

***Minutes of the Boards of  
Studies / Academic  
Council meetings with  
approvals for these  
courses***

***❖ B.C.A.***

***❖ M.Sc. Chemistry***

B.C.A..Part-I,II & III  
(Sem-I to VI)

Prospectus No. 20131221

संत गाडगे बाबा अमरावती विद्यापीठ  
SANT GADGE BABA AMRAVATI UNIVERSITY

विज्ञान विद्याशाखा  
(FACULTY OF SCIENCE)

PROSPECTUS  
OF  
B.C.A.PART-I, II & III (SEMESTER-I to VI)  
SEMESTER-I, III & V EXAM. WINTER-2012 &  
SEMESTER-II, IV & VI EXAM. SUMMER-2013 &  
ONWARDS



2012

Price Rs. ....../-

Published by  
**Dineshkumar Joshi**  
Registrar,  
Sant Gadge Baba  
Amravati University  
Amravati - 444 602

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**(Prospectus No.20131221)**

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**SANT GADGE BABA AMRAVATI UNIVERSITY****SPECIAL NOTE FOR INFORMATION OF THE STUDENTS**

(1) Notwithstanding anything to the contrary, it is notified for general information and guidance of all concerned that a person, who has passed the qualifying examination and is eligible for admission only to the corresponding next higher examination as an ex-student or an external candidate, shall be examined in accordance with the syllabus of such next higher examination in force at the time of such examination in such subjects, papers or combination of papers in which students from University Departments or Colleges are to be examined by the University.

(2) Be it known to all the students desirous to take examination/s for which this prospectus has been prescribed should, if found necessary for any other information regarding examinations etc. refer the University Ordinance Booklet the various conditions/provisions pertaining to examinations as prescribed in the following Ordinances-

Ordinance No. 1	:	Enrolment of Students.
Ordinance No.2	:	Admission of Students
Ordinance No. 4	:	National Cadet Corps
Ordinance No. 6	:	Examination in General (relevant extracts)
Ordinance No. 18/2001:		An Ordinance to provide grace marks for passing in a Head of passing and Improvement of Division (Higher Class) and getting Distinction in the subject and condonation of deficiency of marks in a subject in all the faculties prescribed by the Statute NO.18, Ordinance 2001.
Ordinance No.9	:	Conduct of Examinations (Relevant extracts)
Ordinance No.10	:	Providing for Exemptions and Compartments
Ordinance No. 19	:	Admission Candidates to Degrees
Ordinance No.109	:	Recording of a change of name of a University Student in the records of the University

Ordinance No.19/2001 : An Ordinance for Central Assessment Programme, Scheme of Evaluation and Moderation of answerbooks and preparation of results of the examinations, conducted by the University, Ordinance 2001.

**Dineshkumar Joshi**

Registrar

Sant Gadge Baba Amravati University

**PATTERN OF QUESTION PAPER ON THE UNIT SYSTEM**

The pattern of question paper as per unit system will be broadly based on the following pattern.

- (1) Syllabus has been divided into units equal to the number of question to be answered in the paper. On each unit there will be a question either a long answer type or a short answer type.
- (2) Number of question will be in accordance with the unit prescribed in the syllabi for each paper i.e. there will be one question on each unit.
- (3) For every question long answer type or short answer type there will be an alternative choice from the same unit. However, there will be no internal choice in a question.
- (4) Division of marks between long answer and short answer type question will be in the ratio of 40 and 60.
- (5) Each short answer type question shall contain 4 to 8 short sub question with no internal choice.

**DIRECTION**

No. : 43 / 2010

Date : 03/07.2010

**Subject : Examinations leading to the Degree of Bachelor of Computer Application (Three Year Degree Course-Semester Pattern), Direction, 2010.**

Whereas, University Grants Commission, New Delhi vide D.O.No.F-2/2008/(XI Plan), Dtd.31 Jan.2008 regarding new initiatives under the 11<sup>th</sup> Plan – Academic Reforms in the University has suggested for improving quality of higher education and to initiate the Academic Reform at the earliest.

AND

Whereas, the Academic Council while considering the above letter in its meeting held on 30.4.2008, vide item No.55 has resolved to refer the same to Dean's Committee, and the Dean's Committee in its meeting held on 19.07.2008 has decided to refer the matter to all Board of Studies.

AND

Whereas the recommendations of various Board of Studies in the faculty of Science regarding Upgradation and Revision of various syllabi and introduction and implementation of Semester Pattern Examination System at under graduate level was considered by the faculty of Science in its meeting held on 7.12.2009 and constituted a Committee of all Chairmen of Board of Studies and one member nominated by Chairmen of respective B.O.S. under the Chairmanship of Dean of faculty to decide the policy decision regarding semester pattern examination system.

AND

Whereas, the Academic Council in its meeting held on 20.2.2010 vide item No.15, has resolved to constitute a Committee of Chairman of Board of Studies in Mathematics, Statistics, Computer Science and Electronics under the Chairmanship of Dean, faculty of Science for framing the syllabus of Bachelor of Computer Application (Computer Science) i.e. B.C.A. (Computer Science).

AND

Whereas, the faculty of Science in its emergent meeting held on 11<sup>th</sup> May, 2010 vide item No.30 regarding Scheme of Teaching and Examination and B.C.A. course as per Semester pattern has resolved to refer to concerned Board of Studies, and the faculty further resolved to induct the Chairman, B.O.S. in Mathematics, Electronics & Statistics.

AND

The Combined meeting of the Committees appointed by the Academic Council, faculty of Science and B.O.S. in Computer Science in its meeting held on 24 & 25 June 2010 has resolved to accept and recommend a draft syllabi, scheme of teaching and examination and provision to be incorporated in the Ordinance to Examination leading to the Degree of Bachelor of Computer Application to be implemented from the Academic Session 2010-11 for B.C.A. Part-I (Sem-I & II) and onwards, which is accepted by the Hon'ble Vice-Chancellor u/s 14(7) of the Maharashtra Universities Act, 1994 on dated 1.7.2010.

AND

Whereas, Ordinance No.17 of 2003 in respect of Examinations leading to the Degree of Bachelor of Computer Application is in existence in the University as per annual pattern examination system.

AND

Whereas, new scheme of examination as per semester pattern is to be implemented from the Academic Session 2010-11 for Semester-I & onwards which is regulated by an Ordinance and framing of an Ordinance for the above examination is likely to take some time.

AND

Whereas, the admission of students in the semester pattern at B.C.A.. Part-I (Semester-I) are to be made in the Academic Session 2010-11.

Now, therefore, I, Dr. Kamal Singh, Vice Chancellor of Sant Gadge Baba Amravati University, in exercise of powers conferred upon me under sub-section (8) of section 14 of the Maharashtra Universities Act., 1994, do hereby direct as under:

1. This Direction may be called, "Examinations leading to the Degree of Bachelor of Computer Application (Three Year Degree Course-Semester Pattern), Direction, 2010".
2. This direction shall come into force with effect from the date of its issuance.
3. (i) The following shall be the examination leading to the Degree of Bachelor of Computer Application in the faculty of Science-
  - (1) The B.C.A. (Part-I), Semester -I Examination;
  - (2) The B.C.A. (Part-I), Semester -II Examination;
  - (3) The B.C.A. (Part-II), Semester -III Examination;
  - (4) The B.C.A. (Part-II), Semester -IV Examination;
  - (5) The B.C.A. (Part-III), Semester -V Examination; and
  - (6) The B.C.A. (Part-III), Semester -VI Examination;

- (ii) The period of Academic Session shall be such as may be notified by the University.
4. (i) The examination of Semester-I, II, III, IV, V & VI shall be conducted by the University and shall held by the end of each semester separately.
- (ii) The main examination of Semester-I, III & V and that of Semester-II, IV & VI shall be held in Winter and Summer respectively.
- (iii) The supplementary examination for Semester-I, III & V shall be held in Summer and that of Semester-II, IV & VI in Winter respectively.
5. Subject to their compliance with the provisions of this Direction and of other Ordinances in force from time to time, the following persons shall be eligible for admission to the examinations, namely:-
- (a) A student of a College who has prosecuted a regular course of study for not less than one academic year prior to that examination;
- (b) A teacher in a Educational Institution eligible under the provisions of Ordinance No.18, and
- (c) A women candidate who has not pursued a regular course of study.

Provided that in the case of the persons eligible under clauses (b) and (c) an applicant to the examination shall have attended a full course of laboratory instructions in a College in the subject in which laboratory work is prescribed. The candidate shall submit a Certificate to that effect signed by the Principal of the college.

6. **(I) Every applicant for admission to Examination shall-**

In the case of the Bachelor of Computer Application Part-I, Semester-I Examination, have passed not less than one academic Year previously the 12th standard Examination of the Maharashtra State Board of Secondary and Higher Secondary Education with English and other modern Indian Languages or subject I.T. together with Mathematics or three years Diploma course in Electronics and Computer Engg. or +2 level minimum competency vocational course in Electronics Technology or students passing the 12<sup>th</sup> Standard Examination of Maharashtra State Board of Secondary and Higher Secondary Education and offering Vocational stream with Mathematics shall be

eligible for admission to the Bachelor of Computer Application Part-I, Semester-I course or an Examination recognized as equivalent thereto in such subjects and with such standards of attainments as may be prescribed.

**(II) In the case of B.C.A.. Part-II, (Semester-III & IV) Examination :-**

have passed not less than one academic year previously the B.C.A.. Part-I ( Sem-I & II) Examination of the University or an examination recognised as equivalent thereto, and

**(III) In the case of the B.C.A.. Final, (Sem-V & VI) Examination:-**

have passed not less than one academic year previously the B.C.A.. Part-II (Sem-III & IV) Examination Examination of the University or an examination recognised as equivalent thereto;

7. Subject to his/her compliance with the provisions of this Direction and other Ordinances (pertaining to Examination in General) in force from time to time, the applicant for admission, at the end of the course of study of a particular semester to an examination specified in column (1) of the table below, shall be eligible to appear at it, if,
- (i) he/she satisfied the condition in the table and the provisions there under.
- (ii) he/she has prosecuted a regular course of study in a college affiliated to the University.
- (iii) he/she has in the opinion of the Principal shown the satisfactory progress in his/her studies.

**TABLE**

Name of the Examinatin to appear	The student should have completed the Session / term satisfactorily	The student should have passed
1	2	3
B.C.A. Part-I (Sem-I & II)	Sem-I & II	Qualifying examination.
B.C.A.-II Semester-III	Semester-I & II	One half of the total head prescribed for Sem-I & Sem-II examination
B.C.A.-II Semester-IV	Semester-III	One half of the total head prescribed for Sem-I & Sem-II examination

B.C.A.-III Semester-V	Semester-III & IV	(i) passed the Sem-I & II examination and (ii) One half of the total head prescribed for Sem-III & Sem-IV examination
B.C.A.-III examination	Semester-V	(i) passed the Sem-I & II Semester-VI and (ii) One half of the total head prescribed for Sem-III & Sem-IV examination

(Note: For calculating the heads, the theory and the practical shall be consider as a separate head and on calculation fraction if any shall be ignored.)

8. Without prejudice to the other provisions of Ordinance No. 6 relating to the Examination in General, the provisions of Paragraph 5, 8, 10 and 31 of the said ordinance shall apply to every collegiate candidate.
9. The fee for the examination shall be as prescribed by the University from time to time.
10. The Scope of the subjects of all semester opted by the students shall be as indicated in the respective syllabi from time to time. The medium of instruction and examination shall be English.
11. The maximum marks allotted to each subject and paper and the minimum marks which an examinee must obtain in order to pass the examination shall be as per Appendices A, B, C, D, E and F appended to this Direction.
12. The practical examination of all semesters shall be conducted at the end of each semester externally by the University.
13. Successful examinees at the B.C.A. Final (Sem-VI) Examination who obtain not less than 60% marks in aggregate of Sem-I, II, III, IV, V & VI Examination taken together shall be placed in the First Division, those obtaining less than 60% but not less than 45% in the Second Division, and all other successful examinees in the pass Division.
14. There shall be no classification of successful examinees at the Sem-I to Sem-V Examinations.
15. An examinee successful in the minimum period prescribed for the examination, obtaining not less than 75% of the maximum marks prescribed in the subject shall be declared to have passed the examination with Distinction in the subject. Distinction shall not be awarded to an examinee availing of the provision of the exemptions and compartments at any of the examination.

16. Provisions of Ordinance No.18/2001 in respect of an Ordinance to provide grace marks for passing in a Head of passing and Improvement of Division (Higher Class) and getting Distinction in the subject and condonation of deficiency of marks in a subject in all the faculties prescribed by the Statute No.18, Ordinance 2001 shall apply to the Examination under this Direction.
17. As soon as possible after the examinations the Board of Examination shall publish a list of successful examinees at the B.C.A. Part-I, Semester-I & II, B.C.A. Part-II, Semester-III & IV & B.C.A. Final, Semester-V & VI Examination. Such list at the B.C.A. Final Examination shall be arranged in three Divisions. The names of the examinees passing the examination as a whole in the minimum prescribed period and obtaining the prescribed number of places in each subject in the First or Second Division shall be arranged in Order of Merit as provided in the Examinations in General Ordinance No. 6.
18. No Person shall be admitted to B.C.A. Part-I, Semester-I & II, B.C.A. Part-II, Semester-III & IV & B.C.A. Final, Semester-V & VI Examinations, if he has already passed the same examination of this University or an equivalent examination of any other Statutory University.
19. Successful Examinees at the B.C.A. Part-I, Semester-I & II, B.C.A. Part-II, Semester-III & IV Examination shall be entitled to receive a Certificate signed by the Registrar and successful examinee at the end of & B.C.A. Final, Semester-VI Examination, shall on payment of the prescribed fees, receive a Degree in the Prescribed form, signed by the Vice-Chancellor.

Date : 1/7/2010

Sd/-  
(Dr.Kamal Singh)  
Vice-Chancellor  
Sang Gadge Baba Amravati University  
Amravati

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**CERTIFICATE**

Name of the College/ Institution .....

Name of the Department : .....

This is to certify that this book contins the bonafide record of the practical work of Shri / Kumari / Shrimati .....

.....

of B.C.A. Part – I / II / III / Semester.....during the Academic year.....

Dated: ...../...../20....

Signature of the Teacher  
Who taught the examinee

- 1. ....
- 2. ....

3.

4.

**Head of the Department**

( **Note** :In absence of certificate for record book (Appendix-G), examinee should not be allowed to appear for the practical examination.)

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The distribution of marks in Practical examination is given as:

(1) Program writing/ execution based on 5ST6	15 marks.
(2) Case Studies based on 5ST6	15 marks.
(3) Practical Record	10 marks.
(4) Viva-Voce	10 marks.

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50 marks.

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### Syllabus for B.C.A. Sixth Semester

#### 6ST1: .NET Using ASP

- Unit-I** : **ASP.Net Introduction**-The .Net framework, The .Net Languages, CLR, Types, Objects and Namespaces, Settings for ASP.Net and IIS
- Unit-II** : **Developing ASP.Net Application** - Asp.Net Application, Differences between Web based and Windows based application, Web From fundamentals, Web Controls.
- Unit-III** : Explanation of C#.Net, Validation and Rich Control, State Management, Tracing , Logging and Error Handling
- Unit-IV** : Working With Data-Overview of ADO.Net, ADO.Net Data Access, Data Binding, The Data list ,Data Grid, and Repeater; Files , Streams, and E-Mails.
- Unit-V** : **AdvancedASP.Net**- Component-Based Programming, Custom Control, Caching and Performance Tuning, Implementing Security, Case Studies.

**Books :**

1. The Complete Reference ASP.NET, TATA McGRAW-HILL
2. ASP.NET Black Book.

### 6ST2: CLIENT SERVER TECHNOLOGY

- Unit I** : Client-Server Technology and its uses, historical development, client-server technology and heterogeneous computing, Distributed Computer, Computing plate forms, Microprocessor integration and client server computing, implementations and scalability.
- Unit II** : Fundamentals of client server design, division of labour, Transition to client-server programming; Interaction of client and server communication Techniques and protocols, implementing client server applications, multitasking with process and threads.
- Unit III** : Scheduling implementations, scheduler internals, primitive Vs non-primitive systems; synchronization-understanding.
- Unit IV** : Semaphores, semaphore implementation in Novell Netware, windows NT and UNIX, Memory-management, Allocation, sharing and manipulating,
- Unit V** : Client server computing with ORACLE-Overview of DBMS, client server relationships, ORACLE and client server computing, using SQL with SQL, \*DBS, the ORACLE tools and design aids, SQL windows & Power Builder.

**Books:**

1. Novell's Guide to client-server Applications : Jaffrey D. Schank and Architecture (BPB Public. 1994)
2. Client/server Computing with ORACLE : Salemi (BPB publications 1994)
3. Client/server computing : Smith and Guengerich (PHI) 1998)
4. Client/server Computing : Dewire (Mc Graw-Hill, International)
5. Client/Server Architecture : Bessen (Mc Graw-Hill, International)
6. Building Client Server Networks : Bay Arinze (TMH, 1997)
7. Power Builder: a guide for Developing : Banbara & Allen Client/Server Applications (Mc Graw-Hill International, 1998)
8. Client/Server System Design and : Vaughn Implementation (Mc Graw-Hill International 1997)
9. Mastering ORACLE-7 Client/Server : Bobrowski Computing (TMH 1998)

**6ST3: MULTIMEDIA AND ITS APPLICATIONS**

- Unit I** : **Introductory Concepts:** Multimedia, Definition, CD-ROM and the multimedia highway, Uses of Multimedia; Introduction and Hardware: Definition of Multimedia, CD-ROMs and Multimedia applications, Multimedia requirements-Hardware, Software.
- Unit II** : **Multimedia Software:** Basic tools, painting and drawing tools, OCR software, Sound editing programs, Animation devices. Linking multimedia objects, office suites, word processor, spreadsheets presentation tools, Types of Authoring tools card and page based, icon based and time based authoring tools, object oriented tools.
- Unit III** : **Production Building Blocks:** Test-using test in Multimedia, Computers and Text, Font editing and Design tools, Hyper media and Hyper text, Sounds-multimedia system sounds MIDI verses Digital Audio, Audio file formats, Working with sound in Windows, Adding sound.
- Unit IV** : **Production Tips:** Image-creation, making still images, images colors, Image, File format, Animation-principles of animation, making workable animations Video, using video, Broadcast video, Standard, Integrating Computer and TVs, shooting and editing Video, using Recording formats, Video tips, Video Compression.
- Unit V** : **Multimedia Project Development and Case Studies:** Project planning, Estimating, RPFs and Bid proposals, Designing, Producing acquiring and using contents, Testing, CD-ROM Technology and Standards.

Designing for the Word Wide, working on the Web, Text for the Web, Images for the Web, Sound for the Web, Animation for the Web.

**Books:**

1. Multimedia Making It Work (TMH) 1997 : Tay Vaughan
2. Multimedia Power Tools, 2 Edition : Peter Jerram and M. (Random House Electronic Publishing) Gosney

**6ST4: Software Testing**

- Unit I** : **Principles of Testing:** Context of testing in producing software, Phases of Software Project, Quality Assurance and Quality Control , Testing, Verification and validation concepts ,
- Unit II** : **White Box Testing :** Static testing by Humans, Static Analysis Tools, Structural Testing, Code Functional Testing, Code Coverage Testing, Code Complexity Testing, Challenges in White Box Testing ; Black Box Testing-Need & purpose of Black Box Testing, Requirement based testing, Positive and Negative testing
- Unit III** : **Integration Testing:** Introduction, Top-Down Integration, Bi-Directional Integration, System Integration; System and Acceptance Testing, System Testing Overview, Functional System Testing, Beta Testing, Non-Functional System Testing, Stress Testing, Interpretability Testing.
- Unit IV** : Acceptance Testing, Acceptance Criteria, Selecting Test Cases, Executing Acceptance Tests; Performance Testing-Introduction, Factors governing performance testing, Methodology for performance testing
- Unit V** : Regression Testing:-Introduction, Types of Regression Testing, Understanding the Criteria for selecting Test Case, Classifying Test Cases, Methodology for selecting Test Case; Test Planning, Management, Execution and Reporting:- Test Planning, Preparing a Test Plan, Setting up Criteria for Testing, Test Case Specification, Developing and Executing Test Cases, Test Summary Report.

**Text Book:**

1. Software Testing Principles and Practices - Srinivasan Desikan and Gopalaswamy Ramesh, Publisher: Pearson Education.

**6ST5: Advance Database Management System**

- Unit I** : **Introduction :** Review of Database Concepts, File Organization concepts, Normalization. Physical Database Design and Tunning. Index Selection, Overview of Database Tunning, Choices in tuning the conceptual schema.

Choices in tuning queries and views, DBMS Benchmarking, Security.

**Unit-II** : Concurrency control transactions and schedule, Serializability, Lock based concurrency control lock management, specialized locking techniques, control without locking.

Crash Recovery, Introduction to crash recovery, Log, Check pointing, Recovery from a system crash.

**Unit-III** : Parallel and distributed databases. Architectures for parallel databases, Parallel query Evaluation and optimization, Parallelizing individual operations, Introduction to distributed databases, Architecture, Fragmentation and Replication, Catalog management, Distributed Query processing, updating distributed data, Distributed transaction management, Distributed Concurrency control, Distributed recovery.

**Unit-IV** : **Object database Systems** : Objects, Identity, inheritance, Database Design for an ORDBMS, Storage and access methods, Query processing and optimization, Comparing RDBMS with OODBMS and ORDBMS.

**Unit-V** : **Data Warehousing**  
Introduction, DSS and OLTP, Metadata Management in Data Warehouse. Related data structures, OLAP and Data Warehousing environment.  
Data mining.  
Introduction and application areas.

**Books :**

- 1) Database Management System -Raghu Ramkrishna McGraw Hill. International Editions.
- 2) Introduction to Database System by C.G.Date.

**6SP1: LAB I-6ST1+6ST2:** Minimum 8 practical on each.

The distribution of marks in Practical examination is given as:

(1) Program writing/ execution based on 6ST1	15 marks.
(2) Program writing/ execution based on 6ST2	15 marks.
(3) Practical Record	10 marks.
(4) Viva-Voce	10 marks.

---

**50 marks.**

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**6SP2: LAB II-6ST3+6ST4:** Minimum 8 practical on each.

The distribution of marks in Practical examination is given as:

(1) Program writing/ execution based on 6ST3	15 marks.
(2) Program writing/ execution based on 6ST4	15 marks.
(3) Practical Record	10 marks.
(4) Viva-Voce	10 marks.

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**50 marks.**

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**6SP3: LAB III-**Project work with Report.

**The distribution of marks in Practical examination is given as:**

(1) Project Work with Report	30 marks.
(2) Viva-Voce	20 marks.

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**50 marks.**

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**%SANT GADGE BABA AMRAVATI UNIVERSITY, AMRAVATI  
ORDINANCE NO. 42 OF 2005**

**Examination in Environmental Studies leading to Bachelor Degree, Ordinance, 2005**

Whereas it is expedient to frame an Ordinance relating to Examination in Environmental Studies leading to Bachelor Degree level, hereinafter appearing, the Management Council is hereby pleased to make the following Ordinance.

1. This Ordinance may be called "Examination in Environmental Studies leading to Bachelor Degree, Ordinance, 2005."
2. This Ordinance shall come into force from the Academic session 2005-06.
3. In this Ordinance and in other ordinances relating to the examination, unless there is anything repugnant in the subject or context :-
  - (i) "Academic session" means a session commencing on such date and ending with such date of the year following as may be appointed by the Management Council.
  - (ii) "Admission to an examination" means the issuance of an admission card to a candidate in token of his having complied with all the conditions laid down in the relevant ordinance, by a competent officer of the University.
  - (iii) "Applicant" means a person who has submitted an application to the University in the form prescribed for admission to an examination.
  - (iv) "Candidate" means a person who has been admitted to an examination by the University.
  - (v) "Regular Candidate" means an applicant who has applied for admission to a University examination through an affiliated college, Department or Institute in which he/she has prosecuted a regular course of study.
  - (vi) "Examinee" means a person who present himself/herself for an examination to which he/she has been admitted.
  - (vii) "Examination" means an examination prescribed by the University under the relevant Ordinance.
  - (viii) "External Candidate" means a candidate who is allowed to take a University examination in accordance with the provision of Original Ordinance No. 151.
  - (ix) " Non-Collegiate Candidate" means a candidate who is not a collegiate candidate.

- (x) An "Ex-student" is a person who having once been admitted to an examination of this University, is again required to take the same examination by reason of his failure or absence thereat and shall include a student who may have joined a college, Department or Institute again in the same class.
  - (xi) "Bachelor Degree Examination" means a examination leading to Bachelor Degree of the University.
  - (xii) "Previous Year" means a year following by final year of Bachelor Degree.
4. Save as otherwise specifically provided, the conditions prescribed for admission to the examination under this Ordinance shall apply to all persons who wish to take the examination to the Degrees of the University mentioned in para 5 below.
  5. The conditions prescribed for admission to examination under this Ordinance shall apply to following degrees of the University :-
    - 1) Bachelor of Arts
    - 2) Bachelor of Performing Arts
    - 3) Bachelor of Fine Arts
    - 4) Bachelor of Mass Communication
    - 5) Bachelor of Social Work
    - 6) Bachelor of Commerce
    - 7) Bachelor of Business Administration
    - 8) Bachelor of Science
    - 9) Bachelor of Computer Science
    - 10) Bachelor of Computer Applications
    - 11) Bachelor of Pharmacy
    - 12) Bachelor of Science (Home Science)
    - 13) Bachelor of Technology (Cosmetics)
    - 14) Bachelor of Engineering
    - 15) Bachelor of Engineering (Part Time) (Civil)
    - 16) Bachelor of Textile
    - 17) Bachelor of Technology (Chemical Technology)
    - 18) Bachelor of Technology (Chemical Engg.)
    - 19) Bachelor of Architecture, and
    - 20) Bachelor of Laws (Five Year Course)
  - 6 i) Environmental Studies shall be a compulsory subject for a previous year examination of the following Bachelor Degrees of the University,
    - 1) Bachelor of Arts

- 2) Bachelor of Performing Arts
  - 3) Bachelor of Fine Arts
  - 4) Bachelor of Mass Communication
  - 5) Bachelor of Social Work
  - 6) Bachelor of Commerce
  - 7) Bachelor of Business Administration
  - 8) Bachelor of Science
  - 9) Bachelor of Computer Science
  - 10) Bachelor of Computer Applications
  - 11) Bachelor of Pharmacy
  - 12) Bachelor of Science (Home Science)
  - 13) Bachelor of Technology (Cosmetics)
  - 14) Bachelor of Engineering (Part Time) (Civil)
- ii) Environmental Studies shall be a compulsory subject for IIIrd & IVth Semester of the following Bachelor Degrees of the University,
- 1) Bachelor of Engineering
  - 2) Bachelor of Textile
  - 3) Bachelor of Technology (Chemical Technology)
  - 4) Bachelor of Technology (Chemical Engineering)
  - 5) Bachelor of Architecture, and
- iii) Environmental Studies shall be a compulsory subject for Vth & VIth Semester of the Degree of Bachelor of Laws (Five Year Course)
- iv) Students admitted to Second Year/Third Year/IVth Semester Vth Semester of various degree examination courses in different faculties in the academic session 2005-06 or thereafter shall have to appear for examination in the subject Environmental studies.
7. The main Examination leading to Environmental Studies shall be held in Summer and Supplementary examination in Winter every year, at such places and on such date as may be appointed by the Board of Examinations.
- Explanation** :- Examination shall be conducted on the basis of one common question paper for all Bachelor Degree examination courses irrespective of annual or semester pattern.
8. Scope of the subject for annual pattern examination and or semester pattern examination shall be as provided under the syllabus.
  9. Common question paper for all courses covered under this Ordinance alongwith answer books shall be supplied by the University to the Colleges, Departments and Institutes for conducting the examination of the subject.

10. Valuation of the answer books relating to this subject shall be done at College/Department/Institution level only. Remuneration for valuation of answer books shall not be paid by the University.  
Provided that prescribed evaluation fee for evaluation of each answer Book/s of an external examinee/s appeared from the examination centre shall be paid to each examination centre.
11. It shall be obligatory on the part of the College/Department/Institute to submit candidate wise following information to the University on or before the date as may be prescribed by the University :-

Sr. No.	Grade/Category	Marks secured
1.	“A”	- 60 and above
2.	“B”	- 45 to 59
3.	“C”	- 35 to 44
4.	“D”	- 25 to 34
5.	“Fail”	- 24 and below
6.	“Absent”	

12. For the purposes of teaching, learning and examination, the Committee consisting of three teachers shall be appointed by the Principal/ Head of the Department/Head of the Institution under his/her Chairmanship/ Chairpersonship. While appointing three teachers on the said committee, the Principal shall take care that the teachers to be appointed on the committee, if necessary, shall be from different faculty.
13. i) Duration of theory examination of this subject shall be three hour.  
ii) For all Bachelor Degree examinations, common question paper of 100 marks shall be provided by the University.  
iii) Distribution of these 100 marks shall be as follows :-
  - a) Part-A, Short Answer Pattern - 25 Marks
  - b) Part-B, Essay type with inbuilt choice - 50 Marks
  - c) Part-C, Essay on Field Work - 25 Marks
14. Medium of instruction shall be English or Marathi or Hindi. Question paper shall be supplied in English and Marathi and Hindi. A candidate shall have option to write answers in English or Marathi or Hindi.
15. Examination for the subject Environmental Studies shall be compulsory for external candidates appearing as a fresh candidate at Winter and/or Summer examination.

16. For teaching of the subject, there shall be atleast two hour per week.  
For teaching the subject to the regular candidates, a full time approved teacher of the University and or a person having Postgraduate Degree in any faculty with second class shall be considered elligible.
17. For teaching of the subject, additional fee to be charged to regular candidate shall be as prescribed by the University.
18. Every College/University Teaching Department shall Charge additional fee of Rs. 100/- to every student of the subject Environmental Studies.  
Out of this Rs.100/-, the College/University Teaching Department shall have to pay Rs.25/- to the University as an examination fee of each candidate for the subject Environmental Studies.
19. The Grade secured by an examinee in the examination of this subject shall not be considered for providing the facility of A.T.K.T. in next higher class.
20. The provisions of Ordinance No. 18/2001 shall not be applicable for securing a grade or higher grade in the examination of this subject.
21. Result of the Final Year of the respective Degree shall not be declared of an examinee unless he/she secures any one of the grade in the examination of subject.  

Provided an examinee admitted to Five Year LL.B. course desiring not to continue his/her education beyond Sixth Semester of the said course shall have to secure any one of the grade in the examination of the subject otherwise his/her result of Sixth Semester for awarding B.A. degree shall not be declared.
22. Certificates shall be issued, to the successful examinees in the subject Environmental Studies, after the examination.

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NOTIFICATION

No. 39 / 2018

Date: 7 / 6 / 2018

**Subject : Introduction of new syllabi for M.Sc. (Chemistry) Part-II (Sem. III & IV), which to be implemented from the academic session 2018-19.**

- 1) It is notified for general information of all concerned that the authorities of the University has introduced new syllabi for M.Sc.(Chemistry) Part-II (Sem. III & IV), which to be implemented from the academic session 2018-19. Hence the page Nos. 26 to 91, appearing in prospectus No. 2015125 be substituted respectively by the "**APPENDIX**", which is appended with this notification.
- 2) The authorities further provided two additional chances for the failure students of M.Sc.(Chemistry) Part-II (Sem.III & IV) after implementation of the aforesaid new syllabi.

Sd/-  
(Dr.A.P.Deshmukh)  
Registrar,  
Sant Gadge Baba Amravati University

**APPENDIX**

**SEMESTER –III  
Paper IX SPECTROSCOPY-I**

**Total Lectures: 60Hrs, 4 Hrs per week, 12 Hrs/unit**

**Total Marks-80**

- Unit-I :** **12L**
- A) Unifying principle:** Electromagnetic radiation, interaction of electromagnetic radiation with matter-absorbance emission, transmission, reflection, refraction, dispersion, polarization and scattering, Diffuse Reflectance (DRIFT), reflection absorption (RAIRS), multiple internal reflection (MIR) Uncertainty relation and natural line width and line broadening, transition probabilities, transition moment, selection rule, intensity of spectral lines. rotational, vibrational and electronic energy level. Fourier Transform spectroscopy.
- B) Microwave spectroscopy:** Classification of molecules, rigid rotor model, Rotation and Vibration of Diatomic Molecules: effect of isotopic substitution on the transition frequencies, intensities, non rigid rotor, nuclear and electron spin interaction and effect of external field, energy eigenvalues and Eigen states Classification of polyatomic rotors and the non-rigid rotor, Electronic transitions, Franck-Condon principle. Fluorescence and phosphorescence.
- C) Reactivity and Characteristics of Nanoparticles:** Increased reactivity of nanoscale materials, reasons for high reactivity, effect of size and shape of nanocrystals on reactivity, comparison of nanocrystalline versus macro-crystalline materials in terms of reactivity
- Unit-II** **12L**
- A) Ultraviolet and visible spectroscopy :** Various electronic transition (185-800nm), Beer-Lambert law, effect of solvent on electronic transition, UV band for carbonyl compounds, unsaturated carbonyl compound, diene, conjugated polyenes. Fisher-Woodward rules for conjugated dienes and carbonyl compounds, UV spectra of aromatic and heterocyclic compounds. , Fieser-Kuhn rules for polyenes, Steric effects in biphenyls.
- B) Infrared spectroscopy :** Review of linear harmonic oscillator, vibrational energies of diatomic molecules, zero point energy, force constant and bond strength, unhomonicity, Morse potential energy diagram, vibration of polyatomic molecules, selection rules, normal modes of vibration, group frequencies, overtone band, factors effecting the band position and intensities, far IR region, metal ligand vibrations, Instrumentation and sample handling characteristics. Vibrational frequencies of alkanes, alkenes, alkynes, aromatic compounds, alcohols, amines. Detail study of vibrational frequencies of carbonyl compounds, (ketones, aldehydes, esters, amides, acids, acid chlorides and anhydrides, lactones, lactams and conjugated carbonyl compounds). Effect of hydrogen bonding and solvent on vibrational frequencies, overtones, combinations bands and Fermi resonance. FT-IR, IR of gaseous solids and polyatomic materials. applications of vibrational spectroscopy in investigating (i) symmetry and shapes of simple AB<sub>2</sub>, AB<sub>3</sub> and AB<sub>4</sub> molecules on the basis of spectral data, (ii) mode of bonding of ambidentate ligands (thiocyanate, nitrate, sulphate and urea). mode of bonding of ambidentate ligands, Cyanides, Ethylenediamine and Diketone complexes..
- Unit-III :** **12L**
- Mass spectrometry:** Introduction, theory, measurement techniques (EI, CI, FD, FAB) recording of mass spectrum. types of ions, isotopic contribution, fragmentation process, factors affecting fragmentation, ion analysis, ion abundance. Mass spectral fragmentation of organic compounds of various types, common functional groups, molecular ion, metastable ions, McLafferty rearrangement. Retro-Diels Alder fragmentation, nitrogen rule. High resolution mass spectrometry. Examples of mass spectral fragmentation of organic compounds with respect to their structural determination. studies of inorganic/coordination and organometallic representative compounds Fingerprint applications and the interpretation of Mass spectra Elementary study of GCMS, FTMS, high resolution MS, ESI-MS, MALDI-MS, examples from macromolecules and supramolecules, study of in-organic co-ordination & organometallic compounds.

- 22) Separation, identification and quantitative determination of metal ions by paper chromatography.
- 23) Separation and identification of sugars/ honey/halides by paper chromatography and determination of Rf values
- 24) Thin layer chromatographic separation, identification and determination of Rf values □
  - a. Metal ions (Mn, Co, Ni, Cu, □n, Cd, Pb, alkali metals etc)
  - b. Amino acids/ □rganic compounds
  - c. Sulpha drugs in tablets and ointments.
- 25) Estimation of zinc/metals by fluorimetrically.
- 26) Nephelometric determinations of sulphate, phosphate, silver.
- 24) Potentiometric determination of the percentage of sodium carbonate in commercial washing soda.
- 25) Water analysis:
  1. Determination of sodium and potassium by flame photometry.
  2. Determination of hardness, alkalinity, salinity, Chloride, Fluoride, Nitrite, Nitrate, phosphate and Sulphate.
  3. Determination of D□, C□D and B□D.
  4. Determination of toxic metals viz As, Cd, Pb, Hg, and Ni in water and wastewater by suitable method.

**The Practical examination will be based on the Inorganic Chemistry.**

**Time: 6-8 hours (one day examination)**

**Marks: 100**

- |   |            |
|---|------------|
| I) Exercise -1 (Based on Instrumental)      | - 40 Marks |
| II) Exercise-2 (Based on Separation Method) | - 40 Marks |
| III) Record                                 | - 10 Marks |
| IV) Viva- Voce                              | - 10 Marks |

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**Total - 100 Marks**

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**List of Books-**

1. Day and Underwood: □uantitative Analysis
2. Vogel A.I: A textbook of quantitative Inorganic analysis, Longman.
3. Flaschka: EDTA Titration
4. Meites and Thomas: Advanced Analytical Chemistry.
5. Ewing, G.W.: Instrumental Methods of Chemical Analysis, McGraw-Hill
6. Drago, R.S: Physical Methods in Inorganic Chemistry
7. Christian G.D.: Analytical Chemistry
8. Khopkar S.M.: Basic Concept of Analytical Chemistry.
9. Kolltath and Ligane: Polarography
10. Braun: Instrumental methods of chemical Analysis
11. Willard, Merritt and Dean: Instrumental methods of Chemical Analysis, Van Nostrand
12. Strouts, Crifillan and Wison: Analytical Chemistry.
13. Skoog S.A. and West D.W.: Fundamental of Analytical Chemistry
14. Dilts R.V.: Analytical Chemistry
15. □ahagirdar D.V.- Experiments in Chemistry
16. Chondhekar T.K.- Systematic Experiments in Physical Chemistry, Rajbog S.W., Anjali Pubn.
17. Wlehov G. □- Standard methods of Chemical analysis, 6<sup>th</sup> Ed.
18. Ramesh R & Anbu M, Chemical Methods for Environmental Analyss: Water & Sediment, Macmillan India.

**SEMESTER III**

**Organic Chemistry Practical - VI**

**Total Hours: 90 hrs. (9 Hours per week)**

**Marks: 100**

**A- Multistage Preparations. (Total Laboratory Session 14) (45 marks)**

- i) Preparation of p-nitroaniline from aniline
- ii) preparation of p-bromo aniline from aniline
- iii) Benzaldehyde → chalcone → chalcone epoxide
- iv) Flavnone
- v) Coumarine
- vi) Fisher Indol Synthesis
- vii) Skrup-□uinoline synthesis
- viii) Synthesis of Carbohydrates (any one)
- ix) Hippuric acid → Azalactone → 4-Benzylidene 2-phenyl oxazol-5-one
- x) Benzophenone → benzopinacol → benzopinacolone
- xi) Benzoin → benzil → benzilic acid (By Green Synthesis)
- xii) Acridone from anthranilic acid

**Note:** 1. Synthesis is carried out in molar quantities (Less than 2 gm). 2. Reaction with possible mechanism. 3. Calculate Theoretical and practical □ yield. 4. Product conformation by Physical constant and TLC. 5. Give expected spectral data (IR and NMR) of starting material, intermediate and final product (Theoretically differences). 6. All the prepared organic compounds should be stored as a sample and present at the time of University examination.

**Scheme of Marking:**

- |   |    |
|---|----|
| i) Synthesis of products of. (each steps)               | 09 |
| ii) □ield of the crude product (each steps)             | 09 |
| iii) MP of the recrystallized product (each steps)      | 09 |
| iv) TLC of the recrystallized product (each steps)      | 09 |
| v) Prediction of Spectral data for product of each step | 09 |



**B- Estimations: (0 Laboratory Session)**

**(20 Marks)**

- i) Nitrogen
- ii) Halogen
- iii) Sulphur
- iv) Soxhlet extraction of oil from oil seeds and determination of saponification value, iodine value of the same oil
- v) Soxhlet extraction of piperine from black pepper
- vi) Spectrophotometric/UV estimations of Caffeine.
- vii) Spectrophotometric/UV estimations of Cholesterol.
- viii) Analysis of Lindane in BHC powder
- ix) Analysis of some common pesticides, insecticides, plastics and detergents.

**C- Purification of Solvents**

**(Total Laboratory Session 5)**

**(15 marks)**

**Practical-VI  
Organic Chemistry**

**Time : 6-8 Hrs. (One day Examination) Marks : 100**

- |   |          |
|---|----------|
| (1) Exercise-1 (Organic Synthesis) -    | 45 Marks |
| (2) Exercise-2 (Qualitative Analysis) - | 20 Marks |
| (3) Exercise-3 (Qualitative Analysis) - | 15 Marks |
| (4) Record -                            | 10 Marks |
| (5) Viva-Voce -                         | 10 Marks |

**Total - 100 Marks**

**Books Suggested:**

- 1) Modern Experimental Organic Chemistry-Royston M. Robert, John C. Gilbert, Lyu B. Rodewald, S.
- 2) Experimental Organic Chemistry- L. M. Harwood, C. I. Moody
- 3) Semi-microqualitative Organic analysis-N. D. Cheronis, B. Entrikin, E.M. Wodnett.
- 4) The Systematic identification of Organic compounds-R.L. Shrine, D. Curtin.
- 5) Quantitative Chemical analysis A.I. Vogel.
- 6) Vogel's textbook of quantitative analysis (Revised)-Bassett, R.C. Denney, G.H. Jeffery and
- 7) Experiment and technique in Organic chemistry-D. Pasto, C. Johnson and M. Miller.
- 8) Hand book of organic analysis qualitative and quantitative-H. Clark, Edward Arnold.

**SEMESTER-IV  
Paper XIII SPECTROSCOPY-II**

**Total Lectures: 60Hrs, 4 Hrs per week, 12 Hrs/unit**

**Total Marks-80**

**Unit-I : 12L**

**A) Raman spectroscopy:** Classical and quantum theories of Raman effects, Normal, Resonance and Laser Raman spectroscopies, Pure rotational and vibrational and vibrational rotational Raman spectra, selection rules, mutual exclusion Raman spectroscopy, coherent anti-Stokes Raman spectroscopy (CARS). Applications for the study of active sites of metalloproteins. Structure determination by symmetry selection rules (Normal Coordinate analysis), Rotational Raman- spectra, Vibrational Raman Spectra, polarization of light and Raman effect, structure elucidation from combined Raman and IR spectroscopy, applications in structure elucidation, Application of Raman spectroscopy to structural chemistry.

**B) Photoelectron spectroscopy:** Basic principle, classification of electron microscopy methods, photoelectric effect, ionization process, Koopmans theorem PES and X-PES, PES spectra of simple molecule, ESCA, chemical information from ESCA. Auger electron spectroscopy-basic idea. Scanning electron microscopy, working of SEM instrument surface characterization by spectroscopy and microscopy, (SEM/TEM). atomic force microscopy (AFM), application AFM, comparison of electron microscopy with electron Inversion photo emission, multi photo ionization, spin resolved photoionization.

**Unit-II : 12L**

**A) X-ray diffraction:** Interaction of x-ray with matter, scattering and diffraction. Bragg method Debye-Sherrer method of X-ray structural analysis of crystals, index reflection, identification of unit cell from systematic absence in diffraction pattern structure of simple lattice and x-ray intensities structure factor, its relation to intensity of electron density procedure for x-ray structure analysis.

**B) Electron diffraction:** Scattering intensity Vs scattering angle, Wierl equation, measurement techniques, elucidation of structure of simple gas phase molecules. Low energy electron diffraction and structure of surface.

**C) Neutron diffraction:** Scattering of neutrons by solids and liquids magnetic scattering, measurement techniques. Elucidation of structure of magnetically ordered unit cell.

**Unit-III : 12L**

**Electron Spin Resonance Spectroscopy:** Introduction, basic principle. zero field splitting and Kramer's degeneracy, factors affecting the  $g$  values, hyperfine splitting, hyperfine and super hyperfine coupling constants, determination of  $g$  values. Instrumentation, working of instruments, sensitivity, concentration, choice of solvent. presentation of ESR spectra, application of ESR to study the free radicals, structure determination, reaction velocities, McConnell relation, application to inorganic compounds including biological system and to inorganic free radicals such as  $\text{PH}_4^-$ ,  $\text{F}_2^-$ ,  $\text{BH}_3$ , determination of oxidation state of metals, EPR and EPR techniques The EPR of triplet states Structural applications to transition metal complexes. ESR spectrum when one electron is influenced by a single proton and one electron delocalized over two equivalent protons, difference between ESR and NMR

**Unit-IV :**

**12L**

**Mossbauer spectroscopy:** Basic principle, spectral parameters and spectrum display. Doppler shift. recoilless emission of radiation. The Mossbauer effect, isomer shift, quadrupole splitting, Nuclear quadrupole moment and EFG tensors, quadrupole coupling constants and asymmetry parameters, magnetic hyperfine splitting. Application of the techniques to the studies of 1. Bonding and structure of Fe<sup>2+</sup> and Fe<sup>3+</sup> compounds including those of intermediate spin (2) Sn<sup>2+</sup> and Sn<sup>4+</sup> compounds - Nature of M-L bond, coordination number, Structure and Detection of oxidation state and in equivalent MB atoms. Elucidation of structure of I<sub>2</sub>Br<sub>2</sub>Cl<sub>4</sub>, I<sub>2</sub>Cl<sub>6</sub>, Structural problems, Mossbauer spectroscopy of Biological Systems. pure NMR and Zeeman spectra of spin 1 and spin 3/2 systems the Towners-Dailey theory and interpretation of NMR in terms of bond characteristics. NMR <sup>57</sup>Fe spectra of complexes, other Mossbauer nuclei, applications.

**Unit-V :**

**12L**

Determination of Structures of Complex Organic Molecules by Spectroscopic Means: Problems based on IR, Mass, UV, PMR, <sup>1</sup>H NMR, <sup>13</sup>C NMR data and structure determination of organic molecules / inorganic compounds.

**Books suggested**

- 1) Spectroscopic identification of organic compound-RM Silverstein,GC Bassler and TC Morrill, John Wally
- 2) Introduction to NMR spectroscopy-R.Abrahm, Fisher and P loftus Wiely
- 3) Application of spectroscopy to organic compound-R Dyer,Printice Hall
- 4) Organic spectroscopy-William kemp,ELB with McMillan
- 5) Spectroscopy of organic molecule-PS Kalsi,Wiley,Esterna,New Delhi
- 6) Organic spectroscopy-RT Morrison,and RN Boyd
- 7) Practical NMR spectroscopy-ML Martin, Delpench, and D.Martyin
- 8) Spectroscopic methods in organic chemistry-DH Willson,I Fleming
- 9) Fundamentals of molecular spectroscopy-CN Banwell
- 10) Spectroscopy in organic chemistry-CNR Rao and R Ferraro
- 11) Photoelectron spectroscopy-Baber and Betteridge
- 12) Electron spin resonance spectroscopy-Wertz and R Bolten
- 13) NMR Basic principle and application-H Guntur
- 14) Interpretation of NMR spectra-Roy H Bible
- 15) Interpretation of IR spectra-NB Coulthop
- 16) Electron spin resonance theory and applications-W gordy
- 17) Mass spectrometry organic chemical applications ,H Banyon

**Semester IV  
Paper XIV  
General Analytical Chemistry**

Total Lectures: 60Hours, 4Hours per week, 12Hours/unit

**Total Marks: 80**

**Unit-I : Radiochemical methods of analysis:**

**12L**

- (A) Radiation detection and measurement : principle and working of ionization chemicals. multiplicative ion collection. reasons of multiplicative operation. proportional counters and Geiger Muller (GM) counters. principle and working of scintillation counters. semiconductor detectors (eg. HPGe). Gamma ray spectrometer.
- (B) neutron activation analysis : principle and methodology of neutron activation analysis, application of NAA in following branches of science.
  - (i) Material science,(ii) Geochemistry(iii) Archacology(iv) Life sciences / Biomedical science(v) Food and Nutrition(vi) Environmental science(Vii) Forensic science(viii) Cosmochemistry
 advantages of NAA. Sources of errors and limitations of NAA.
- (C) isotopic dilution analysis (IDA) : principle and method of isotope dilution analysis (IDA). substoichio metric IDA. comparision of IDA with NAA. Applications of IDA for the measurement of trace quantatites of organic and inorganic components in a given complex mixture. sources of errors and limitations of IDA.
- (D) Radiometric titrations : principle and method of radiometric titrations. types of radiometric titrations. applications of radiometric titrations.source of errors and limitations of radiometric titrations. Radioactivity tracers- Principal and applications

**Unit II :**

**Molecular photofluorescence and phosphorescence spectrometry: 12L**

Basic theory, instruments, different photonic and deactivation process (interval conversion, vibration, relaxation, intersystem crossing fluorescence, phosphorescence, external conversion etc.), their inter-relationships and differences □ energy level diagram, Morse curve □ principal types of electronic transitions, principal types of linkages in fluorimetric reagents, reagents, effect of substitution (on aromatics) upon photoluminescence, structural and environmental effects on photoluminescence, quenching and non-quenching extinction of fluorescence and probable mechanism for quenching, characteristics of  $\pi$ - $\pi$  states, spectra, mirror image rule, its violation and causes of violation delayed fluorescence, charge transfer process, structural factor favourable for fluorogenic reagents, fluorescence, immunoassay and its advantage over Radio-immunoassay, cations favouring fluorescent metal chelate formations. Fields of applications, merits and demerits of fluorometry, assessment as an ultratrace analysis technique. Principal types of reactions used in fluorimetric analysis. Analytical Applications. Phosphorimetry: Low temperature phosphorescence, Room temperature phosphorescence (RTP). Advantages and disadvantages. Applications. Chemiluminescence: Theory, measurement of chemiluminescence, mechanisms in analytical applications.

**Unit III : Optical Methods & Flow Injection Analysis : 12L**

□RF: Basic principle, instruments, excitation sources, energy dispersive and wavelength dispersive □RF techniques □ their advantages and disadvantages, matrix effects and their suppression, health hazards and safety. Applications.

Inductively Coupled Plasma Atomic Emission Spectroscopy (ICPAES): Principles, atomization and excitation, ICP-source, Instrumentation and applications

Flow Injection Analysis: Introduction, principal, theoretical aspects of FIA, techniques, pretreatment of sample in packed reactors, components of FIA apparatus, Factors affecting FIA and applications.

**Unit-IV : Food and Cosmetic Analysis: 12L**

**A) The chemical analysis of food:** Importance of food analysis, Determination of approximate composition: Moisture, fat, protein, fiber, carbohydrate, etc. □ quantitative analysis for food quality and safety - Determination of minerals, vitamins, anti-oxidants, toxins and preservatives. General idea of the properties of drugs for their characterization and quantification. □ quantitative methods of analysis - Gravimetric and volumetric analysis, potentiometry, coulometry and amperometry titrations, colorimetry, fluorimetry and polarimetry methods, Analysis of artificial sweeteners in food and colouring agents.

**B) Analysis of Cosmetics-**Composition of creams and lotions- determination of water, propylene glycol, non-volatile matter and ash content. Determination of borates, carbonates, sulphates, Phosphates, chlorides, titanium and zinc oxides.

**Analysis of face powder-** estimation of boric acid, Mg, Ca, Zn, Fe, Al and Ba.

**Analysis of deodorants and antiperspirants-**composition, analysis of fats and fatty acids, boric acid, magnesium, calcium, zinc, iron, titanium, aluminium, phenol, hexachlorophenone, methanamine, sulphonates and urea

**Unit V : Forensic & Fuel analysis: 12L**

**Forensic Analysis:** Special features of forensic analysis, sampling, sample storage, sample dissolution, classification of poisons, lethal dose, significance of LD-50 and LC-50. general discussion of poisons with special reference to mode of action of cyanide, organophosphate and snake venom. Estimation of poisonous materials such as lead, mercury and arsenic in biological samples.

**Fuel analysis :** Solid, Liquid and gaseous fuels. Characteristics of ideal fuels. Ultimate and proximate analysis of coal, heating values, grading of coal, liquid fuels-flash point, aniline point, knocking, antiknock compounds, octane number, cetane number and carbon residue. Gaseous fuels, producer gas and water gas, determination of calorific value. Analysis of fuel Gas. Numerical problems.

**Books Suggested:**

1. Day and Underwood: Quantitative Analysis
2. A. I. Vogel: A text book of quantitative Inorganic analysis.
3. Flaschka: EDTA Titration
4. Meites and Thomas: Advanced Analytical Chemistry.
5. G. W. Ewing: Instrumental Methods of Chemical Analysis.

6. R. S. Drago: Physical Methods in Inorganic Chemistry
  7. G. D. Christian: Analytical Chemistry
  8. S. M. Khopkar: Basic Concept of Analytical Chemistry.
  9. Kolltath and Ligane: Polarography
  10. R.D.Braun: Instrumental methods of chemical Analysis
  11. Willard, Merritt and Dean: Instrumental methods of Analysis
  12. Strouts, Crifillan and Wison: Analytical Chemistry.
  13. □ W. T. Spinks and R. □ Woods: Introduction to Radiation Chemistry.
  14. S. A. Skoog and D. W. West: Fundamental Of Analytical Chemistry
  15. R. V. Dilts: Analytical Chemistry
  16. Nuclear and radiochemistry by Friedlander, Kennedy and Miller.
- 1□ **Essentials of nuclear chemistry by H. □ Arnikar**

**Semister IV**

**Paper-XV**

**Special Paper-III**

**Inorganic Chemistry (Photoinorganic & Organometallic Chemistry)**

**Total Lectures: 60Hrs, 4 Hrs per week, 12 Hrs/unit**

**Total Marks-80**

- Unit-I : 12L**  
**A) Basics of Photochemistry:** Absorption, excitation, photochemical laws, quantum yield, electronically excited states-life times-measurements of the times. Flash photolysis, stopped flow techniques, Energy dissipation by radiative and no-radiative processes, absorption spectra, Frank-Condon principles □ photochemical stages-primary & secondary processes.  
**B) Properties of e<sup>-</sup> excited states:** Photochemical kinetics, Calculation of rates of radiative processes.
- Unit-II : 12L**  
**A) Ligand field photo chemistry of transition metal complexes.** Electronically ligand field excited states of metal complexes containing  $d^1$  to  $d^{10}$  configuration, , charge transfer spectra, charge transfer excitations, methods for obtaining charge transfer spectra Photochemistry Cr(III) of complexes : Photo-substitutions, properties of ligand field excited states ,Photo aquation reactions, photolysis rule , photoisomerization , photo recimization, photoanation reactions, Sensitizer, Types of sensitizer molecules, energy transfer process, Mechanism of photo sensitization, photo reactive excited state, The Doublet hypothesis, Role of quartet excited states, Photochemistry of Co(III) complexes : Introduction, energy level diagram, Photoaquations in Co(III) amine, Co(III) cyanide complexes, Fe(II) low spin complexes., Ru(II) ammine derivative complexes, Photo redox properties of (Ru(III) complexes, Ce(III) and Ce(IV) complexes. Application of redox processes of electronically excited states for catalytic purposes, transformation of low energy reactants in to high-energy products, chemical energy in to light.
- Unit III : 12L**  
**Photochemical reaction on solid surface:** Introduction,Basic principle of Photocatalysis, Photocatalysts, Phoreactive oxides, relation between solar spectrum & band gap, acceptor and donor level of photocatalyst, generation of electron □holepair, Needs of modification of photo catalysts, semiconductor supported metal oxide systems, synthesis methods, Characterization ,water photolysis, application of photocatalytic materials for degradation of organic pollutants, end product of organic pollutants with suitable examples.Nnitrogen fixation & carbon dioxide reduction.
- Unit-IV : 12L**  
**Organotransition metal chemistry:**  $\sigma$ -Bonded transition metal-alkyls, - aryls, -alkenyls(vinyls), -alkynyls(acetylides), reactions in  $\sigma$ □organyls - homolytic cleavage, reductive elimination, electrophilic cleavage, insertion,  $\beta$ -metal hydrogen elimination,  $\alpha$ -abstraction or  $\alpha$ -elimination  
**Transition metal organyls with metal-carbon multiple bonding:** Transition metal-carbenes, - carbynes, -bridging carbenes and -carbynes, reactions of carbene/ and carbyne complexes □ ligand substitution, nucleophilic, electrophilic attack, dismutation, ligand coupling reactions  
**Organotransition compounds with multicenter bonds (non-classically bonded):** Concept of hapticity, transition metal complexes of alkenes, □iese salt, allenes, alkynes, allyls, butadienes□ cyclic  $\pi$ -metal complexes of cyclobutadienes, cyclopentadienyls, arenes, cycloheptatrienyls and cyclooctatetraenes□ reactions and bonding in ferrocene□ stereochemical non-rigidity in organometallic compounds and fluxional compounds, bimetallic and cluster complexes.
- Unit-V : 12L**  
**Transition Metal Pi -Complexes-Carbon multiple bonds:** Transition metal complexes with unsaturated organic molecules like alkenes, alkynes, allyl, diene, dienyl, arene & trienyl complexes: Preparations,properties,nature of bonding and structural features.Important reactions relating to nucleophilic & electrophilic attack on ligands to organic synthesis.  
**Organometallics as catalysts:** Bonding and structure transition metal complexes, applications in reactions such as hydrogenation, Hydrognation by Willkinsons catalyst, synthesis of chiral pharmaceuticals, □lefin metathesis, heterogeneous catalysis: □iegler Natta Polymerization, Water gas reduction ,carbonylation, coupling reactions - Suzuki coupling, Heck coupling and related cross coupling reactions. Alkene oligomerization and metathesis. Catalytic oxidations and reductions, epoxidation, dihydroxylations, decarbonylation, olefin isomerization, arylation, polymerization, asymmetric synthesis, heterogenised homogeneous catalysts, phase transfer catalysis, atalysis in green chemistry

**Books:**

1. Elschenbroich Ch. and Salzer A.: Organometallics, VCH, Weinheim, N.
2. Balzani Vand Cavassiti V.: Photochemistry of Coordination compounds, AP, London
3. Purcell K.F. and Kotz C., An Introduction to Inorganic Chemistry, Holt Soudner, Japan.
4. Rohtagi K.K. and Mukharjee, Fundamentals of Photochemistry, Wiley eastern
5. Calverts G. and Pitts N., Photochemicals of Photochemistry, John Wiley
6. Wells, Introduction of Photochemistry
7. Paulson, Organometallic Chemistry, Arnold
8. Rochow, Organometallic Chemistry, Reinhold
9. Weiss, Organometallic Chemistry, Reinhold
10. Gilbert A. and Baggott, Essential of Molecular Photochemistry, Blackwell Sci. Pub.
11. Turro N. and Benjamin W.A., Molecular Photochemistry
12. Cox A and Camp, T.P. Introductory Photochemistry, McGraw-Hill
13. Kundall R.P. and Gilbert A, Photochemistry, Thomson Nelson Coxon and Halton B., Organic Photochemistry, Cambridge University Press.

**Semester IV**

**Paper-XVI**

**Special Paper-IV**

**Inorganic Chemistry (Materials Chemistry)**

**Total Lectures: 60Hrs, 4 Hrs per week, 12 Hrs/unit**

**Total Marks-80**

- Unit-I : Glasses, Ceramics & Composite materials: 12L**  
**Glass:** Glassy state and its properties, classification (silicate and non-silicate glasses). Manufacture and processing of glass. Glassy state, glass formers and glass modifiers.  
**Ceramics:** Ceramic structure. Mechanical properties. High technology ceramics and their applications.  
**Clays and refractory materials:** Classification, structure and modifications of clays. Properties and applications of clays.  
**Refractories:** Classification, properties and applications. Microscopic composites.  
**Composite materials:** Definition, glass transition temperature, fibres, concrete and asphalt materials, polymer composites, application  
**Ceramic & Refractory:** Introduction, classification, properties, raw materials, manufacturing and applications.
- Unit II : 12L**  
**A) Liquid Crystals:** Mesomorphic behaviour, thermotropic liquid crystals, positional order, bond orientational order, nematics & smectic mesophases, smectic-Nematic transition clearing temperature-homeotropic, planer & schlieren textures twisted nematics, chiral nematics, molecular arrangement in smectic A & smectic C phases, optical properties of liquid crystals. Dielectric susceptibility & dielectric constants. Lyotropic phases & their description of ordering in liquid crystals.  
**B) Bio-materials:** Biomineralisation, controlled formation of biological composites, bone & other mineralised tissues, materials of construction, applications (General aspect only).
- Unit-III : Nano Chemistry: 12L**  
**Introduction:** Definition of nanoscale materials, different types, different physical and chemical synthetic routes, characterization of nanoscale materials by modern instrumental techniques.  
**Physical and Chemical Properties of Nanoscale Materials:** Electrical properties, magnetic properties, optical extinction properties, unique optical signatures of various nanostructures, fluorescence, chemical reactivity, self-assembly of various nanostructures and its importance.  
**Catalytic Aspects of Nanoscale Materials:** Catalysis using nanoparticles of metals and metal oxides with different sizes and shapes, useful chemical conversions using nanoparticles.  
**Nanoscale Materials in Emerging Technologies:** Useful properties that can be exploited for applications, applications in the areas such as environmental remediation, adsorption, drug delivery, medical imaging, future prospects, precautions in using nanoparticles.
- Unit IV : Nanoporous Materials: 12L**  
 Introduction, zeolites & molecular sieves, Classifications, fundamental properties of zeolites, qualitative & quantitative determination of surface acidity, Hydrothermal synthesis of zeolites, factors affecting the zeolite preparations, modification, methods of characterizations, & catalytic applications.  
 Catalysis: Basic principals, types, industrial requirements, classification, theories of catalysis, Types of homogeneous and heterogeneous catalysts, Advantages and disadvantages, thermodynamic and kinetic aspects. Essential properties of catalysts. Characterization of catalysts  
**Solid State Reactions:** Types, sintering, nucleation, Factors influencing the reactivity of solids, Precursors to solid state reactions, Tammann and Hedvall mechanism, Wagner's diffusion theory of reaction, Material transport in solid state reaction, counter diffusion, Kirkendall effect, Huttig's mechanism, Kinetic model: Reaction in powder compact, parabolic rate law, Fick's rate equation.

Unit V : 12L

A) **Fertilizers:** Different types of fertilizers. Manufacture of the following fertilizers: Urea, ammonium nitrate, calcium ammonium nitrate, ammonium phosphates □ polyphosphate, superphosphate, compound and mixed fertilizers, potassium chloride, potassium sulphate  
 B) **Coordination Polymers:** Homo and heterocatenated inorganic polymers. Polyphosphazenes: synthetic routes and bonding features, polymerization of organo/organometallic substituted phosphazenes and their applications. Polysilanes: sigma bond delocalization in polysilanes and its implications, synthesis and characterization of polysilanes. Polysiloxanes: synthetic routes via anionic and cationic polymerization, properties and environmental aspects. Dendritic macromolecules based on inorganic elements. Coordination polymers. Polymers based on Boron, Borazine, polymeric compounds of sulphur, polythiazoles, silicates with reference to preparation, properties, structures, bonding and applications. Natural polymers and reactions yielding coordination polymers. Synthesis of coordination polymers.

**Books Suggested:**

1. Barsoum, M.W., Fundamentals of Ceramics, McGraw Hill, New Delhi
2. Ashcroft, N.W. and Mermin, N.D., Solid State Physics, Saunders College
3. Callister W.D., Material Science and Engineering, An Introduction, Wiley
4. Keer, H.H., Principles of Solid State, Wiley Eastern
5. Anderson □C., Lever K.D., Alexander □M and Rawlings, R.D., ELBS
6. Gray G.W. Ed. Thermotropic Liquid Crystals, John Wiley
7. Kelkar and Hatz Handbook of Liquid Crystals, Chemie Verlag.
8. Kalbunde K.I., Nanoscale Materials in Chemistry, John Wiley, N□.
9. Shull R.D., McMichael R.D. and Swartzendrub L. □, Studies of Magnetic Properties of Fine particles and their relevance to Materials Science, Elsevier Pub. Amsterdam
10. Breck D.W., Zeolite Molecular Sieves: Structure Chemistry and Use, Wiley Chichester, Eng.
11. Morrish A.H., Haneda K., Zhou □. □ In Nanophase Materials: synthesis, properties, applications, Kulwer, London.
12. Shriver & Atkins. Inorganic Chemistry, Peter Atkins, Tina Overton, Jonathan Rourke, Mark Weller and Fraser Armstrong, 5th Edition, Oxford University Press (2011-2012)
13. Adam, D.M. Inorganic Solids: An introduction to concepts in solid-state structural chemistry. John Wiley & Sons, 1974.
14. Poole, C.P. & Owens, F. □ Introduction to Nanotechnology John Wiley & Sons, 2003.
15. Rodger, G.E. Inorganic and Solid State Chemistry, Cengage Learning India Edition, 2002.

**Semester IV**

**Paper XV**

**Special Paper-III Organic Chemistry (Organic Synthesis: II)**

**Total Lectures: 60Hrs, 4 Hrs per week, 12 Hrs/unit**

**Total Marks-80**

Unit-I : 12L

**Application of organometallics in organic synthesis**

A) **Organometallic Reagents** □rgano Lithium, Magnesium, Mercury, zinc and copper reagents, preparation using transmetallation, functionalized zinc and copper reagents, synthetic applications And Cram rule. □rgano tin reagents, hydrostannation reaction and synthetic utility □rgano boron and aluminium reagents, alkyl and aryl derivatives, synthesis and examples of applications in C-C bond forming reactions.

B) **Organo transition metal reagents:** Metal (Fe, Cr, Mo, Ni, Co, Rh) carbonyl compounds in organic synthesis. Metal (Cr, Fe, Ru) arene complexes, synthesis and structure. Activation of arene nucleus and side chain. Nucleophilic substitution and addition of arene.

Metal (Fe, Pd) ene, diene and dienyl complexes, metal complexes as protecting groups, activation towards nucleophilic addition reaction synthetic utility.  $\pi$ -allyl palladium, nickel and iron complexes, synthesis and their synthetic utility.

Metal Cobalt alkyne complexes, protection of triple bond, Metal (Rh, Ir) catalyzed C-H activation reactions and their synthetic utility.

C) **Metalloenes:** Introduction, Synthesis and Chemical Reactivity of Ferrocene, Cobaltocene, Nickelocene, Copper and Rhodium Based Carbene & Nitrene Complexes

Unit-II : 12L

**Designing the synthesis based on retrosynthetic analysis**

A disconnection approach to the synthesis of organic compound. Different consideration in designing target molecule, concept of synthonss, FGI, Chemoselectivity, regioselectivity, specificity, stereoselectivity, general strategy choosing a disconnection. Types of bond disconnection, some of the applications of these concepts in designing the synthesis of common important class of the compounds.

**Ring synthesis:** Saturated heterocycles, synthesis of 3, 4, 5 and 6- membered rings. b) Synthesis of some complex molecules by Retrosynthetic analysis of following compounds: Camphor, Reserpine, and Vitamin-D2.

- Unit-III :** **12L**  
**A) Protection and Deprotection of functional groups** Protection and deprotection of functional groups like, hydroxyl, amino, carbonyl and carboxylic acids groups, techniques employed for these.  
**B) Phase Transfer Catalysis:** □uaternary ammonium and phosphonium salts, Crown ethers. Their methods of preparation and application in □rganic Synthesis, Mechanism of Phase transfer reaction. ozone phase transfer catalyst,
- Unit-IV :** **12L**  
**Reagents in Organic Synthesis:** Use of following reagents in Synthesis and functional group transformations such as complex metal hydrides, Gillmen reagents, Lithium dialkyl cuprate LDA, DCC, Trimethyl silyl Iodide, Tributyl Tin hydride, Woodward and Prevost Hydroxylation, DD□, Chloranill, Peterson Synthesis, Becker □east. Periodic Acid and periodate, Diazomethane, Selenium Dioxide, Ru□4, IB□, DMP, Heck Reaction, Mukaiyama Reaction
- Unit-V :** **12L**  
**Heterocyclic Compounds:** Nomenclature and familiarity with the heterocyclic ring (3- 7 members containing up to 3 heteroatoms). Detailed chemistry of Pyrozole, imidazole, oxazole, thiazole, thiazine, diazines, triazines pyrimidines, pyrazines and zepines, oxepines, Indoles, Benzofurans, □uinolines Flavones, Chromones, Coumarines, Phenithiazines, Azitidines

**Books suggested :**

- 1) Principle of organic synthesis. R□C Norman & □M coxon
- 2) Modern synthetic reaction. H.□.House W.A.Benjamin
- 3) □rganic synthesis, The disconnection approach-S. Warren
- 4) Designing organic synthesis-S. Warren
- 5) Some modern methods of organic synthesis-W. carruthers,
- 6) Advance organic reaction. Mechanism & structure-□erry march
- 7) Advance organic chemistry Part-B-F.A. caray & R□sundberg, plenum P.
- 8) □rganic reaction and their mechanism-PS kalsi
- 9) Protective group in organic synthesis-TW Greene, & PGM
- 10) The chemistry of organo pphosphorous-A□kirbi, & SG Warren
- 11) □rganic silicon compound-C. Eabon
- 12) □rganic synthesis via Boranes-HC. Brown
- 13) □rganic borane chemistry-TP onak
- 14) □rganic chemistry of boron-W. gerrard
- 15) □rganic Chemistry Reaction: Moondy
- 16) Heterocyclic chemistry :□oule & Smith (Van Nostrand).
- 17) Heterocyclic chemistry :R. K. Bansal: (Wiley E).
- 18) Principals of modern heterocyclic chemistry :L. A. Paquette
- 19) The structure and reactions of heterocyclic compounds :M. H. Palamer.
- 20) Advances in Heterocyclic chemistry : A. R. Katritzky:
- 21) □rganic Chemistry: Clayden, Greeves, Warren & Wothers

**SEMESTER –IV**

**Paper XVI**

**Special Paper-IV : ORGANIC CHEMISTRY (Applied and Medicinal Chemistry)**

**Total Lectures: 60Hrs, 4 Hrs per week, 12 Hrs/unit**

**Total Marks-80**

- Unit-I :** **Polymers, Dyes and Agrochemicals:** **12L**  
**A) Mechanism of polymerization,** study of polyesters, polyamides, PVC, polystyrene, Polyvinyl acetate and polyvinyl alcohol, polythenes, viscous rayon. Synthesis of polyethylene, polypropylene.  
 Synthetic Rubber: Styrene-butadiene, Butyl polyisoprene, polyurathrene Vulcanization mechanism, phenol formaldehyde resin, stereo regulated polymers. Atactic, Isotactic and Syndiotactic polymers. Plasticizers, Foaming agents. Antioxidants for polymers,  
**B) DYES:** General Introduction, . optical brighteners, thermal sensitive dyes, dispenses dyes. Fiber swelling in dyeing . Use of carriers in dyeing . Use of heat energy in dyein , study of quinoline yellow, cyamine dye, ethyl red, methylene blue, Alizarin, cyamine-green, fluorescein, cosin, erythrosine, Rhodomines and Indigo  
**C) Agrochemicals:**  
 i) **Carbamate pesticides:** Introduction, Carbaryl, Bayon, □iram.  
 ii) **Organophosphorous pesticides:** Malathion, Monocroptophos, Dimethoate.  
 iii) **Plant growth regulators:** General survey synthesis of simple compounds.
- Unit-II :** **12L**  
**General aspects of drug:** Historical, Definitions used in drug chemistry-pharmacy, pharmacology, pharmacodynamics, pharmacodynamic agents, metabolite and antimetabolites, gram positive and gram negative Bacteria, Virus, Actinomucetes, Mutation, Chemotherapy, Nomenclature of medicinal compounds. Classification of drugs on basis of their Therapeutic actions. Chemotherapeutic agents Cancer chemotherapy, Synthesis of mechloroethamine, cyclophosphamide, Mephalan, uracils, mustards. Recent development in cancer chemotherapy. Pharmacodynamic agents Mechanism of Chemotherapeutic action: . Biological defences . Chemical defences, Surface active agents, Metabolic Antagonism Assay of Drugs: Chemical assay, Biological assay, Immunological assay

**Unit-III**

**12L**

**DRUGS DESIGN:** Classification of Drugs, procedures followed in drug design. Concept of lead compound and modification concept of Prodrugs and Softdrugs structure activity relationship (SAR) Factors affecting bioactivity resonance, inductive effect, isosterism, Biosterism, Spatial consideration, theories of drug activity occupancy theory, Rate theory induced tit theory, Quantitative structure activity relationship. History and development of QSAR, Concept of drug receptor interaction, Physico-Chemical parameter. Lipophilicity, Partition coefficient Electronic ionization constants, Steric Shelton and surface activity parameters and redox potential. Free Wilson analysis, Hansch analysis LD-50, ED-50 (Mathematical derivatives of equations included) Ligand-Based Drug Design, Diversity-oriented Synthesis for Drug Design, Structure-Based Drug Design, Fragment-Based Drug Design, Natural Products-Based Drug Discovery, Diversity-oriented Synthesis in Drug Discovery, Virtual Screening

**Unit-IV : Classification of Drugs- I**

**12L**

Synthesis, mode of actions, Pharmacokinetics, pharmacodynamic data and secondary metabolism of following Drugs

- A) Antibiotics:** Introduction, Penicillin V And G, Streptomycin, Chloramphenicol, Tetracyclins.  
**B) Antimalarial :** Chemotherapy of malaria, Aminoquinolines, pamaquine, chloroquine and sulphones.  
**C) Antipyretic and Analgesic:** Aspirin, salol, phenacetin, antipyrin:  
**D) Anti-inflammatory:** Ibuprofen, Oxycodone, Diclofenac, Indomethacin.  
**E) Sedatives & Hypnotics:** Barbiturates, mode of action, diazepam, caffeine, Mescaline, hermine

**Unit-V : Classification of Drugs- II**

**12L**

Synthesis, mode of actions, Pharmacokinetics, pharmacodynamic data and secondary metabolism of following Drugs

- A) Antitubercular & antileprotic :** Ethambutol, Isoniazide & Dapsone  
**B) Anaesthetics :** Lidocaine, Thiopental.  
**C) Antihistamines:** Phenobarbital, Diphenhydramine.  
**D) Tranquilizers:** Diazepam, Trimeprazine.  
**E) Cardiovascular:** Synthesis of diltiazem, quinidine, methyl dopa

**Books Suggested:**

- 1) Pesticides: R. Cleymlin
- 2) Chemistry of Pesticides: K. H. Buchel
- 3) The Chemistry of Pesticides and formulations: N. N. Melikov
- 4) Chemistry of Synthetic Dyes Vol- 1 to 7: K. Venkataraman
- 5) Colour Chemistry: Allan
- 6) Text book of organic medical and pharmaceutical
- 7) chemistry: Wilson, Gisvold & Dorque
- 8) Strategies for Organic Drug synthesis and Design, D. Lednicer, Wiley
- 9) Medicinal Chemistry: A. Kar
- 10) Text book of organic medicinal chemistry-wilson, gesvold
- 11) Medicinal chemistry Vol I & II-Burger
- 12) Synthetic organic chemistry-Gurudeep chatwal.
- 13) A textbook of pharmaceutical chemistry-Layshree Ghosh
- 14) Synthetic dyes series-venkataraman
- 15) Chemistry process industries-shreve & brink paquette
- 16) Introduction to medicinal chemistry-A Gringuadge
- 17) The Organic Chemistry of Drug design and Drug action, R. B. Silverman Academic press.
- 18) Text book of Polymer Science: F. W. Billmeyer
- 19) An introduction to drug design-SS pandey, & R demmock
- 20) Goodman and Gilman's pharmacological basis of therapeutics-
- 21) Strategies for organic drug synthesis & design-D lednicer
- 22) Polymer science-v govarikar
- 23) Principle of polymer chemistry-Pflory
- 24) An outline of polymer chemistry-james q.allen
- 25) Organic polymer chemistry-K Saunders

**Semester IV**

**Physical Chemistry Special Paper III  
Paper XV**

**60 Hours (4-Hours/week)**

**80 Marks**

**12 hours/Unit**

**Unit-I : Liquid Crystals:**

**12L**

- A) Liquid State:** The vacancy theory of liquids, free volume of liquid, physical properties of liquids, Kelvin equation for Volume Pressure of droplet, Laplace equation and Young Laplace equation. Viscosity, effect of Temperature on viscosity and Reynolds number. 6L  
**B) Liquid Crystal, VPT diagram, thermography, LCD and seven segment cell, classification of thermotropic crystals: Smectic, Nematic, Cholesteric, Disc shaped and polymer liquid crystal. Polymorphism in thermotropic liquid crystal, Pressure induced mesomorphism. 6L**



<b>Unit-II</b>	<b>: Phase Equilibria:</b>	12L
	Phase rule, derivation of Gibbs phase rule, Liquid Helium system(one component), Two component system- Type A- simple eutectic system, Lead-silver, Bismuth-Cadmium system, potassium iodide water system. Type B- formation of compounds with congruent melting point, Ferric chloride water system, formation of compound with incongruent melting point, calculation of eutectic point and eutectic composition, Three component solid liquid system- Acetic acid chloroform water system and system containing two salt and water.	
<b>Unit-III</b>	<b>: Kinetics in Liquid solutions:</b>	12L
	Introduction, Theory of Absolute Reaction rates in ideal solutions, theory of reaction rates for ions in solution, Linear Free energy relationship, Mechanistic Deductions used in Hammett Equation, Relaxation Time for simple reaction in solution, Kinetic Isotope effect, Diffusion controlled reaction, Full macroscopic and partial macroscopic diffusion controlled and ionic reaction.	
<b>Unit-IV</b>	<b>: Chemical kinetic methods:</b>	12L
	A) Bioelectrochemistry: Membrane Phenomena Applications of Donnan's Membrane equilibria, Bioelectrodes, Electrocardiogram, Membrane Potentials.	6L
	B) Electrocatalysis: Introduction, Electropower of electrolysis, Mechanism of Electrocatalysis, Bioelectrocatalysis, immobilization.	6L
<b>Unit-V</b>	<b>: Photochemical Reaction Dynamics:</b>	12L
	Reaction Kinetics of thermal hydrogen-bromine reaction, reaction kinetics of photochemical hydrogen-bromine reaction and hydrogen chlorine reaction, reaction kinetics of decomposition of ethane, reaction kinetics of pyrolysis of acetaldehyde. Oscillatory reactions, Homogeneous catalysis, Acid base catalysis, Enzyme catalysis.	

**Books Suggested:**

- 1) Physical chemistry by P.W. Atkins & dePaula 7Th Edition
- 2) Chemical Kinetics by K. Laidler. 3rd Edition. Pearson Education.
- 3) Liquid State by A. Pryde.
- 4) Thermotropic Liquid Crystals by G.W. Gray, Wiley
- 5) Hand Book of Liquid Crystals by Kelkar & Hatz, Chemie Verlag.
- 6) A Dynamic Liquid State, A. F.M. Barton, Longman.
- 7) Chemical Kinetics & Dynamics by I. Steinfeld, S. Francisco & W.L.Hase. Prentice Hall. 1989.
- 8) Kinetic & Mechanism of Chemical Transformation by Rajaram & Kuriacose, McMillion.
- 9) Advanced Physical Chemistry by Gurdeep Raj, Goel Publications.
- 10) Physical Chemistry by Puri Sharma Pathania

**Semester IV  
Paper- XVI  
Special Paper-IV  
Physical Chemistry**

**60 Hours (4-Hours/week)**

**80 Marks 12 hours/Unit**

<b>Unit-I</b>	<b>: Nuclear reactions:</b>	12L
	Bath's notation, types of nuclear reactions, conservation in nuclear reaction, reaction cross section, compound nucleus theory, Experiments of Ghoshal, of Alexander and Simonoff specific nuclear reactions, trans uraniens, photonuclear reactions, thermonuclear reaction, fusion reactors	
<b>Unit-II</b>	<b>: Nuclear fission:</b> Process of nuclear fission, fission fragments and their mass and charge distribution. Fission energy, fission cross-section and threshold. Theory of nuclear fission, fission neutrons, other types of fissions.	12L
<b>Unit III</b>	<b>: Nuclear Reactors</b>	12L
	The fission energy, natural uranium reactor, the classification reactor, critical size of thermal reactor the breeder reactor, reprocessing of spent fuel, nuclear waste management, Nature's nuclear reactors.	
<b>Unit-IV</b>	<b>: Radiation Chemistry :</b> Radiation chemistry, interaction of radiation with matter, passage of neutron through matter, interaction of gamma radiation with matter, unit of measuring radiation absorption, radiation dosimetry, and free radicals in water, radiolysis, and radiation induced colour centers in crystals.	12L
<b>Unit-V</b>	<b>Applications of radioactivity and Dosimetry:</b> Probing by isotope typical reactions involved in preparation of radioisotopes, the Szillard Chalmer's reaction, cow and Milk system, Radiochemical principles in the use of tracers, typical applications of radioisotopes as a tracer, uses of nuclear reaction, radioisotopes as a source of energy.	12L

**Books Suggested:**

- 1) Introduction to radiation chemistry by W.T. Spinks and R. Woods.
- 2) Essentials of Nuclear chemistry by H. Arnikaar.
- 3) A Dynamic Liquid State, A. F.M. Barton, Longman.
- 4) Chemical Kinetics & Dynamics by I. Steinfeld, S. Francisco & W.L.Hase. Prentice Hall. 1989.
- 5) Kinetic & Mechanism of Chemical Transformation by Rajaram & Kuriacose, McMillion.
- 6) Advanced Physical Chemistry by Gurdeep Raj, Goel Publications.
- 7) Physical Chemistry by Puri Sharma Pathania

**Semester IV Paper XV  
Special Paper III  
Industrial Chemistry (Polymers, Dyes and Paints)**

60 Hours (4-Hours/week)

80 Marks 12 hours/Unit

- Unit – I :** 12L  
**Polymer Chemistry:** Basic concepts, nomenclature, degree of polymerization, classification of polymerization reactions, thermodynamic. Types of polymerization: dendrimer, copolymerization, block copolymerization, graft copolymerization, stereo isomers, isotactic and syndiotactic polymers. Mechanism of polymerization: Free radical and ionic □ characterization and rheology of polymers, heterogeneous polymerization, □iegler-Natta catalysis.
- Unit – II :** 12L  
**A) Commercial polymers:-** Manufacturing process, properties and uses of nylon-66, polyethylene, polypropene, polyvinylchloride, polystyrene, teflon and polybutene. Effect of stereochemistry on the structure and properties of polymers.  
**B) Degradation of polymers:** □xidation, thermal, photo and hydrolytic degradation methods.
- Unit – III :** 12L  
**Dyes:** Introduction, classification of dye on the basis of mode of application and structure dye intermediates, preparation of dye intermediates, structural features of a dye □ preparation and applications of picric acid, methyl orange, fluorescence, methyl red, indigo phthalenes, xanthenes, cyanine, anthraquinone.
- Unit - IV:** 12L  
**Paper and Pulp:** Raw materials, classification, methods of pulping, production of sulphate and sulphite pulp, general principles of some mechanical and chemical pulping kinetics. **Paper industry:** Production of paper, wet process, paper properties testing, process instrumentation □ Emission: Solid and gas waste □ Applied processes and techniques: Sizing, coating, dyeing, addition of chemicals, and calendering □ Fibre recovery: Broke system
- Unit - V:** 12L  
**A) Paints and Pigments:** Introduction of paints, ingredients and classification, new technologies □ properties of coatings □ solvents, plasticizers, dyes and bioactive additives □ paint formulations, testing and evaluation. Pigments: Introduction, classification and general physical properties.  
**B) Corrosion:-** 12L  
 Introduction, Principle of corrosion, Types of corrosion relevant to chemical industries, Mechanism of electrochemical corrosion, Factor influencing corrosion, Corrosion testing methods - Weight loss method, electrochemical approach, corrosion rate at short time intervals. Mechanism of corrosion and Corrosion prevention Methods- Galvanizing, tinning and electroplating. Corrosion Hazards and its industrial implications.

**Books Suggested-**

- 1) Textbook of polymer science by F. Bill Mayer, Wiley Inter Science.
- 2) Polymer Science by V. Govarikar, N. Viswanathan and □ Sreedhar, New Age International (P) Ltd. Publishers New Delhi.
- 3) Plastic materials, □A. Brydson, Newnes-Butterwarths (London)
- 4) Polymer science, Bill meyer, F. W. □. □ohn Wiely & sons
- 5) Introduction to plastics, □H. Brison and C.C. Gosselin, Newnes, London
- 6) Polymeric Materials, C. C. Winding and G. D. Hiatt McGraw Hill Book Co. Polymer Science by Gowarikar
- 7) Physical chemistry of polymers by D. D. Deshpande, Tata McGraw Hill.
- 8) Principles of polymer chemistry By P. □ Flory, Cornell Univ. Press.
- 9) Introduction to polymer chemistry by R. B. Seymour McGraw Hill.
- 10) A Practical Course in polymer chemistry by S. □ Pnnea, Pergamon press.
- 11) Labortary preparation of macro chemistry by E. M. M. Effery McGraw Hill.
- 12) Synthetic dyes by Venkatram (V □ L I & II)
- 13) Fundamental processes of dye chemistry, by Fietz.
- 14) Dyes and Intermediates by Adrahaedt.
- 15) Paints, coatings and solvents by D. Staye
- 16) Paints and surface coating theory and practice by R. L. Lambourna
- 17) Pigments handbook by T. C. Patton
- 18) Coating technology handbook by D. Satas

**Semester IV Paper XVI  
Special Paper IV**

**Industrial Chemistry (Chemical Process Industries, Green Chemistry and Process Economics)**

60 Hours (4-Hours/week)

80 Marks 12 hours/Unit

- Unit – I :** 12L  
**Agrochemicals :** General introduction, synthesis, structure and application:  
**Insecticides:** DDT, BHC, aldrin, endosulfon, malathion, parathion.  
**Herbicides:** 2,4-dichloro phenoxy acetic acid, dalapon, paraquat, banalin, butacarb, alachlor, suphonyl ureas.  
**Fungicides:** Boardeaux mixture, copper oxychloride, benomyl.  
**Rodenticides:** Warfarin, sodium monofluoroacetate, zinc phosphide.  
**Pesticides:** Endosulphan, methyl parathion.

**Unit – II :** **12L**

**A) Industrial Gases:** Heavy chemicals and production of gases. Chemistry, manufacture, storage, hazards & uses.- Hydrogen, Oxygen, nitrogen, carbon dioxide, chlorine, fluorine, SO<sub>2</sub>, phosgene, acetylene, argon, neon & helium.

**B) Fertilizers:** Fertilizer industries in India, Manufacture, uses and major engineering problems of Ammonium sulphate, Urea, Ammonium nitrates, Ammonia, Nitrogenous fertilizers, Ammonium Phosphate, superphosphates, complex fertilizers.

**Unit – III :** **12L**

**Pharmaceuticals :** Product profile study of the following drugs and intermediates with particular stress on the manufacturing process engineering problems involved, quality control and equipment

- i) Sulpha drugs:- Sulphaguanidine, sulphamethoxazole.
- ii) Antimicrobial:- chloramphenicol, streptomycin, Tetracyclines. Amoxiciline, Erythromycine
- iii) Analgesic:- anti inflammatory, Acetyl Salicyclic acid, Ibuprofen, paracetamol.
- iv) Vitamin Vit. A, Vit. B<sub>6</sub>, Vit. C
- v) Barbiturates:- Pentobarbital
- vi) Cardiovascular gent:- Methyl dopa
- vii) Antidepressants Resperidone, sertraline.

**Unit – IV :** **12L**

**Principles and Concepts of Green Chemistry :** Introduction.

- (a) Atom economic reactions - Rearrangement reactions, Addition reactions.
  - (b) Atom un-economic reactions - Substitutions reactions, Elimination reactions, Witting reaction
  - (c) Reducing toxicity - Measuring toxicity.
- Synthesis involving basic principle of Green Chemistry - Introduction, Synthesis of Styrene, Adipic acid, Urethane, Aromatic amine, Selective alkylation of active methylene group, Synthesis of Acetaldehyde, Furfural from biomass, Synthesis of s-metalochlore (herbicide), Ibuprofane, Paracetamol.

**Unit – V :** **12L**

**A) Chemical Process Economics :** Cash flow for Industrial operation, factors affecting project cost and investment, cumulative cash position, salvage value, estimation methods employed for the estimation of capital investment. Interest, Methods of determining depreciation: Straight Line Method, Declining Balance Method and Sum of Years digit Method. Economics of selecting alternatives. Break even point, production scheduling.

**B) Safety:** General occupational safety, flammable materials, Handling, fuel fighting equipments, control measures for Toxic chemicals. Safety with chemical engineering operations, hazardous chemicals process. Safety in Laboratories and pilot plant. Safety in transportation & storage of chemicals, management of safety & loss prevention.

**Books Suggested :**

- 1) Pesticites-Color Publications,P. L. Bombay.
- 2) Elements of Plant Protection by L. L. Pyenson, John Wiley and sons.
- 3) Chemistry of Pesticides by N. N. Melnikov Springer-Verlag, New York.
- 4) Fungicites in Plant Disease control by L. L. Nines, Oxford and IBH Publishing company New Dehli.
- 5) Methods of Pesticides Analysis by Sree Ramuly, U. I. Oxford and IBH Publishers.
- 6) Chemical Process Industries by R. N. Shreves and M. A. Brink. McGraw Hill Ltd. 4th Edition.
- 7) Charles E. Dryden, Outline of Chemical Technology Edited by M. Gopal Rao and
- 8) Marshall Siting, East West press 2nd Edition 1973.
- 9) Indian Pharmacopoeia, 1985.
- 10) British pharamacopoeia, 1990.
- 11) Text book of Organic Medicinal and Pharmaceutical Chemistry by Willson, Eivold,
- 12) Dejjia, Lippinett Toppan.
- 13) Essentials of Medicinal Chemistry by Korolkovas and Burkhatler-Wiley-Inter science.
- 14) Pharmaceutical Dosage forms.
- 15) D. A. Crowl & F. Louvar, Chemical Process Safety (Fundamentals with applications), Prentice Hall
- 16) H. H. Fawcett and W. S. Wood, Safety and Accident Prevention in Chemical Operations, Wiley and sons.
- 17) Green Chemistry: Theory and PracticePaperback by Paul Anastas, John Warner.
- 18) Introduction to Green Chemistry, Editors: Ryan, M., Tinnesand, M.
- 19) Green Chemistry: Environmentally Benign Reactions, Second Edition V. K. Ahluwalia.

**Semester IV**

**Practical-VII**

**Inorganic Chemistry Special**

**Pracitcal Workload 9 Hrs./week**

**Time: 6-8 hours**

**Marks: 100**

**Unit-I :**

- 1) Extraction and absorption spectral study of chlorophylls from green leaves.
- 2) Determination of Phosphates from cold drink samples by spectrophotometry.
- 3) Analysis of talcum and nyclin powders (Mg-complexometry, n/H<sub>3</sub>B<sub>3</sub>)
- 4) Determination of iron in soap bar.
- 5) Analysis of N, P, K from fertilizer
- 6) Analysis of cement/paint/soil.

**Unit II : Study of complex formation:**

- 1) To determine the formula and formation of a complex by spectrophotometry (Mole/Slope ratio methods)
- 2) To determine stepwise proton-ligand and metal-ligand stability constant of complex by Irving-Rossotti method.
- 3) To determine the instability constant of complex by potentiometry (AgNH<sub>3</sub>, Ag-thiosulphate)
- 4) To determine the composition and formation constant of a Fe-SSA complex by conductometry.
- 5) Determination of composition and stability constant of complex by polarography.
- 6) Cyclic Voltametric study of i) Potassium ferricyanide ii) Ferrocene

**Unit-III : Inorganic reaction mechanism:**

Kinetics and mechanism of following reactions:

- 1) Kinetics of Aquation/Isomerisation /Substitution reactions in octahedral complexes (Acid/Base hydrolysis)
- 2) Isomerization reaction of octahedral complexes.
- 3) Enzyme kinetics in presence of metal ions.
- 4) To determine the corrosion rate of metal strip.
- 5) To study the 1,10 phenanthroline as corrosion inhibitor for mild steel in sulphuric acid.
- 6) To study the adsorption and desorption of gases on heterogeneous catalyst.
- 7) Kinetics of substitution reaction of [Fe(Phen)<sub>3</sub>]<sup>2+</sup>
- 8) Synthesis and photochemistry of K<sub>3</sub>[Fe(C<sub>2</sub>O<sub>4</sub>)<sub>3</sub>].3H<sub>2</sub>O

**Unit-IV : Solid State:**

- 1) Synthesis of oxides and mixed oxides : Zinc Ferrite, MnMn<sub>2</sub>O<sub>4</sub>, NiO, Nickel Ferrite, CuMn<sub>2</sub>O<sub>4</sub> Nano particles of MnO<sub>2</sub>
- 2) Preparation of Gold Nanoparticles using Tea  
□ Synthesis of nano size ZnO, its characterization by UV-Visible spectroscopy and removal of dye by ZnO-photocatalysis
- 4) Preparation of Silica and Alumina by sol-Gel technique.
- 5) To study the electrical conductivity and DRS of ferrites, Magnetites, doped oxides and pure samples and determine band gap.
- 6) Solvent free, microwave assisted one pot synthesis of phthalocyanine complex of copper (II).

**Unit-V : Two/Three steps synthesis and characterization:**

Synthesis of metal complexes/Polymers and their structural characterizations by possible physical methods such as: elemental analysis (N, S, M etc.), m.p. Solubility, MW, molar conductance, magnetic moment, thermogravimetric analysis, IR and electronic spectral data, determination of crystal field parameters (minimum five)

- 1) Solvent free and one pot synthesis of Phthalocyanine complex of Copper (II).
- 2) Zinc(II) /Copper(II)/ Cobalt(II)/ Nickel(II) complexes of Schiff base derived from salicylaldehyde with aniline/ substituted aniline
- 3) Synthesis and characterization of coordination polymers of Zinc(II) /Copper(II)/ Cobalt(II)/ Nickel(II) .
- 4) Magnetic Susceptibility and Thermogravimetric studies ( 3 samples).
- 5) Solution state preparation of [Ni(en)<sub>3</sub>][S<sub>2</sub>O<sub>3</sub>], [Ni(H<sub>2</sub>O)<sub>6</sub>][Cl<sub>2</sub>], [Ni(NH<sub>3</sub>)<sub>6</sub>][Cl<sub>2</sub>]. Record absorption spectra in solution of all three complexes and analyse it. Arrange three ligands according to their increasing strength depending on your observations
- 6) Metal DNA interactions (Viscosity & spectrophotometry)

**Book Suggested:**

1. Synthesis and Characterization of Inorganic Compounds, W. L. Jolly, Prentice Hall.
2. Inorganic Experiments, □ Derck Woollins, VCH.
3. Practical Inorganic Chemistry, G. Mairand, B. W. Rockett, Van Nostrand.
4. A Text Book of Quantitative Inorganic Analysis, A. I. Vogel, Longman.
5. EDTA Titrations. F. Laschka
6. Instrumental Methods of Analysis, Willard, Merit and Dean (CBS, Delhi).
7. Inorganic Synthesis, Jolly
8. Instrumental Methods of Chemical Analysis, □ elri Lalikov
9. Fundamental of Analytical Chemistry, Skoog D.A. & West D.M Holt Rinehart & Winston Inc.
10. Experimental Inorganic Chemistry, W.G.Palmer, Cambridge.
11. Solid state Chemistry, N.B.Hanney
12. Introduction to Thermal Analysis, Techniques & Applications, M.E.Brown, Springer
13. Preparation and Properties of solid state Materials, Wilcox, Vol. I & II, Dekker
14. The Structure and Properties of Materials Vol.IV, □ohn Wulff, Wiley Eastern.

**The Practical examination will be based on the Inorganic Chemistry.**

**Time: 6-8 hours (One day examination)**

**Marks: 100**

I) Exercise -1 (Synthesis & Analysis)	- 40 Marks
II) Exercise-2 (Kinetics/complex)	- 40 Marks
III) Record	- 10 Marks
IV) Viva- Voce	- 10 Marks

Total -100 Marks

**SEMESTER IV  
Practical – VII  
Organic Chemistry Special**

**Total Hours: 90 hrs. (9 Hours per week) Marks: 100**

**A- Qualitative Organic Analysis: (40 Marks) (12 Laboratory Session)** Separation, purification and identification of ternary (three component) mixtures. The water soluble solid/liquid should also be given. Student should submit the purified samples of the separated compounds and prepare a suitable derivative of the three compounds separated out.

**Note :** Analysis of at least ten mixtures should be carried out.

<b>Scheme of Marking: Type of the mixture</b>	<b>10</b>
i). Analysis of the individual components: (10 Marks for each component)	
ii). Detection of Elements	02
iii). Detection of functional groups	02
iv). Determination of MP/BP	02
v). Preparation of the derivative	02
vi). Identification (Spotting)	02

**B- Spectral Interpretation and use of Chem draw software (Total Laboratory Session 6) (15 marks)**

**C: Miscellaneous Experiments (Mandatory) (Total Laboratory Session 8) (25 marks)**

- (1) Reduction reaction of 3-nitroacetophenone (Stereo selective synthesis)
  - (i) Reduction with Tin and Hydrochloric Acid
  - (ii) Reduction with sodium borohydride
- (2) Grignard Reaction: Conversion of Benzophenone into triphenyl methanol.
- (3) Synthesis of 5,5-Diphenylhydantoin from benzil, as an anticonvulsant.
- (4) Extraction of Limonene (essential oil) from orange by steam Distillation.
- (5) Synthesis of anaesthetic drug Benzocaine.
- (6) Synthesis of anticancer drug 6-methyl uracil.
- (7) Synthesis of  $\alpha$ -Acetylamino cinnamic acid from glycine.
- (8) Estimation of blood sugar, calcium, and total nitrogen and non-protein nitrogen in blood.

**Practical-VI  
Organic Chemistry**

**Time : 6-8 Hrs. (One day Examination) Marks : 100**

(1) Exercise-1 (Organic Synthesis) -	40 Marks
(2) Exercise-2 (Qualitative Analysis) -	15 Marks
(3) Exercise-3 (Qualitative Analysis) -	25 Marks
(4) Record -	10 Marks
(5) Viva-Voce -	10 Marks

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Total	100 Marks
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**Books Suggested:**

1. Textbook of practical organic chemistry qualitative and quantitative analysis (Vol I & II)- A.I. Vogel.
2. Elementary practical organic chemistry small scale preparation (Langman)- A.I. Vogel.
3. A handbook of organic analysis.-H.T.Clark.
4. Systematic qualitative organic analysis H. Middleton.
5. Advanced practical organic chemistry-N. K. Vishnoi.
6. Small scale organic preparation-P. Hill
7. Practical organic chemistry-H. Dupont Durst & George W.Gokal.
8. Experimental organic chemistry Part I & II, P. R. Singh, D. S.Gupta & K.S. Bajpai.
9. Vogel's textbook of practical organic chemistry-A.R. Tatchell

Semester IV  
Practical-VII  
Physical Chemistry Special

**Practical Workload 9 Hrs./week**

**Time: 6-8 hours**

**Marks: 100**

**USE OF COMPUTER PROGRAMS 5 TERMS OF PRACTICALS.**

**Treatment of experimental data, X-Y plots, programs with data preferably from physical chemistry practical. Students will operate two packages I) MS-Word and II) MS-Excel.**

**Part-A**

- 1) To find out Energy of activation & Temperature coefficient of hydrolysis of methyl / ethyl acetate
- 2) To find out Energy of activation of the reaction between potassium persulphate & potassium iodide.
- 3) **Determination of partial molar volume of solute and solvent in binary mixture.**
- 4) **To study the variation of solubility of calcium sulphate with ionic strength and hence determine thermodynamic solubility product.**
- 5) **To study the adsorption of acetic acid on charcoal and prove the validity of Freundlich and Langmuir adsorption isotherm.**
- 6) To determine the critical micelle concentration of soap.
- 7) To determine the molecular weight of high polymer by viscosity measurement.
- 8) To find out partition coefficient of Iodine/Benzoic/Salicylic acid between benzene and water.

**Part-B**

- 1) Determination of Half Wave potential of metal ions by polarography.
- 2) Simultaneous determination of suitable of metal ion by polarography
- Analysis of aspirin conductometrically and potentiometrically
- 4) Determination of sodium, potassium, lithium and calcium by Flame photometric individually and mixture.
- 5) Electronics measurement of resistance with multimeter and use of Wheatstone Bridge for accurate measurement of resistance.
- 6) Determine the dipole moment of given liquid.
- Plot the current voltage curve for copper sulphate and sulphuric acid using bridge platinum electrode.
- 8) Determine the transport number of ions by moving boundary method.
- 9) Determine the composition of binary mixture spectrophotometrically

**Physical Chemistry Practical :**

**Distribution of marks:**

Two Days Examination - 6-8 Hrs.	100 Marks
Unit A □ □	40
Unit B □ □ □	40
Record	10
Viva-voce	10
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TOTAL	100
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**Semester IV  
Practical-VII  
Industrial Chemistry Special**

**Practical Workload 9 Hrs./week**

**Time: 6-8 hours**

**Marks: 100**

**Multi step organic Synthesis (Minimum 20 practical should be performed):**

1. Nitrobenzene - m-dinitrobenzene □ m-nitroaniline- m-nitrophenol.  
Anthranilic acid □ phenylglycine orthocarboxylic acid □ indigo
2. Cyclohexanone □ cyclohexanone oxime □ caprolactum.
3. Preparation of P- bromoaniline from aniline.
4. Preparation of Synthetic zeolites.
5. Determination of □ N □ and □ P □ nitrogen and phosphorus containing fertilizer respectively by suitable methods.
6. Determination of Iron and Calcium from Cement by suitable methods.
7. Determination of Lead (Pb) from □ pal Glass by suitable methods.
8. Experiments based on distillation under reduced pressure, fractional and steam distillation.
9. Measurement of flash point, ignition point, kinematic viscosity by U-tube method.
10. Estimation of Copper from □ fungicides.
11. Determination of pesticide contents in the soil.
12. Preparation of Methyl orange, Methyl red, orange II, Fluorescein, □ quinoline, Anthraquinone.
13. □ Quantitative estimations of important commercially available drugs.
14. □ Qualitative analysis of commercial available drugs including chromatographic technique.
15. Preparation of simple drugs involving two or three steps.
16. Preparation of melamine □ HCH □ resin.
17. Determination of number average molecular weight (Mn) by end group analysis by conductometric method.
18. Determination of average molecular weight of polymer by viscometric method.
19. Determination of reducing sugar in cane juice.
20. Determination of moisture content and ash content of wood sample.
21. Experiments based on simple & fractional crystallization.
22. Analysis of nonfibrous materials used in pulp industries such as caustic soda as Na<sub>2</sub>□, Soda ash as Na<sub>2</sub>□, lime as Ca□.
23. Extraction of essential oils from medicinal plants (Tikhadi).
24. Separation of Chromium (VI) & Chromium (III) by TLC in wastewater sample from electroplating industry.
25. Estimation of Manganese from Tea leaves-component
26. Preparation of selected pesticide formulations in the form of dusts, emulsions, sprays.
27. Preparation of biodiesel from vegetable/ waste cooking oil
28. Determination of calorific value of fuels.
29. Preparation and characterization of inorganic complexes containing Fe, Co, Ni, Cu, □ n, with N, and P containing ligands. Applications of these complexes for □ organic coupling reactions like Heck, Suzuki, Stille and Sonogashira reactions

**Distribution of marks:**

**The Practical examination will be based on the syllabus for Industrial Chemistry (Elective Paper).**

**Time: 6-8 hours (one day examination)**

**Marks: 100**

I) Exercise -1 (Based on Synthesis)	- 40 Marks
II) Exercise-2 (Based on Quantative Analysis)	- 40 Marks
III) Record	- 10Marks
IV) Viva- Voce	- 10 Marks

Total	-100 Marks
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**List Of Books-**

1. Practical Engineering by S. S. Dara.
2. Labortary Preparation of Microchemistry by E. M. M. Effery, McGraw Hill.
3. Practical Course in Polymer Chemistry by S. Pnnea, Pargaman Press
4. Practical Pharmacognosy by T. B. Willis.
5. Practical Pharmacognosy by T. N. Vasudevan.
6. Indian Pharmacopea-1985, British Pharmacopea-1990.
7. Handbook of Drugs and Cosmetics by Mehrotra
8. Methods of Pesticide Analysis by Sree Ramuly U. I. Oxford and IBH Publishing Co.
9. Methods of testing for petroleum and petroleum products. IS 1448-1960 Part I to Part IV. Published by ISI New Delhi 1967
10. IP Stands for Petroleum and products Published Applied Service Publisher Ltd. London, 33<sup>rd</sup> Edition 1974.
11. American Stds. For testing Materials, New York 1967.
12. Textbook of Inorganic Chemistry by A. I. Vogel.
13. Instrumental Methods of Analysis by Willard, Merit and Dean
14. Industrials Chemicals, Faith et. al. Wiley Interscience New York
15. Textbook of Practical Organic Chemistry by I. C. Voley.
16. Industrial Organic Chemistry by K. Stille
17. Unit Operations by Kale
18. Reagents for Organic Synthesis Fisher and Fisher.
19. Technique of Organic Chemistry Vol I, Part I- IV A. Weishberger.

**SEMESER IV  
Practical – VII  
Project Work**

**Total Hours: 90 hrs. (9 Hours per week)**

**Marks: 100**

The students will develop utilities such as analytical spectra, simulation programs that will supplement laboratory exercises in their subject of specialisation. Literature survey, Studies of reactions, synthesis, mechanism, isolation of natural products, standardization of reaction conditions, new methods etc. External and internal examiners will examine this jointly at the time of practical examination. (Students should present his/her work in power point presentation. Open Viva is compulsory. Soft Copy of presentation in CD should be submitted with dissertation.)

**Study Tour:**

**Educational/Industrial tour is compulsory for M.Sc. Chemistry.**

- (i) Semester I/II: Visit to local Industry/Institute.
- (ii) Semester III/IV: Education tour to visit the industry/Research laboratory (Long Tour).  
Students should submit their tour report at the end of Semester II and Semester IV respectively with proof of visiting (Photo etc.).

**List of equipments/appratus required for the M.Sc. Chemistry Semester-I to IV Practicals.**

1. Rotaevaporater	01 no./batch
2. Crycooler	01 no./batch
3. Sonicator bath	01 no./batch
4. Stirrer With Hot Plate	04 nos./batch
5. Eye Washer	01 no./batch
6. Chemdraw Software (version12)	01 no./batch
2. Conductivity meter	03 nos./batch
2. pH meter	03 nos./batch
3. Potentiometer	03 nos./batch
4. Polariometer	02 nos./batch
5. Centrifuge machine	02 nos./batch
6. Vaccum Pump	01 no./batch
7. Hot air oven	01 no./batch
8. Blower hot & cold	03 nos./batch
9. Stop watch	10 nos./batch
10. Weight box con.100 gm.	10 nos./batch
11. Analytical double pan balance	10 nos./batch
12. One pan electronicl balance	02 nos./batch
13. Tripple beam balance	02 nos./batch
14. Melting point apparatus	02 nos./batch
15. Spectrophotometer	02 nos./batch
16. Water still	01 no./lab

17. Colorimeter	02 nos./batch
18. Thermostate	01 no./batch
19. Electrodes platinum	03 nos./batch
Silver, □n, Cu	03 nos./batch
Glass	03 nos./batch
Reference	03 nos./batch
20. Heating mentle	02 nos./batch
21. Glass double distillation unit	01 no./lab
22. Flame Photometer	01 no./batch
23. High Resistivity meter	01 no./lab
24. Polarpraph with recorder	01 no./lab
25. U.V.visible spectrophotometer(Double beam)	01 no./lab
26. Infrared Spectrophotometer	01/class
26. Standard cell	02 nos./batch
27. Muffle furnace	01 no./lab
28. D.C.Voltmeter	01 no./lab
29. Infrared lamp	05 nos./lab
30. Refrigerator	01 no./lab
31. Magnetic stirrer 2 ml, 5 ml.	02 nos./batch
32. Dimmer state	01 no./lab
33. Abbe□ refractometer	01 no./batch
34. Sodium lamp for polarimeter	02 nos./batch
35. T.L.C. Kit	01 no./lab
36. Calorimeter	01 no./lab
37. Bomb Calorimeter	02 nos./batch
38. B□D analyser	01 no./lab
39. Water analysis kit	01 no./lab
40. Computer-386/486	01 no./lab
41. U.V.Lamp	02 no./lab
42. Ice making machine	01 no./lab
43. LCR bridge(Four Probe Method)	01 no./lab
44. Gas Chromatograph	01 no/course
44. HPLC	01 no./course
45. Deioniser	01 no./lab
46. Ion exchange column□	04 no./lab
47. Turbidity meter	01 no./lab
48. □optical densitometer	01 no./lab
49. □rsat apparatus (gas analysis)	01 no./lab
50. Interferometer (ultrasound)	01 no./batch
51. Magnetic Susceptibility balance	01 no./lab
52. Hydraulic press	01 no./lab
53. TGA, D.T.A. Apparatus	01 no./course
53. Shaking machine	01 no./lab
54. G.M.Counter	01 no./lab
55. Electrophorasis apparatus	01 no./lab
56. Karl-Fisher Titration apparatus	01 no./lab
57. Power supply (regulator)	01 no./batch
58. Regulated furnace	01 no./lab
59. Thermocouple	01 no./lab
60. Vaccum oven	01 no./lab
61. Top pan balance	01 no./lab
62. UV Chamber	01 nos/batch
63. Fume Hude	01 no/class
64. Gaussian softwere(version 9 )	01 no/class

**List of glasswares (main) for M.Sc. Chemistry Semester-I to IV Practicals**

1. Glass Column	10 nos./batch
2. Dean-Stark Apparatus	02 nos./batch
3. Addition funnel	10 nos./batch
4. Round bottomed flask	10 nos./batch
5. Sintered funnels	03 no./batch
6. Pressure bottle	02 nos./batch
7. Cannula	01 no./batch
8. Rubber septum	10 nos./batch
9. □-adaptor	03 nos./batch
10. Vacuum adaptor	03 nos./batch
11. Thermometer adaptor	02 nos./batch
12. Claisen adaptor	02 nos./batch
19. Flow control adaptor	03 nos./batch
13. Side-arm flask	02 nos./batch
14. Buchner funnel	02 nos./batch
15. Crystallizing dish	04 nos./batch



16.	Versatile clamp	02 nos./batch
17.	3-Prolonged clamp	02 nos./batch
18.	Ring clamp	05 nos./batch
19.	Soxhlet set	02nos/batch
20.	Kjeldahl's apparatus set (for Nitrogen element estimation)	02 nos./batch
21.	Distillation unit	04 nos./batch
22.	Separating funnel	10 no./batch
23.	Steam distillation unit	02 nos./batch
24.	Vacuum desiccator	01 no./batch
25.	Paper chromatography chamber	03 nos./batch
26.	TLC chamber	05 nos./batch
27.	Silica crucibles	20 nos./batch
28.	Sintered glass crucibles g4/g5	20 nos./batch
29.	Spot test plates	10 nos./batch
30.	Wash bottles	10 nos./batch
31.	Density bottles	10 nos./batch
32.	Viscometer	10 nos./batch
33.	Kipp's apparatus	01 nos./batch
34.	Beakers, capacity :50 ml, 100 ml, 250 ml, 400 ml, 500 ml, 1000ml	10 nos/batch
35.	Conical flask : 100 ml, 250 ml	10nos /batch
36.	Burettes with stop cock, capacity : 2ml, 5 ml, 10ml, 25 ml.	10nos/batch
37.	Lambda pipette	02 nos./batch
38.	Volumetric flasks, capacity : 10 ml, 25 ml, 50 ml, 100 ml, 250 ml, 500 ml, 1000ml.	10nos /batch
39.	Measuring cylinder, capacity : 10 ml, 25 ml, 50 ml, 100 ml, 500 ml, 1000 ml	10nos/batch
40.	Pipette, capacity : 1 ml, 2 ml, 5 ml, 10 ml, 25 ml.	10nos/batch
41.	Stalagmeter	10 nos./batch
42.	Thermometer (b-24) 0 to 360 <sup>0</sup> C (quick fit)	05 nos./batch
43.	Water suction pump (glass)	05 nos./batch
44.	Filtration flasks with buckner funnels 50 ml, 100ml, 250ml, 500ml	10 nos./batch
45.	China dishes	10 nos./batch
46.	Desiccators	10 nos./batch
47.	Platinum/Nickel Crucible	02 nos./batch
47.	Thiele tube for melting point	10pkt./batch
48.	Quick fit water condensers b-19, b-24	10 nos./batch
49.	Quick fit flasks, Capacity 50 ml, 100 ml, 250 ml, 500 ml, 1000 ml.	10 nos./batch
50.	Microanalysis Kit	10 nos/batch

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