

DEPARTMENT OF CHEMISTRY

Pre - Ph.D. Chemistry **(One Semester Course)** **Scheme of Examination**

| Paper No. | Nomenclature | Load | Maximum Marks |
|---|---|-------------|----------------------|
| Paper –I | Compulsory Paper | 3 hrs | 100 |
| Paper-II | Core Paper | 3 hrs | 100 |
| Paper-III- Student can select any five section | Elective Paper | 3 hrs | 100 |
| Paper IV | Research activities field & practical WORK | 3 hrs | |

SYLLABUS FOR Pre-Ph.D. COURSE WORK.

RULES AND REGULATIONS.

The course-work will be treated as Pre-Ph.D. Preparation and it has been introduced from year/Session 2011 onwards in B.N.Mandal University, Madhepura. The Ph.D. course work Programme is intended to provide advance training in research.

Admission into Pre-Ph.D. Programme will be ensured in accordance with the existing applicable reservation rules enforced in the University.

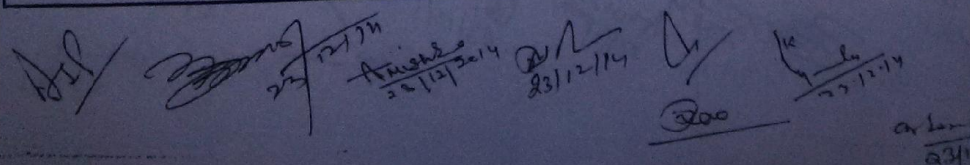
A candidate who has qualified National Eligibility Test (NET), State Level Eligibility Test (SLET) accredited by UGC, Central or State Govt., M.Phil degree, National Doctoral awarded Fellowship by such as UGC, Indian Council of Historical Research (ICHR), Indian Council of Philosophical Research (ICPR), Indian Council for Cultural Relations (ICCR), Junior research fellowship (JRF). May be considered for direct admission to the Pre-Ph.D course work on supernumerary basis without appearing in the PRT.

The period of course work will be of one Semester of Six months duration. The period of Class work will be minimum 90 working days. Classs work, examination & result will be completed within the Semester period.

There will be four papers consisting of 100 marks each. The first paper will be research-Methodology & Computer applications which is compulsory for all faculties as model paper. All deparments have to teach according to their own subject paper-ii & iii will be core paper and elective paper respectively of concerned subjects. The fourth paper will be research activities and common to all faculty.

The Course-Structure shall be as follows.

| Serial No. of Paper | Course Components | Name of the paper | Full Marks | Pass Marks | No. of Credits |
|------------------------------|--------------------------|---|------------|------------|----------------|
| i. Common for all Faculties | Compulsory Paper | Research Methodology & Computer Applications | 100 | 45 | 05 |
| ii. Subject concerned | Core Paper | Theoretical & Methodological frame work of the concerned Subject. | 100 | 45 | 05 |
| iii. Subject concerned | Elective Paper | Different branches of concerned subject. | 100 | 45 | 05 |
| iv. common for all faculties | Compulsory applied Paper | Research Activities : Field and Practical work | 100 | 45 | 05 |



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6. A candidate shall be required to put in a minimum of 75 % attendance. Condonation for shortage of attendance will be permitted only on justified grounds or by the order of the Hon'ble Vice-Chancellor. The weekly attendance particulars will be sent to the Hon'ble V.C on the last day of every week.
7. **Mode of Examination:**
 - (i). The examination will be conducted after the completion of course-work by each department. Accordingly, the date will be decided and published by the University.
 - (ii). The time of the examination will be three hours for paper i, ii, & iii. The paper fourth is applied paper and assesment will be done as per syllabus by each department.
 - (iii). The examination will be compulsory for all concerned students of each paper and they will have to obtained passing marks seperately.
 - (iv). Two chances will be allowed for those students who fail or fail to appear at examination. They will be treated as ex-candidate. In case examinee passes at least two papers he will be treated promoted and he will have to appear and pass in the next examination in remaining papers then their result will be declared. After that he will be eligible for doing research work.
 - (v). Paper setting and evaluation of papers will be conducted by the concerned department by the approval of the University.
 - (vi). Result will be published and mark-sheet will be issued by the University examination department.
8. **Process of Ph.D. Registration :**
 - (i). After passing Pre-Ph.D. course work examination the successful condidates will present their synopsis in the concerned department for Ph.D. research work on selected / prescribed topics.
 - (ii). Pre-registration -Viva/ Presentation will be conducted by the Departmental council/ Research advisory committee on the basis of his/ her synopsis and guide/supervisor will be decided by the HOD/ DC/RAC to each scholar.
 - (iii). After consent & recommendation of DC/RAC the PGRC will approve the concerned synopsis finally to proceed research-work.
 - (iv). In the light of approval form the PGRC and letter issued by the DR. Academic, the research scholar will deposit prescribed registration fee.
 - (v). The research scholar will undertake research work and will send progress report half yearly through guide to HOD and DR. Academic.
9. **Submission of thesis:-**
 - (i). Prior to the Submission of thesis, the scholar has to appear in a pre-submission viva in the concerned department along with his draft-thesis. Such viva in the department will be open to all faculty members and research scholars for getting feed back and comments, which may be suitably in corporated in to the draft thesis on the advice of the supervisor.
 - (ii). On completion of the research work the candidate will have to submit five copies of his/ her thesis with soft copy and research-substance in the examination department of University within three months through the concerned department.

- (iii). Prior to the submission of final thesis the candidate will have to publish at least one research paper in standard/ referred/ISSNo., Journal and produce evidence of such publication in the form of either (a) photo copy of published work (b) acceptance letter of the Publisher and (c) reprint of research paper.
 - (iv). Certificate of paper-presentation in National/International seminar would be presented by the scholar before the final Viva-Voce examination.
 - (v). On the recommendation of examiners the final Viva-Voce will be conducted by the concerned department by the order of the Hon'ble Vice-Chancellor and the result will be published accordingly.
10. All types of fees related with the Pre-Ph.D. course work would be collected by the concerned department on rate approved by the University.
 11. Remuneration /T.A./ C.A. etc. for concerned teachers/Examiners would be paid by the department as rate approved by the University.

SYLLABUS FOR Pre-Ph.D. COURSE WORK

As per Ph.D. New Regulation w.e.f. Academic year-2011 on wards.

Paper-1st.

**Full Marks-100
Time- 3 Hrs.
Credit-05.**

Research Methodology & Computer Applications.

Common Paper for the faculties of Social Science, Science, Commerce & Humanities.

Note-Ten questions will be set & the setter will set two questions from each unit. The Candidate will be required to answer five questions choosing one question from each Unit. All questions will carry equal Marks.

Unit-1-Concept of Research : Definitions, Characteristics, Principles and Type of Research. Research Problems: Meaning, Nature, Scope, Sources & Criteria of Research, Ethics in Research.

Unit-2-Methods of Research: Types of Research Methods-Scientific research, Quantitative & Qualitative research, Pure & Applied research, Historical research, Comparative research, Analytical & Experimental research, Empirical research, Descriptive & operational research, Archival Research, Survey and Census method of research.

Unit-3-Research Design & Process; Meaning & Types of research design, Selection of research topic, Work Plan&Need & objectives of research, Details of Project with Chapterization, review of literature, Hypothesis formation, types & testing of hypothesis. Methodology- Types & its application, Bibliography-Meaning & System of bibliography, Meaning & Characteristics of good report. Writing. Foot notes, Index, Abstract & Appendix.

Unit-4-Statistical Techniques : Use of Statistics in research, Collection Classification organization & presentation of data Measures of Central tendency & disperation - Mean, Meadian, Mode, Time Series Analysis-Concept & Components.

Unit-5- Computer Applications : History & Characteristics of Computer, Applications of Computer in Research Knowledge about internet, Use of Internet & search engines like yahoo,Google etc. Introduction to operating System-Windows, MS office, MS Word, Generating Charts graphing in microsoft Excel, Power Point persentation.

Suggested Readings-

1. A.K.Swain - A text book on research methodology, Kalyani Publishers, New Delhi.
2. C.R.Kothari - Research methodolog, Methods & Techniques , New Age interna-tional publishers.
3. J.W.Creswell - Research Design-Qualitative & Quantitatives Methods.

4. Hart Chris (1998) -Doing a Literature Reviw, SAGE Publication, New Delhi.
5. Walliman Nicholas (2003) Your research Project, SAGE Publication, New Delhi.
6. V.Rajaraman - Fundamental of Computer.
7. S.C. Gupta - Fundamentals of Statistics, Himalaya Publication House, Bombay.
8. D.H. Sanders - Computer Today, McGraw Hill, New york.
9. P.K.Sinha- Computer Fundamentals, BPB Publication, New Delhi.
10. Zina Olerary-The essential Guide to diong Research Vistar Publication, New Delhi.
11. Estelle & Philips-Atttand book for Students & their Supervisors, UBS Publication & Bist Ltd. New Delhi.
12. Treveni & Shukla; Research Methodology, College Book Dipo Jaipur.
13. राम आहूजा, सामाजिक सर्वेक्षण एवं अनुसंधानण रावत पब्लिकेशन जयपुर, 2003.

Pre PhD (Chemistry)
Paper-I
Research Methodology

Max. Marks: 100
Time: 3 hrs.

Note: Examiner will set 09 questions and the candidates will be required to attempt 05 questions in all. Question number 01 will be compulsory containing 08 short answer type questions covering the entire syllabus. Further, examiner will set 02 questions from each section and the candidates will be required to attempt one question from each section. All questions will carry equal marks

Pre-Ph.D (Chemistry)
Paper – II
Techniques in Chemistry

Max. Marks: 100
Time: 3 hrs.

Note: Examiner will set 09 questions and the candidates will be required to attempt 05 questions in all. Question number 01 will be compulsory containing 08 short answer type questions covering the entire syllabus. Further, examiner will set 02 questions from each section and the candidates will be required to attempt one question from each section. All questions will carry equal marks

Section A
Purification/ Crystallization

Isolation and purification of organic compounds (solids and liquids) with special emphasis on chromatographic techniques: TLC, column chromatography and HPLC. Drying and dehydrating agents.

Section B
Spectroscopic Techniques

Theory and applications of NMR spectroscopy of H-1, C-13, N-15, P-31 nuclei, two-dimensional NMR spectroscopy, theory and applications of infrared and mass spectrometry of organic compounds.

Section C
Thermal Techniques

Differential Thermal Analysis (DTA): Theories of DTA, factors affecting DTA curves, instrumentation and application of DTA.

Thermogravimetry (TG): Instrumentation and balances, X'- Y' recorder, thermogram, factors affecting thermogram, correlation of DTA and TGA data.

Section-D
Measurement of Thermodynamic Properties

Excess molar volume; dilatometric and density measurement methods. Excess molar enthalpies, Adiabatic, Isothermal, flow calorimeters.

Gibbs free energy of mixtures ; Marsh as well as Gibb's and VAN Ness static vapour methods for measuring vapour pressure of liquid and hence Gibb's free energy of mixing.

Excess isentropic compressibility ; Tecqniques for measuring speed of sound by DSA and Interferrometer ;determination of excess isentropic compressibilitys.

Books suggested:

1. A textbook of Quantitative Inorganic Analysis, A.I. Vogel, ELBS, London.
2. Dynamics of Chromatography- Part I; J.C. Gidding; Dekker, New York.
3. Vogel's textbook of practical Organic Chemistry, B.S. Furhen ey. al. Longman Group.
4. Spectrometric Identification of Organic Compounds, R.M. Silverstein, G.C. Bassler and T.C. Morrill.
5. Spectrometric Methods in Organic Chemistry, D.H. Williams and I. Fleming.
6. Organic Spectroscopy, William Kemp, John Wiley.

Pre - Ph.D (Chemistry)
Paper-III (i)
Inorganic Chemistry (Optional)

Max.
 Marks:100
 Time: 3 hrs.

Note: *Examiner will set 09 questions and the candidates will be required to attempt 05 questions in all. Question number 01 will be compulsory containing 08 short answer type questions covering the entire syllabus. Further, examiner will set 02 questions from each section and the candidates will be required to attempt one question from each section. All questions will carry equal marks*

Section A

Electro analytical Techniques

Polargraphy:- Introduction and Basic Principles, Polarograph, Polarographic cells, Half wave Potential and its significance.
 DME:- Advantages and Disadvantages of DME,
 SCE Carbon electrodes-Carbon paste Electrode
 Types of Currents:- Diffusion Current, Migration Current, Kinetic Currents, Catalytic Currents, Limiting Currents
 Amperometry :- Principles and Applications
 Square Wave Polarography, Voltametry, Coulometry, Superimposed AC Polarography:- Principles, theory and applications of these techniques.

Section-B

Nanomaterials:- Definition, Methods of Preparation
 Properties of Nanomaterials:- Physio-chemical and optical, Electrical and Electronics properties.
 Applications of Nanomaterials
 Gold, Silver & Pt Nanomaterials:- General Properties and Applications

Section-C

Phosphorescent Materials

Luminescence, Types of Luminescence, Fluorescence, Phosphorescence, Frank Condon Principle, Jablouski diagram, Organic Electroluminescence, Organic Light Emitting diode, Structure and working of OLED, Applications of OLED Inorganic phosphorescent materials, Long Persistent phosphors phosphors for LED, Applications of Inorganic Phosphors

Section -D

Organometallic Compounds of Main Group Elements:

General characteristics of different types of main group organometallics, stability, routes of M-C bond formation: Oxidative addition, transmetallation, Carbanion halide exchange, metal-hydrogen exchange, metal hydride addition to alkenes, methylenations and by Aryl diazonium salts.

Structure elucidation by spectral techniques like IR, NMR, Mossbauer for compound of Si, Ge, Sn, Pb, As, Sb, Bi and Te.

Section-E

Thermodynamics of liquid mixtures

Molecular interactions in liquid mixtures: Ion-ion interactions, Ion-dipole interactions, Dipole-dipole interactions, Ion-induced dipole interactions, Dipole-induced dipole interactions, Quadruple-octuple interactions; specific interactions, hydrogen bonding, charge-transfer interactions and contact charge-transfer interaction. Thermodynamic of excess functions; excess molar volumes, excess molar enthalpies, excess isentropic compressibilities, excess Gibbs free energy, excess heat capacity and their significance. Statistical theories of liquid mixtures; (i) Cell model (ii) Flory's theory (iii) Sanchez and Lacombe's theory.

Section-F

Quantum mechanics

The Born-Oppenheimer approximation, The Hellmann-Feynman theorem, Huckel molecular orbital (HMO) theory. Applications of HMO theory (i) to set up and solve secular equation ; (ii) to calculate resonance energy; (iii) to draw molecular orbital energy diagram for (1) Ethylene molecule taking in to consideration the overlap integral and (2) Pyrrole molecule. Determination of resonance integral, “ ” in HMO theory by (1) Ionization potential; (2) Electronic spectra and (3) delocalization energy methods.

Section-G

Solid State Chemistry:

Defects in crystals; Various types of defects in crystal; Thermodynamics of Schottky and Frenkel defects formation; Colour centers; Non-stoichiometric defects; Classification of solids; lattice energy; evaluation of Madelung constant (NaCl); calculation of repulsive potential exponent; Lattice heat capacity; Einstein and Debye model of lattice heat capacity; Debye T^3 law.

Section H

Electrodics:

Electron transfer under an interfacial electrical field; Butler-Volmer equation; electrode kinetic involving semiconductor solution interface; photo-electrochemistry; p-type photo-cathodes; n-type photo-anodes; Rate determining step in photo-electrochemical reaction; Ionic conductivity in solids; Solid electrolytes; Fast-ion conductors, oxygen ion conductors, sodium ion conductors; Solid state ionic devices, Batteries: Lithium batteries; Sodium batteries; fuel cells; sensors.

Section – I

Stereo selective Synthesis

Principle of stereo selectivity, 1,2- and 1,3-asymmetric induction, acyclic stereoselection, distereoselection in cyclic systems.

Enantioselective synthesis: Enantioselective hydroboration, hydrogeantion, epoxidation, enantioselective synthesis via hydrazones. Role of enzymes in chiral synthesis.

Section - J

Disconnection approach of synthesis

Introduction, main synthetic strategies, Synthetic strategies of 1,2- and 1,4-difunctionalised compounds, Group disconnection, Umpolung Strategies, - functionalisation of carbonyl compounds. Synthetic approach to cyclic systems. Retro synthetic and reconnection strategies.

Reagents

Preparation and application of following reagents:

Hypervalent iodine, organoboron reagents (IBBN, CATB, Ipc_2BH , PINB), Organosilicon compounds, Trifluoromethyl sulphonates (triflates).

Section – K

Heterocyclic compounds

General synthesis of

- (a) compounds with three or more heteroatoms in the ring (1,2,3)- and (1,2,4)-triazoles
- (1,2,4)- and (1,3,4)-oxadiazoles
- (1,2,5)- and (1,3,4)-thiadiazoles
- (1,2,3)-, (1,2,4)- and (1,3,5)-triazines.

Tetrazoles and tetrazines.

- (b) Bridgehead nitrogen containing compounds: Indolines
 Imidazo [1,2-a] and [1,5-a]pyridines
 Triazolo [1,5-a] pyridines
 S-triazolo [3,4-b] [1,3,4] thiadiazoles
 Imidazo [2,1-b] [1,3,4] thiadiazoles S-
 triazolo [3,4-b] [1,3,4] thiadiazines
 Thiazolo [3,2-b] [1,2,4] triazoles.

Section – L

Green Chemistry

Basic principles of green chemistry, Application of non-conventional techniques in organic synthesis (ultrasonic, microwave and grinding). Solid state synthesis and synthesis under solvent free conditions. Use of ionic liquids.

Drug discovery and development

A rational approach to drug design and drug development of following drugs: cimetidine
 oxamniquine.

Paper IV

Full Marks: 100

Pass Marks: 45

- a). Seminars of the candidates on the relevant research theme
- b). Preparation and submission of review report based upon the relevant papers addressing to the research problem chosen by the candidate

Books recommended:

1. Asymmetric Synthesis Ed. J, D. Morrison, vol. 1-5. Academic Press.
2. Stereochemistry of Organic Compounds by D. Nasipuri.
3. Designing organic synthesis by S. Waren.
4. Heterocyclic Chemistry by T. L. Gilchrist.
5. Comprehensive Heterocyclic Chemistry by A. R. Katritzky and C. W. Rees.
6. Green Chemistry by M. Kidwai and V. K. Ahluwalia.
7. Wilson and Gisvold's Text Book of organic medicinal and pharmaceutical chemistry Ed. R. F. Dorge.