLARATION

I ……..hereby declare that the dissertation, entitled "…….……." submitted to the Dr. Ambedkar Government College, under University of Madras, in partial fulfillment of the requirements for the award of the Degree of Master of Philosophy in Chemistry is a record of original research work done by me during…….…….under the supervision and guidance of Dr/Mr.…… …….…….…….
Department of **Chemistry** and it has not formed the basis for the award of any Degree / Diploma /Associate ship / Fellowship or other similar title to any candidate in any University.

Signature of the Candidate **Countersigned**
(Research Supervisor)

CERTIFICATE

This is to certify that the dissertation, entitled "…… ……..……..……" submitted to Dr. Ambedkar Government College, under University of Madras, in partial fulfillment of the requirements for the award of the Degree of Master of Philosophy in **Chemistry** is a record of original research work done by Mr./Ms…….. during the period ……..of his /her study in the Department of **Chemistry** at Dr. Ambedkar Government College, under my supervision and guidance and the dissertation has not formed the basis for the award of any Degree / Diploma / Associate ship / Fellowship or other similar title to any candidate of any University.

Signature of the Guide **Countersigned**
Head of the Department

LIST OF TABLES

Title of the Table	**Page No.**

Note: In the table numbers given, the first one indicates the Chapter number and the second number following the dot refers the number of the table in that Chapter. Similar approach has to be followed for List of Figures also.

Objectives of the Course

Chemistry is a part of a larger body of knowledge called Science. Although Chemistry is concerned with only a part of the scientific knowledge that has been accumulated, it is in itself an enormous and broad field. Chemistry touches all parts of our lives. The scope of chemistry is extremely broad and it touches every aspect of our lives. The principles of chemistry are fundamental to an understanding of all processes of the living state. The major objectives of M.Phil. Chemistry course are:

* To impart knowledge in advanced aspects of all branches of chemistry
* To acquire deep knowledge in the survey of literature.
* To acquire specific knowledge in the specialized research area of chemistry.
* To train the students in various analytical techniques.

Part - I Paper – I

Subject Code:

RESEARCH METHODDOLOGY IN CHEMISTRY

UNIT-1: Meaning of Research

The search for knowledge- purpose of research,scientific method,role of theory, characteristics of research. Types of research- fundamental or pure research, applied research, action research, historical research, experimental research.

UNIT-2: Chemical Literature

Sources of chemical information- primary, secondary and tertiary sources.

Indexes and abstracts, chemical titles, current chemical reaction , current contents and science citation index. Classical and comprehensive reference works in chemistry-Beilstein,compilations of data,synthetic methods and techniques, treatises,reviews.

Current awareness searching-CA weekly issues, CA issue indexes. Retrospective searching- CA volume indexes-general subject index, chemical substance index, formula index, index of systems, author index,patent index. CA collective indexes-collective index(CI), decennial index(DI). Access points for searching CA indexes-index guide, general subject terms, chemical substance name, molecular formulas, ring systems, Author names, patent numbers. Locating the reference – finding the abstract, finding the original document, chemical abstract service source index.

UNIT-3: Scientific Writing

Scientific writings – Research reports, theses, journal, articles and books.

Steps to publishing a scientific article in a journal – types of publications, communication, articles, reviews; when to publish, where to publish, specific formet required for submission, organization of the meterial. Documenting – abstracts – indicative or descriptive abstract, informative abstract, foot notes, end notes, referencing styles, bibliography – journal abbreviations(CASSI),abbreviations used in scientific writing.

UNIT-4: Computer Searches of Literature

ASAP Alerts, CA Alerts, SciFinder, Chemfort, ScienceDirect, STN International and Journal home pages.

UNIT-5: Data Analysis

Precision and accuracy – Reliability – Determinate and Indeterminate errors, Distribution of random errors – Normal distribution cure – statistical treatment of finite samples – T test and F test, Criteria for rejection of an observation – Q test – Significant figures and computation rules – Data plotting – Least square analysis - significance of correlation co-efficient.

Reference books

1. R.L.Dominoswki, Research Mothods, Prentice Hall, 1981.
2. J.W. Best , Research in Education , 4th edition. Prentice Hall of India, New Delhi, 1981.
3. H .F. Ebel, C.Bliefert and W.E. Russey, The Arts of Scientific Writing, VC.Weinheim
4. The art of Scientific Writing – H.F. Ebel, C. Bliefert and W.E. Russcy , WILEY-VCH Verlas Gmbh & Co, K G a A.Wecnhcim 2nd Edn(2004)
5. R. Berry, “How to Write a Research Paper”, Pergamon, 1969

6. Ralph Berry , "The Research Project: How to Write It", Fourth Edition Routledge (UK), 2000
7. W.G. Campbell, "Form and Style in thesis writing", Boston M.A;Houghton Mifflin Co., 1970.
8. J.Anderson, "Thesis and Assignment Writing", Wilely, 1970

QUESTION PAPER PATTERN

PART A	5 Questions out of 6 = 5 X 4 = 20 marks (at least one question from each unit)
PART B	4 Questions out of 6 = 4 X 10 = 40 marks (at least one question from each unit)
TOTAL	60 MARKS

Part - I Paper – II

Subject Code:

PHYSICAL METHODS IN CHEMISTRY

UNIT I

UV -Visible Spectroscopy:

Electronic excitation – origin of different bands – intensity of bands – selection rules - laws of photometry – correlation of electronic absorption with Molecularstructure–chromophoricgroups – conjugated systems – systems of extended conjugation– aromatic systems – empirical rules – experimental methods – photometric titrations.

IR - Spectroscopy: Molecular vibrations – selection rules – force constant - band assignments – applications – organic structures – finger printing – identification or common functional groups – applications.

UNIT II

^{1}H and ^{13}C NMR Spectroscopy:

Proton chemical shifts – aromatic ring systems – anisotropic effects – ^{13}Carbon chemical shifts – mechanisms of spin-spin coupling – vicinal, germinal and long range proton – proton coupling.

Analysis of NMR Spectra: The energy level diagram – the selection rule – AB, ABC, AB and ABX spectrum. Pulse fourier transform techniques. Accumulation of spectra by the pulsed NMR technique – nuclear relaxation – fourier transformation - the pulsed FT NMR spectrometer.

UNIT III

Double resonance technique and relaxation mechanisms: Homonuclear decoupling – heteronuclear decoupling – proton decoupling technique. In ^{13}Cspectrum – INDOR and nuclear overhauser effect (NOE) – 13C relaxation mechanisms – measurement of 13C- relaxation times- Spin- lattice relaxation (T_1) and pin – spin relation (T_2) measurements –assignment ^{13}C technique in ^{13}C spectra – 2D-NMR –COSY, HETCOR, NOESY, ROESY-DEPT. 13C. SPECTRA-INADEQUATE, spectrachemical shift correlation –quantitative measurement in ^{13}C – NMR – relaxation reagents – intensity standards.

UNIT IV

EPR and Mossbauer Spectroscopy:

EPR – Principle, Instrumentation – hyperfine splitting – identification of free radicals and salicylidimine copper(II) compounds. Factors affecting the magnitudes of g and A tensors in metal species – zero field splitting and kramers degeneracy – spectra of V(II), Mn(II), Fe(II), Co(II), Ni(II) and Cu(II) complexes - Application of EPR to a few biological molecules containing Cu(II), Fe(II) and Fe(III) ions – densities and McConnel relationship – application of EPR to some simple system such as CH_3 and p-benzoquinone .

Mossbauer spectroscopy – Mossbauer effect - Isomer effect – Magnetic interactions – Quadrupole splitting – Application to Iron and Tin complexes.

UNIT V Mass Spectrometry:

Theory – instrumentation – various types of mass spectrometers – magnetic focusing instruments – sample handling – production and reactions of gaseous ions – isotopic abundance – determination of molecular weights and formulae – metastable peaks – nitrogen rule – ion fragmentation mechanisms – rearrangements – use of mass spectrometry in the structural elucidation of organic compounds – mass spectra of compounds containing different functional groups.

REFERENCES:

1. Proton and Carbon -13 NMR Spectroscopy – An Integrated Approach – R.J.Abraham and Loftus.
2. Spectroscopy of organic compounds, P.S.Kalsi, new age international publisher (2002)
3. Spectroscopic Identification of Organic Compounds – R.M.Silverstein, G.C.Bassler and Morril.
4. Physical Methods in Inorganic Chemistry – R.S.Drago.
5. Physical Methods in Organic Chemistry – Scharz.
6. Applications of NMR Spectroscopy in Organic Chemistry – Jockmann and Strenhell.
7. Applications of absorption spectroscopy of organic compounds – J.Dyer.
8. Interpretation of Mass Spectra – Mclafferty.
9. Interpretation of Mass Spectra of Organic Compounds – Budcikowiex, Djerassi and Williams.
10. NMR of Organic Chemists – Mathioson
11. Interpretation of NMR Spectroscopy –R.H.Bible.
12. High Resolution NMR - Becker.
13. Interpretation of Mass Spectra of Organic Compounds – Hamming and Foster.
14. Interpretation of 13C NMR - F.W.Wehrli, T.Wirthlin and Heydon.
15. Fundamentals of Analytical Chemistry- A.Skog and M.West
16. Instrumental methods of Chemical Analysis – B.K.Sharma
17. Fundamentals of Molecular Spectroscopy – C.N.Banwell
18. Atomic Structure and Chemical Bonding including Molecular Spectroscopy-Manas Chanda

QUESTION PAPER PATTERN

PART A	5 Questions out of 6 = 5 X 4 = 20 marks (at least one question from each unit)
PART B	4 Questions out of 6 = 4 X 10 = 40 marks (at least one question from each unit)
TOTAL	60 MARKS

Part - I Paper – III (Special Paper)

Subject Code:

ADVANCED COORDINATION CHEMISTRY

Unit I: Synthesis of Novel Coordination Compound

Design ad Synthesis of macrocyclic Ligands - Synthetic Procedures - Direct Macrocyclic synthesis, Microwave assisted synthesis - Metal ion template synthesis – Macrocyclic systems Macrocycles with pendant functional group - Catenands, Cage macrocycles, Cryptands and Crown Polyethers - Binucleating macrocycles – Compartmental Ligands. Natural macrocycles - Host-guest chemistry- macrocyclic host and non metallic guests – Analtical techniques to determine the nature of the complexes. Elemental - analysis, Estimation of metal ions, Conductivity and magnetic measurements.

Unit-II Theories of Coordination Compounds and Mechanisms

Crystal Field , Ligand Field, Molecular Orbital Theories and Angular Overlap – Model Mechanism of Electron Transfer Reactions – Innersphere and Outer sphere electron - transfer mechanisms - Substitution reaction in square planar complexes, trans effect - Oxidative addition and insertion reactions.

Unit-III Determination of Electronic Structure and Geometry of Coordination Compounds-I

Electronic spectroscopy: Electronic states and spectra of Td and Oh complexes, charge transfer spectra LMCT, MLCT, crystal field spectra. Evaluation of values in Co(III) Oh and Ni(II) Oh complexes Dq xy and Dq z in tetragonally distorted cobalt(II) octahedral complexes. Infrared and Raman spectroscopy: Structural diagnosis: IR spectral assignment of coordinated ligands in metal complexes and differentiation of isomers (CN/NC, OCN/NCO, SCN/NCS, CNO/ONC, NO2/ONO NMR Spectroscopy - Application of spin-spin coupling to structure determination. NMR of paramagnetic trans metal ion complexes , scalar shift and covalency. Lanthanide shift reagents. ESR anisotropy in the g-value, hyperfine and zerofield effect on the spectrum, Survey of the EPR spectrum of first row transition metals. Mossbauer : Quadrupole and magnetic interactions, Mossbauer emission spectroscopy and applications.

Unit-IV Determination of Electronic Structure and Geometry of Coordination Compounds-II

Magnetic Behaviour of Coordination Compounds. Methods of determiningmagnetic susceptibility, and electron states - Electrochemical methods of studying coordination compounds. Electrochemical and electrochemical reversibility. Pulse polarography, AC Polarography, Cyclic voltammetry. Electrochemical synthesis of complexes. Coupled chemical reactions – EC, CE and ECE mechanisms. Photoelectron spectroscopy and X-PES - Study of chiral coordination compounds by ORD and CD - Mass Spectroscopy - CIMS, EIMS and FAB-MS.

Unit-V: Catalysis of Organometallic compounds and Bio-inorganics

Ziegler – Natta polymerization, cyclooligomerization , olefin isomerization, metathesis and polymer bound catalysis. The oxygen carriers- hemoglobin and myoglobin and synthetic oxygen carriers. Electron transfer agents – Cytochromes, iron-sulphur proteins. Mechanism of electron transfer reactions. Nitrogen Fixation. Essential and trace elements in biological systems. Chelate therapy. Applications.

References

1. Lindoy.L.F, 1989, The Chemistry of Macrocyclic Ligand Complexes, Cambridge University Press, N.Y.
2. Huheey J.E., 1988, Inorganic Chemistry, 4th Edition . Harper and Row, NY
3. Cotton.F.A and Wilkinson, G 2001Advanced Inorganic Chemistry, 6th Ed., Wilrey Interscience, NY,
4. Purcell.K.F and Kotz. J.C. 1976, Inorganic Chemistry, Saunders.
5. Lever.A.B.P, 1984, Inorganic Electronic Spctroscopy, 2nd Ed., Elsevier Publishing Company, Amsterdam
6. Nakamoto. K, 1986, Infrared and Raman Spectra of Inorganic and Coordination

Compounds, 4th Ed., Eiley Interscience
7. Basolo F and Pearson .R.G, 1967, Mechanism of Inorganic reactions, 2nd Ed., Wiley Eastern. New Delhi.
8. Kissinger.P.T, and Heineman.W.B, 1984, Laboratory Techniques in Electroanalytical Chemistry, Editors, Marcel Dekker, Inc., New York
9. Drago R.S., 1977, Physical Methods in Chemistry, Saunders, Amsterdam.
10. J. Chem. Educn., 1983, 60, 252-308.
11. J. Chem. Educn., 1983, 60, 687-706.
12. Eichhorn G.L., Ed., 1976, Inorganic Biochemistry, Elsevier, Amsterdam.

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TOTAL	60 MARKS

Part - I Paper – III (Special Paper)

Subject Code:

PHYSICAL CHEMISTRY

UNIT I

Theories of Reaction Rates:

Absolute reaction rate theory – thermodynamic treatment of ARRT – Significance of reaction co-ordinate – application of ARRT to simple unimolecular and bimolecular process – potential energy surfaces – partition functions and activated complexes. Eyring equation – estimation of free energy enthalpy and entropy of activation and their significance – kinetic isotopic effect-steady state approximation applications.

UNIT II

Reaction in solution

Introduction – application of ARRT to solution kinetics – the influence of solvent – the ionization of neutral molecules kinetics of ionization – reaction between ions – reaction between ions & molecules – influence of ionic – strength – primary salt effect – secondary salt effect.

UNIT III

Quantitative structure and Reactivity Relationships

The linear free energy principle – (LFER) linear relationship involving difference reaction – the cettler correlation. The Hammett equation – steric effects – resonance interaction – normal substitutent constants - □□-, □+ constants – inadequancy of dual hypothesis – regularities in the through resonance effect- the Yukawa Tsuno equation – systematic deviation- steric inhabitation of resonance – Taft equation – correlation of aliphatic and aromatic relativities.

UNIT IV

Photochemistry

LAWS OF PHOTO CHEMISTRY- quantum efficiency and its experimental determination – deviation and reasons- excited states and ground state, singlet and triplet states – forbidden transmissions (spin forbidden and symmetry forbidden transition) types of excitation properties of excited states – photolytic cleavage – the fate of excited molecules – physical process – Jablonski – diagram chemical processes – various types. chemiluminescence, bioluminescence, lasers, practical lasers – uses of lasers.

UNIT V

ADSORPTION AND CATALYSIS

5.1 Adsorption

Physisorption and Chemisorption-Freundlich adsorption isotherm-Langmuir adsoption isotherm –BET equation (nonderivation)-Applications of adsorption.

5.2 Types of catalysis

Factors affecting catalytic reactions-Heterogeneous and homogeneous catalysis-Acid-base catalysis – Hammet's acidity function Bronsted relationship – enzyme catalysis – mechanism of single substrate reactions – Michalis -Menten law- influence of pH and temperature.

Recommended Text Books

1. K.J. Laidler chemical kinetics, 2nd Ed. Tata Mc.Graw Hill 1975 (Unit I, II, IV).
2. W.J. Moore, Physical chemistry 5th Ed. Orient Longman 1982 (Unit I & II).
3. S. Glasstone, Text Book of Physical chemistry Mc Millan (Unit I & II).
4. Harish & Gurdeep. Advanced Physical chemistry, Goel publishing Home, Meerut (Unit I, II & IV)
5. K.K. Rastoghi & Mukherjee, Fundamentals of Photo Chemistry, Wiley Eastern (1978) (Unit IV).
6. Catalysis- Rajaram and Kuriacose.

References

1. S.W. Benson, "The Foundation of Chemical Kinetics" Mc. Graw Hill, 1960.
2. C.M. Banford and E.F.M. Toiper comprehensive chemical kinetic Vol. I & I Elsevier,

1969.
3. Amdur and Hammes Chemical Kinetics – Mc. Graw Hill.
4. N.H. Turro, Molecular Photochemistry, W.A. Benjamin Reading 1965.

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TOTAL	60 MARKS

Part - I Paper – III (Special Paper)

Subject Code:

ELECTROCHEMISTRY AND CORROSION

UNIT I

Introduction and Principles

Definition – cost of corrosion – importance of corrosion studies – classification of corrosion – expressions for corrosion rate. electrochemical principles of corrosion: Faraday's laws – types of electro chemical cells formed in corrosion process.

Thermodynamic principles of corrosion: electrochemical series/ standard electrode potentialsand thermodynamic corrosion theory – Galvanic series of metals and alloys and limitations. Forms of corrosion (Definition – cause and effects) : galvanic – crevice – pitting – intergranular - selective leaching - erosion - stress – hydrogen damage.

UNIT II

Kinetics of Corrosion

Importance – graphical presentation of kinetic data - exchange current density – different types of polarization of electrodes. activation polarization and Tafel plots – mixed potential theory – application of electrode kinetics to experimental observations – faradic impedance and corrosion.

UNIT III

Kinetics of Passivity

Introduction – electrochemical behaviour of active/passive metals – Flade potentials – criteria for selecting a metal exhibiting passivity – effects of various factors on electrochemical behaviour and corrosion rate of metal exhibiting passivity – measured versus theoretical anodic polarization behaviour – theories of passivity.

UNIT IV

Monitoring of Corrosion

Determination of corrosion and corrosion inhibition parameters – non-electrochemical methods: Coupon – electrical resistance – gasometric methods. electrochemical methods: polarisation – galvanostatic – potentiostatic– potentiodynamic – AC impedance – hydrogen permeation.

UNIT V

Corrosion Control

Metals and alloys – metal purification – non metallic – cathodic and anodic protection – comparison. Alteration of environment: changing the medium – use of inhibitors - classification of inhibitors – mechanism of inhibition – coating (Elementary ideas only).

References:

1. An introduction to metallic corrosion and its prevention by Raj Narayan, Oxford and IBH Publishing C., New Delhi (1983).

2. Corrosion and Corrosion control (An introduction to corrosion science and engineering) by Herbert H. Uhlig and R.Winston Review, Third Edition, A Wiley – Interscience Publication. New York (1984).

3. Corrosion engineering by Mars G. Fontana, Third Edition, McGraw Hill Book Company, Singapore (1984).

4. Application of inhibitors for acid media by G. Schmitt, Br.Corros. J., 1984. Vol.19, No.4, P.165-172.

5. Test methods for corrosion inhibitors by A.D. Mercer, Br.Corros J., 1985, Vol.20, No.2, P.61-70.

6. Inhibitors – An old remedy for a new challenge (1991 – Whitney Award Lecture) by G. Trabanelli, Corrosion, June 1991. P.410-418.

1. Bockris.J.O.M. and Reddy A.K.N, 1970, *Modern Electro chemistry* Volume I and II, New

York, Plenum Press.

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PART B	4 Questions out of 6 = 4 X 10 = 40 marks (at least one question from each unit)
TOTAL	60 MARKS

Part - I Paper – III (Special Paper)

Subject Code:

POLYMER CHEMISTRY

UNIT I

Step-reaction polymerization (condensation polymerization)

Chemical reactivity and molecular size, theory of reactivity of large molecules, kinetics of condensation polymerization, self catalyzed polymerization, external catalysis of polymerization, cyclization Vs linear polymerization, multi-chain polymerization and their molecular weight determination. Kinetics of degradation of Condensation polymers – hydrolysis of polyimides, hydrolysis of polyesters-interchange reactions in condensation polymers.

UNIT II

Radical Chain (Addition) Polymerization

Kinetics of chain polymerization – dependence of RP on initiator, monomer and temperature. Photo chemical initiation, thermal initiation, redox initiation, initiator efficiency, auto acceleration, kinetics of thermal polymerization. Kinetic chain length and degree of polymerization. Kinetics of chain transfer, chain transfer with monomer, solvents, Nonradical chain polymerization – cationic polymerization – mechanism and kinetics (General), anionic polymerization – kinetics and mechanism (General).

UNIT III

Co-ordination Polymerization

Definition of Ziegler- Natta catalysts, factors determining behaviour of catalysts, importance of physical state of the catalyst, soluble catalyst, colloidal catalyst, heterogeneous catalyst and supported catalysts. Proposed mechanism – monometallic mechanism, bimetallic mechanism, experimental evidence. Mechanisms for stereochemical control of □- olefins – mode of addition, isotactic propagation, syndiotactic propagation. Industrial uses of co-ordination catalysts.

UNIT IV

Chain Structure and conformation of Polymers

Vibrational spectroscopy and nuclear resonance spectroscopy of polymers – polymethyl methacrylate, polystyrene-propagation statistics. Region regularity and branching in vinyl polymer chains – head-to-tail versus head-to-head; tail-to-tail (special evidence) isomerism – regioregularity – poly vinyl chloride, polyvinyl alcohol - branching in vinyl polymers – polyethylene, polyvinyl chloride - geometrical isomerism in diene polymers – Polybutadiene and polychloroprene (special evidence) solid state NMR of Polymers (General).

UNIT V

Glass Transition of Polymers

Theories of glass transition. The free-volume theory, the SLF equation, kinetic theory of glass transition, Gibbs and Gi Merzio theory, effect of cross-link density, polymerization, molecular weight, co-polymerization, crystallinity - chemical structure, tacticity and pressure on glass – transition temperature.

References

1. F.W. Bill Mayer, Text Book of Polymer Science' Wiley – Inter Science (1971).
2. H.R. Allcock and F.W. Larube, 'Contemporary Polymer Chemistry' Prentice Hall (1981).
3. L.H. Sperling 'Introduction to Physical Polymer Sciences' John Wiley & Sons (1986).
4. George Odian – 'Principles of Polymerization' McGraw Hill Book Company (1970).
5. P.J. Flory – 'Principles of Polymer Chemistry' Cormell Univ. Press (1953).
6. AD Ketley 'The Stereochemistry of Macromolecules' Decker (1967).
7. Zbinder – 'Infrared spectroscopy of High Polymers' Academic Press (1964).
8. K.J. Saunders 'Organic Polymer Chemistry' – Capman Hall: (1973).
9. Randall –'Polymer sequence Determination Carbon – 13 NMR Method' Academic Press (1977).
10. Bovey F.A. 'High Resolution NMR of Macromolecules' Academic Press (1972).

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TOTAL	60 MARKS

Part - I Paper – III (Special Paper)

Subject Code:

ORGANIC SYNTHETIC METHODOLOGY AND CONFORMATIONAL ANALYSIS

UNIT I

Synthons and synthetic equivalents

Synthon approach- electron donor (nuecleophiles)-electron acceptors (electrophiles)- Chiron-umpolung-synthetic equivalents-regioselective and stereoselective alkylation of cyclic ketones, cyclic enones-selective alkylation(mono and di) via enamine reactions.

Functional group interconversions

Modern methods of functional group interconversions involving >C=O, -CHO, -OH, - SH, -COOH, >C=C<, NH_2**,** -COOR, CONHR functions-reversible protection of reactive sites.

UNIT II

Retrosynthetic Analysis of Simple Organic Compounds

Retrosynthetic analysis of mono & difunctional open chain target molecules and monocyclic target molecules.

Selective reactions and Reagents

Olefination of carbonyl compounds-McMurray's methods-reductions with LiAlH4 and NaBH4-Mannich reaction-Strecker synthesis-Wolf-Kishner reduction and Grignard reaction.

UNIT III

Stereochemistry and Conformational Analysis

Stereoselective, stereospecific and regiospecific reactions- stereoselectivity in carbonyl addition-Cram's rule- configuration-conformation-torsional strain-Vander Waals strain-gauche interaction-allylic strain- conformational analysis of acyclic molecules.

UNIT IV

Conformational Analysis of cyclic compounds

Conformational analysis of mono and disubstituted cyclohexanes-stability and reactivity-decalins- use of UV,IR & NMR spectroscopy for the conformational analysis of acylic and cyclic molecules- stereodynamics of fluxional moleculesvariable temperature NMR spectra (eg. N,N-dimethylacetamide)

UNIT V

Problem Solving

Solving the structure of simple organic molecules on the basis of UV,IR, NMR & Mass spectral data

References

1. R.K. Mackie and D.M. Smith, "Guide book to Organic Synthesis", ELB, 1982.
2. Jerry March, "Advanced Organic Chemistry: Reaction and Structure" 5th Ed., Wiley,1996.
3. Silverstein and Webster, "Spectrometric Identification of Organic Compounds",6th Ed., Wiley 1998.
4. W. Kemp, NMR in Chemistry- A Multinuclear Introduction," McMillan, 1986.
5. C.D. Becker, "High Resolution NMR- "Theory and Applications" Academic Press, 2nd Ed., 1980.
6. R.E. Ireland, "Organic Synthesis", Prentice Hall.
7. Eliel, Stereochemistry of carbon compounds.
8. Nasipuri, Stereochemistry of organic compounds.
9. Norman, Principles of Organic Synthesis.
10. Caruthers, Some modern methods of Organic synthesis
11. Waren, Designing Organic Synthesis. A programmed introduction to synthetic approach.

QUESTION PAPER PATTERN

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	(at least one question from each unit)
TOTAL	60 MARKS

Part - I Paper – III (Special Paper)

Subject Code:

ENVIRONMENTAL CHEMISTRY

UNIT I

Chemistry of Water and Waste Water

Basic Principles and their significance with special reference to colour, turbidity alkalinity, acidity, chemical coagulation, hardness, water softening, disingection, residual chlorine and chlorine demand, dissolved oxygen, biochemical oxygen demand, chemical oxygen demand, nitrogen, phosphate, sulphate, gas analysis, enzymes, factors affecting enzymic activity, bio-chemistry of carbohydrates, proteins, fats and oils under aerobic and anaerobic conditions, detergents and their degradation, composition and characteristics of sewage.

UNIT II

Chemistry of air Pollutants:

Introduction, definition, classification of air pollutants, effect of air pollutants on man, materials, animals and plants, ambient air quality standards, harmful concentrations, geographical and meteorological factors in air pollution control, measurement of gas flows, volume, quantity and velocity,

UNIT III

Control of air pollution

Methods of sampling, particulate collection by liquid scrubbing, centrifugal spray scrubbers, venturi scrubbers, foam scrubbers: field sampling techniques such as deposition, absorption, filtration, condensation, absorption, adhesion, electrostatic precipitation, thermal precipitation; analysis of air pollutants such as particulates sulphur dioxide, carbon monoxide, oxides of nitrogen, hydrogen sulphide, etc, control
measures.

Unit IV

Chemistry of Solid Waste:

Chemistry of composting; mechanism involved in the decomposition of organic materials like hemicelluloses, proteins, carbohydrates, food materials, organic insecticides, form wastes, etc., by aerobic and anaerobic processes.

UNIT V

Chemistry of Incineration and Pyrolysis:

Incineration: definition, incineration of solid waste; combustion characteristics of various inorganic and organic materials, heating values – determination of heating values of combustible liquid and solid wastes, air requirements for combustion, fate of trace constituents such as sulphur during incineration; gaseous pollutants; definition of pyrolysis; chemical changes taking place in organic and inorganic materials during pyrolysis; importance of pyrolysis in the solid waste disposal; chemistry of recycling of solid waste; recycling and reuse of materials such as paper, plastic, glass, etc.

References :

1. Sawyer, C.N. and PL. McCarty, ‘Chemistry for Environmental Engineers’, Mc.Graw Hill, 1978.
2. Stumm, W. And J.J. Morgan, ‘Aquatic Chemistry’, Wiley Interscience 1972.
3. American Public Health Association inc., New York, ‘Standard methods for the examination of water and waste water’, 1976.
4. Stern, A.C., ‘Air Pollution’, Vol. 1,2 and 3, Academic Press, New York 1968.
5. Strauss, W.Ed., ‘Air Pollution Control’, Part 1,2 and 3, Wiley Interscience, New York, 1960.
6. Jacobs,M.B., ‘Chemical Analysis of Air Pollutants’, Interscience, New York, 1960.
7. Ross. R.D., ‘Air Pollution and Industry’, V.N. Reinhold Co., New York, 1972.
8. Leithe, W. Translated by R.Kenor, ‘The Analysis of Air Pollutants’, Ann Arbor, 1971.

9. Hagerty, D.J., J.L.Pavoni and J."E.Heer, Jr., 'Solid Waste Management', Van Nostrand Reinhold Co., New York, 1973.
10. Wilsion,D.G.'Hand book of Solid Waste Management', V.R.Nostrand, Reinhold, New

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