

BANKURA UNIVERSITY



EXAMINATION PATTERN

And

COURSE DESIGN

For C.B.C.S. Ph.D. Course work in Bengali

(To be implemented from the session 2019 – 2020 onwards)

Ph. D. Course work Guidelines

- As per Bankura University Regulations Relating to Doctoral (Ph.D.) Degree 2017, after admission to PhD, a research scholar shall be required to undertake coursework for a minimum period of one semester. All candidates admitted to the Ph.D. programme shall be required to complete the coursework prescribed by the Department during the initial one semester.
- Candidates already holding M. Phil. degree and admitted to the Ph.D. programme, or those who have already completed the course work in M.Phil. / Ph.D. and have been permitted to proceed to the Ph.D. in integrated course, may be exempted by the Department from the Ph.D. course work. All other candidates admitted to the Ph.D. programme shall be required to complete the Ph.D. course work prescribed by the Department.
- 75 % attendance for coursework classes is compulsory.

Course Structure:

Subject Code	Name of Module /Course	Paper Type	Credits	Total Marks
PhD/Beng-01	Research Methodology [Part A: Common, Part B: Subject related Research Methodology]	Theory	4	100 [Part A: 70 + Part B: 30]
PhD/Beng-02	Subject specific topic	Theory	2	50
PhD/Beng-03	Critical appreciation of Books, Composition of Research Articles and Seminar on Research topic	Internal Assesment (Assignment and Seminar Presentation)	2	50
Total			8	200

Award of Grades:

- A Ph.D. scholar has to obtain a minimum of 55% of marks or its equivalent grade in the UGC 7-pointscale (or an equivalent grade/CGPA in a point scale wherever grading system is followed) in the coursework in order to be eligible to continue in the programme and submit the dissertation/thesis.
- Maximum two chances shall be given to the scholar for clearing the course work, failing which may lead to cancellation of admission.

C.B.C.S. Syllabus for Ph.D. Coursework

Full Marks: 200

Course -1 **100** **Research Methodology**

Half –A: General Research Methodology **70**

নামপত্র প্রস্তুতি, প্রশ্নমালা তৈরি, তথ্যসংগ্রহ – তথ্যসংশ্লেষ – তথ্যপ্রক্রিয়াকরণ, প্রকল্পপত্র প্রস্তুতি, সারসংক্ষেপ প্রস্তুতি, গবেষণা অভিসন্দর্ভ রচনা পদ্ধতি, ICSSR নির্দেশিকা, গ্রন্থপঞ্জি, পাদটীকা, নির্ঘণ্ট, গবেষণা প্রকরণ ও পদ্ধতি, গবেষণাপত্র উপস্থাপন পদ্ধতি, গবেষণা পদ্ধতি সংক্রান্ত অন্যান্য বিষয়

Half – B: related research methodology **30**

বিভিন্ন প্রকার সাহিত্য গবেষণা-পদ্ধতি, ক্ষেত্রসমীক্ষা, গ্রন্থ সম্পাদনার রীতি-পদ্ধতি, সাহিত্য-গবেষণায় কম্পিউটার ব্যবহারের উপযোগিতা

Course -2 **100** **Subject Specific topic** **50**

Half –A

প্রাচীন ও মধ্যযুগের বাংলা সাহিত্য, আধুনিক বাংলা কাব্য-কবিতা, আধুনিক বাংলা কথাসাহিত্য, আধুনিক বাংলা নাট্যসাহিত্য, আধুনিক বাংলা গদ্য ও প্রবন্ধ সাহিত্য, লোকসংস্কৃতি ও বাংলা সাহিত্য, রবীন্দ্র সাহিত্য, তুলনামূলক সাহিত্য

Half –B

i) বিভিন্নপ্রকার সাহিত্য তত্ত্ব

ক) শৈলীবিজ্ঞান

খ) বিনির্মাণবাদ

গ) নারীবাদী সাহিত্য সমালোচনা

ঘ) পরিবেশবাদী সাহিত্য সমালোচনা

ঙ) প্রকৃতিলগ্ন নারীবাদ

Course -3 **50** **Internal Assesment**

Half –A

গ্রন্থ সমালোচনা, গবেষণাধর্মী প্রবন্ধ রচনা **25**

Half –B

গবেষণাধর্মী প্রবন্ধের উপস্থাপনা **25**

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Ph. D. Coursework guidelines

- As per Bankura University Regulations Relating to Doctoral (Ph.D.) Degree 2017, after admission to PhD, a research scholar shall be required to undertake coursework for a minimum period of one semester. All candidates admitted to the Ph.D. programme shall be required to complete the coursework prescribed by the Department during the initial one or two semesters. Women candidates may be allowed a relaxation of two terms / semesters in case of maternity.
- Candidates already holding M. Phil. degree and admitted to the Ph.D. programme, or those who have already completed the course work in M.Phil. / Ph.D. and have been permitted to proceed to the Ph.D. in integrated course, may be exempted by the Department from the Ph.D. course work. All other candidates admitted to the Ph.D. programme shall be required to complete the Ph.D. course work prescribed by the Department.
- 75 % attendance for coursework classes is compulsory.
- Teaching work per credit is 16 hours. (This may include lectures, seminars, and tutorials).

Course Structure:

Subject Code	Name of Module / Course	Paper Type	Credits	Total Marks
PhD/E-01	Research Methodology [Part A: Common, Part B: Subject related Research Methodology]	Theory	4	100 [Part A: 70 + Part B: 30]
PhD/E-02	Subject specific topic (Assignment)	Assignment	2	50
PhD/E-03	Seminar on Research topic or Literature Review or Research Paper	Seminar Presentation	2	50
Total			08	200

Award of Grades:

- A Ph.D. scholar has to obtain a minimum of 55% of marks or its equivalent grade in the UGC 7-point scale (or an equivalent grade/CGPA in a point scale wherever grading system is followed) in the coursework in order to be eligible to continue in the programme and submit the dissertation/thesis.
- Maximum two chances shall be given to the scholar for clearing the coursework, failing which may lead to cancellation of admission.

Coursework Assessment

Subject Code	Name of Module / Course		Total Marks
PHD/E-01	Written Examination: 100 Marks		
	Research Methodology	Part A	20 <i>Objective type questions</i> x 2 = 40 5 <i>Short answer type questions</i> (out of 7) x 6 = 30
		Part B	2 <i>Descriptive type questions</i> (out of 4) x 15 = 30
PHD/E-02	Submission of Hardcopy: 50 Marks		
	Subject specific topic (Assignment)		<ul style="list-style-type: none">• Topic for assignment should be related to scholar's Ph.D. subject / research area• Assignment shall be of a minimum of 5000 words
PHD/E-03	Submission of Hard copy with presentation: 50 Marks		
	Seminar on Research topic or Literature Review or Research Paper		<ul style="list-style-type: none">• 3500-- 5000 words• Presentation and viva voce
Total			200

C.B.C.S. Syllabus for Ph.D. Coursework

Name of Module/ Course: Research Methodology

Subject Code: PhD/E-01

Credit: 4 Credit Hours / week

(4 x 16 teaching weeks = 64 credit hours per semester)

Course Objectives and Outcomes:

To identify and apply appropriate research methodology in order to plan, conduct and evaluate basic research. The Course will furthermore enable scholars to distinguish between the scientific method and common sense knowledge while laying the foundation for research skills at higher levels.

Part A (Common for all faculties)

1. Basics of Research:

Definition of research - Objectives of research - Scientific research - Social science research - Ethics in research, Plagiarism, How to write a research proposal

2. Types and Methods of Research:

Classification of Research- Pure and Applied Research - Exploring or Formulative Research - Descriptive Research - Diagnostic Research/Study - Evaluation Research/Studies - Action Research - Experimental Research - Analytical Study of Statistical Method - Historical Research - Surveys - Case Study - Field Studies

3. Literature Review:

Need for Reviewing Literature - What to Review and for What Purpose - Literature Search - Procedure - Sources of Literature

4. The Planning Process of Research:

Selection of a Problem for Research - Formulation of the Selected Problems - Hypothesis Formation - Measurement - Research Design/Plan, Research process

5. Computer Application in Research:

Introduction to MS Excel, Using Formulas and Functions, Hand on to SPSS, Features for Statistical Data Analysis, Generating Charts/Graphs, Introduction to MS Word, Features and Functions, Writing Report in MS Word, Introduction to Open Office or Latex, Creating Presentations in MS Power Point, Introduction to Internet Based Search, Use of Advanced Research Techniques

6. Report Writing:

Types of Reports - Planning of Report Writing - Research Report Format - Principles of Writing - Documentation - Data and Data Analysis in Thesis - Writing of Report - Typing of Report - Briefing - Preparation of Manuscript for Publication of Research

Paper - Pictures and Graphs, Citation styles, Writing a Review of Paper, Bibliography, Writing Synopsis & Thesis.

7. Literary Concepts and Theory

8. Seminar about literature review or research paper by research scholar

Suggested Readings List:

Research Methodology: An Introduction by CR Kothari, New Age International Publishers.

Research Methodology: Methods and Techniques by C. R. Kothari, New Age International Publishers.

Research Methodology for Business: A Skill Based Approach by Kumar, Shekaran (2009), New York, John Wiley Publishers.

Research Methodology-A Step-by-Step Guide for Beginners, Kumar, Ranjit. (2nd.ed), Pearson Education.

Sinha P.K., *Computer Fundamentals*, BPB Publishing.

Inderpal Singh, *Research Methodology and Statistical Methods*, Kalyani Publishers, Ludhiana.

Krishnaswamy, K.N., Sivakumar, A. and Mathirajan, M.: *Management Research Methodology: Integration of Principles, Methods and Techniques*, Pearson Education, New Delhi.

A.S. Gaur & S.S. Gaur, *Statistical Methods for Practice and Research (A Guide to Data Analysis using SPSS)*, Sage Publications

Part B: Subject related Research Methodology

F.M-30

Optional Paper (Select any one):

1. Microbiology, Microbial Culture and Advanced Microbial Techniques
2. Ecology
3. Plant Taxonomy, Systematics and Biodiversity
4. Mycology, phytopathology and Plant Pathological techniques
5. Phycology
6. Plant Physiology and Biochemistry
7. Pteridology

Microbiology, Microbial Culture and Advanced Microbial Techniques

Transcription: Organization of transcriptional units Mechanism of transcription of prokaryotes-Structure and function of RNA polymerase, RNA processing (Capping, polyadenylation, splicing, introns and exons), Translation: Ribonucleoprotein, Salient features of genetic code, structure of mRNA, rRNA, tRNA. polycistronic mRNA in bacteria, translation mechanism in bacteria, Post-translational

modification, Regulation of gene expression in prokaryotes: Control of gene expression. Positive gene regulation, negative gene regulation and attenuation, using the lac, gal, trp, ara and tol operons, with emphasis on recent advances, Gene cloning: Plasmid biology (Types; Detection and purification; Replication); Genetic engineering (Splicing of DNA; Insertion of DNA into vector; Detection of recombinant molecules; Expression of cloned genes; PCR and Its variants, Genetic recombination: Genetic recombination processes: Role of rec proteins in homologous recombination. Conjugation: Discovery, F+, F- and Hfr cells, types of Hfr; F+ and F- and Hfr and F- genetic crosses. Mechanism of conjugation. Sexduction, conjugational transfer of colicinogenic and resistance transfer factors. Genetic mapping.

Preparation of Media, Types of growth media, Techniques for pure culture establishment and maintenance, Preservation of pure culture, Techniques for cultivation of anaerobes, Different staining methods, Identification of Prokaryotes, Antigen-Antibody reaction, ELISA, RIA, RAST, RIST, Lyophiliser, sonicator, Cold centrifuge, Ultracentrifuge, Electron Microscopy, Fluorescence Microscopy, PCR, Gel-documentation system, HPLC, GC-MS, FPLC, Northern, Southern and Western Blotting, Use of Bioinformatic tools for study of gene and protein sequences, Basic idea about Pharmacogenomics and Drug designing.

Ecology

The environment: Physical environment, biotic environment, biotic and abiotic interactions.

Ecosystem : Principle and concept of ecology, Structure and function , energy flow and mineral cycling (CNP) , primary production of some Indian ecosystems – terrestrial (forest , grassland) and aquatic (fresh water, marine).

Population ecology : Characteristics of a population, population regulation, life history strategies (r and k selection); concept of meta population – demes and dispersal, interdemec extinction, age structured populations.

Synecology or community ecology: Definitions, classification of vegetation, community composition, classification of community, study of plant community structure.

Species interactions: Types of species interactions; mathematical model/ Lotka- volterra model for interspecific competition; species coexistence and niche.

Plant succession and productivity: Plant succession – Definition, types, mechanisms and changes involved during succession, concept of climax; Productivity – Definition, types and measurements of primary productivity.

Ecological genetics of population or gene ecology: definition, concepts, characteristics, formation and origin of new ecotypes, significance of ecotypes, ecoclines.

Biodiversity: General concept, levels, importance, assessment of variation and isolation, conservation principles and strategies, Red Data Book and different categories of threatened plants (IUCN), hotspots.

Ecology and environmental issues: Food production, energy crisis, conservation of wastes to resources, salinity and water logging, reclamation of waste and mined lands, climatic changes, natural calamities, deforestation.

Ecology and man: International Biological Programme (IBP), Man and Biosphere Programme (MAB).

Environmental pollution and standard parameters: Air, water and soil pollution, effects on plants and ecosystems, methods/ techniques used in phytoremediation/ bioremediation.

Practical : To study physical characteristics of soil, To study chemical characteristics of soil, Determination of species area curve by quadrat method, Determination of density, frequency, basal cover and IVI of the species, Estimation of organic matter content of soil, Determination of total soluble salts of soil/ water, Colorimetric determination of nitrogen and phosphorus of soil, Determination of dissolved oxygen (D.O.) in unpolluted and polluted water, Determination of nutrient content of soil by kit method, Preparation of biological spectrum of a vegetation and comparison with Raunkiaer's normal biological spectrum.

Plant Taxonomy, Systematics and Biodiversity

Taxonomy and Systematics: Concept, objectives and significance.

Plant Nomenclature: ICN/ICBN, Principles, rules, recommendations and appendices, type concept, rules of priority, effective and valid publication, rejection of names.

Taxonomic Hierarchy: Definition, concept of species, genus, and other categories.

Taxonomic Literatures: Types, definition and examples.

Angiospermic Classifications: Broad outline classification of Cronquist (1988) and

APG IV (2016) with merits and demerits, phenetic versus phylogenetic systems, cladistics in taxonomy.

Data sources in Taxonomy: Supportive evidences from morphology and micro morphology, palynology, cytology, chemotaxonomy, serology and molecular taxonomy; molecular markers in plant systematics (chloroplast DNA, mitochondrial DNA and nuclear ribosomal DNA), DNA barcoding, application of computer and GIS in taxonomy.

Taxonomy and Phylogeny: Salient features, floral diversity, diversity of families and phylogeny of the following orders: Ranales, Centrospermae, Amentiferae, Helobiae and Glumiflorae.

Practical: Work out of at least 10 wild taxa representing different plant families and identification to species level, Construction of taxonomic keys: Indented and Bracketed, Study of flora, Formation of Phenogram and Cladogram.

Mycology, phytopathology and Plant Pathological techniques

Ultrastructure of fungal cell; Cell wall composition and biogenesis, Economic importance of Fungi (General account), Fungi as pathogen and biocontrol agents (general account), Human diseases of Fungi, Fungi in industry & medicine: Antibiotics- Penicillin; Organic acids – Citric acid; Plant growth regulator- Gibberellin, alcohol and Fungal enzymes (general account), Fungal toxins: Host non-selective toxins- cercosporin (Mode of action); Host specific toxins- structure, mode of action and concept of Vb gene, Mycotoxins- aflatoxin biosynthetic pathway with enzymatic and genetic informations, Mycorrhizae: interaction; Specific recognition in mycorrhizal association; Application as biofertilizer and bioprotector in forestry and agriculture, Structural and chemical decay of wood by decaying microorganisms, Details studies of fungal diseases: Damping off, powdery mildew, smut, rust, wilt, root rot, leaf spots, leaf blight and gall of economically important crops, Bacterial diseases: bacterial leaf blight of rice, bacterial wilt of potato, bacterial canker of tomato, crown gall of rose, Virus disease: Symptoms, carrier, transmission, interaction of virus and host; role of nucleic acid in virus infection; Control strategies, Plant disease control: chemical control, biological control of phytopathogens, integrated disease management practice. Resistance mechanisms in plants: Biosynthetic pathways for the main plant antimicrobials, PR proteins.

Study of mycoflora of air/soil, Preparation of media, Isolation of pathogen (Fungi and Bacteria) from diseased plant material, Study of Koch's postulates and pathogenicity test in whole plants/cut shoots/ leaves, Identification of fungi by molecular technique (by ITS region amplification and BLAST analysis) -Demonstration from an Identified organism.

Bioassay of antifungal compounds/fungicides by agar well/disc method, Artificial inoculation of plants with pathogen(s) and disease assessment, Comparison of soluble protein content between healthy and artificially inoculated plants, Comparison of total and orthodihydroxy phenol content between healthy and artificially inoculated plants, Extraction and assay of Phenylalanine ammonia lyase activity in plants following infection, Extraction and assay of peroxidase activity in plants following infection.

Phycology

General overview Basic characteristics features and modern system of classification, Evolution of Algae and range of thallus structure among different groups, General features of the division Cyanophyta. Ultrastructure of cell and Heterocyst, Glaucophyta-General characteristics and primitive features, phylogenetic significance. Dinophyta- Cell structure; Heterotrophic nutrition; Chlorophyta -Ultra structure of flagella; classification and phylogeny. Bacillariophyta - Classification; Ultra structure and developmental patterns of Diatom frustules.

Algal sampling techniques, Phytoplankton, benthos, preservation techniques (both wet and dry), algal ecology, community structure and population dynamics, culture and mass cultivation of algae, techniques for extraction, estimation and analysis of different algal component

Plant Physiology and Biochemistry

Unit I: Lipids and Amino Acids Biosynthesis

Lipids- structural and storage lipids and their functions; Amino acid biosynthesis and assimilation in plants

Unit II: Thermodynamic

Concept of free energy: Thermodynamic principles, energy-rich bonds, coupled reactions and oxidative phosphorylation, bioenergetics. Cellular oxidations: Pathways of ATP production, mitochondrial electron transport system, mitochondrial F₀F₁, ATPase and mechanism of ATP synthesis.

Unit III: Secondary Metabolites

Secondary metabolites- Role of natural products in plant defense, pharmaceuticals and cosmetics; Development of transgenic plants for abiotic stress tolerance; Stress Proteins in plants- HSP, osmotin, PR, BSIPS, Stress- induced proteins.

Unit IV: Stress physiology

Biotic and Abiotic stress; Physiological and Biochemical responses of plants to environmental stress; Plant responses to salinity and chilling stress; Abiotic stress and secondary metabolite production.

Unit V: Hormones & Signal Transduction

Hormonal regulation of plant growth and development, signal Transduction, Role of PGR in agriculture and horticulture, Status of Plant Physiology Research in India.

Practical

Quantitative estimation of Pigments in plant tissue.

Extraction and estimation of Chlorophyll, protein, Carbohydrate.

Evaluation of seed viability by reliable physiological and biochemical methods.

Quantitative estimation of proline in water-stressed leaf-tissues.

Effect of water stress on root metabolic activity.

Extraction and estimation of fat.

Separation of amino acids by paper chromatographic technique.

Extraction and estimation of the enzyme catalase, peroxidase and amylase from plant samples.

Separation of phenolic compounds by thin layer chromatography

Purification of protein by SDS-PAGE

Pteridology

Introductory idea about pteridophytes, Characteristic features, geological distribution, evolutionary trends and interrelationships of Rhyniopsida, Zosterophyllopsida, Trinerophytopsida, Psilotopsida, Lycopsidea and Sphenopsida, An idea about the system of classifications of ferns, A comparative study of the members belonging to the following taxonomic groups and also their systematic treatments, evolutionary tendencies and affinities: Cladoxylales, Marratiales, Ophioglossales, Osmundales, Filicales (Schizaeaceae, Gleicheniaceae, Cyatheaceae, Polypodiaceae), Salviniaceae, Marsileales, Stelar organization in pteridophytes and its evolution, Soral evolution in ferns, Mating systems in ferns, sexuality in homosporous ferns, apospory & apogamy ,Types of plant fossils according to their mode of preservation; Preparation of fossil slides through peeling technique, Spore-pollen symmetry, polarity, apertural pattern, exine stratification .

SYLLABUS
For
Ph.D. Coursework in
CHEMISTRY

(CBCS format)



(Effective from the academic session 2019 – 2020 and onwards)

DEPARTMENT OF CHEMISTRY
BANKURA UNIVERSITY
BANKURA

Ph.D. Course Work in Chemistry**Course Structure**

Paper	Course Code	Course name (Core/Elective)	Marks (Credits)	Lectures per week
Compulsory Paper (CP)				
I	(Part A)	Research Methodology	50 (2)	4 hrs
	(Part B)	Computer Applications	50 (2)	
Total			100 (4)	
Elective Paper (EP)				
II	CHEM-EP-1 (Part A)	Elective Paper	50 (2)	2 hrs
	CHEM-EP-2 (Part B)	Project work/Term Paper	50 (2)	
Total			100 (4)	

Important Points to Note:

1. Duration of Course Work: One Semester (6 Months).
2. Total Marks: 200 (8 credits) (Two papers 100 marks each)
3. Students are required to secure minimum 75% attendance (as per university rules) in each course to qualify for appearing in End semester examination.
4. For **Paper – I** (Part A and Part B each), Marks 100, Examination time: 4 hrs
5. Each student has to study an elective paper of 2 credits.
6. For **Paper – II** (Part A), a student can opt any one of the elective course of his/her area of research interest. The elective papers shall be offered from Annexure - II depending upon the availability of the expert faculty. Marks 50, Examination time: 2 hrs) and for **Paper–II** (Part B), students have to submit a written report based on his/her **Review Work or Research Topic or Research Paper** under the supervision of his/her respective supervisor and finally one presentation should be given using Power Point on same topic.

Annexure-II

Detailed Syllabus

Paper – I [Compulsory Paper (CP)]

Part A: Research Methodology (CHEM-CP-1): [Total 25 Lectures, 50 marks]

A1. Introduction to Research Methodology:

Meaning of Research, Objectives of Research, Motivations in Research, Types of Research, Criteria of good Research, What is Research Problem? Basic and Applied research.

A2. Review of Literature and Literature survey:

Meaning and Purpose of the Literature Review & Literature Survey, Identification of the related Literature.

A3. The Research Report:

General format of the Research report, style and formatting of writing, typing of the research report.

A4. Testing of Hypotheses and Sampling design:

Definition, Concepts Concerning Testing of Hypotheses, Formulation of hypotheses and related difficulties; Needs of sampling, Sampling for chemical analysis, Random sampling

A5. Quantification of research output:

Impact Factor, *h*-index, *i10*-index and *i20*-index, G-index.

A6. Ethics in Research and Intellectual Property Rights:

Environmental Impacts, Ethical Issues, Reproduction of published material, Plagiarism, Citation and Acknowledgement, Reproducibility and accountability. Intellectual Property Rights, Patents, Copyright, Royalty.

Part B: Computer Applications (CHEM-CP-2): [Total 25 Lectures, 50 marks]

B1. Computer Applications in Research: Literature survey using web, handling search engines.

Preparation of-

- (i) Research papers: Using word processing software – MS Word/Latex/others,
- (ii) Drawing graphs and diagrams – Origin/Excel/others,
- (iii) Seminar presentations – Power point for oral and poster presentations,
- (iv) Data presentation,
- (v) Figure insertions in documents.

References:

1. C R Kothari, Research Methodology: Methods and Techniques, New Age International (P)Ltd. (2010) , New Delhi
2. Garg, B.L., Karadia, R., Agarwal, F. and Agarwal, U.K., 2002. *An introduction to Research Methodology*, RBSA Publishers.
3. Handbook of Communication and Social Interaction Skills by John O. Greene, Brant Raney Burleson.

4. W.M.K.Trochim, 2005. *Research Methods: the concise knowledge base*, AtomicDog Publishing. 270p.
5. Ranjit Kumar, *Research Methodology: A Step-by-Step Guide for Beginners*, SAGE Publications
6. Inderpal Singh, *Research Methodology and Statistical Methods*, Kalyani Publishers, Ludhiana.
7. G Kanji 100 statistical tests, Sage Publications.
8. R.A. Day (1992) *How to write and publish a scientific paper*. Cambridge Universitypress.London.
9. P.K. Sinha (1992). *Computer Fundamentals*, BPB Publications, New Delhi.
10. SPSS – Operating Manual and handbook – Latest version.
11. Leon & Leon (2002). *Internet for everyone*, Vikas Publishing House.

Paper – II [Elective Paper (EP)]

Part A: Elective Paper (CHEM-EP-1):

[Total 25 Lectures, 50 marks]

Student can opt any one of the following elective paper of his/her area of research interest

Course Name: Application of Modern characterization Techniques

Course Code: CHEM-EP-1.1

Full Marks: 50

Credit: 2

Course Contents:

Ultraviolet Spectroscopy: Introduction. Studies of conjugated and extended conjugated systems etc. Woodward rules. Spectrophotometry, theory and applications.

Infrared Spectroscopy: Introduction. Identification of functional groups, hydrogen bonding etc., metal ligand vibrations.

Nuclear Magnetic Resonance Spectroscopy: Introduction. Application of ^1H and ^{13}C NMR spectroscopy techniques in the structural determination of complex organic systems.

Mass Spectrometry: Basic concepts. Fragmentation and rearrangements (including McLafferty rearrangement) of different classes of organic molecules. Isotope effects etc.

Structural elucidation by joint application of UV, IR, NMR and mass spectrometry

Electron Spin Resonance Spectroscopy: A brief review of theory. Analysis of ESR spectra of systems in liquid phase, radicals containing single set, multiple sets of protons, triplet ground states. Transitionmetal ions. Rare earth ions, ion in solid state. Double resonance techniques: ENDOR in liquid solution, ENDOR in powers and non-oriented solids. Biological applications: Substrate free radical, flavins and metal free flavin proteins, photosynthesis, Heme proteins, Iron-sulphur proteins, spin labels.

Fluorescence spectroscopy: Fluorescence energy transfer and its applications to measurement of distances in molecules.

Reference:

1. R. L. Pecsok, L. D. Shields, T. Cairns and L.C. Mc William, *Modern Methods of Chemical Analysis*, 2nd Edition (1976), John Wiley, New York.

2. Robert M. Silverstein, Francis X. Webster, David Kiemle, Spectroscopic identification of organic compounds, John Wiley & Sons; 7th Revised edition 2005.
3. G. D. Christian, Analytical Chemistry, 5th Edition (1994), John Wiley & Sons, New York.
4. D. A. Skoog, D.M. West, F.J. Holler, S.R. Crouch, Analytical Chemistry - An Introduction, 7th Edition (2000), Saunders College Publishing, Philadelphia, London.
5. G. M. Barrow, Introduction to Molecular Spectroscopy, (1962) McGraw-Hill.
6. C. N. Banwell and E. M. McCash, Fundamentals of Molecular Spectroscopy, 4th edition, (1994), Tata McGraw Hill, New Delhi.
7. J. M. Hollas, Modern Spectroscopy, 4th edition (2004), John Wiley & Sons, Ltd., Chichester.
8. W. Kemp, *Organic Spectroscopy*, 3rd Edn, Macmillan Press Ltd., 1991.

Course Name: Catalysis: Theory, Synthesis, Characterization and application

Course Code: CHEM-EP-1.2

Full Marks: 50

Credit: 2

Course Contents:

Adsorption, Types of adsorption and Catalysis, Adsorption Kinetics, law of mass action, conversion, yield, selectivity, reaction rate, activation energy, kinetic orders, molecularity, rank, power rate law

Synthesis of Catalyst. In-situ polymerization and composite formation (IPCF) reaction. Homogeneous and Heterogeneous catalysis.

Characterization by Powder X-ray diffraction technique, Scanning Electron Microscope (SEM) and Transmission Electron Microscope (TEM).

Terminology in catalysis, TO(Turnover), TON(Turnover number), TOF(Turnover frequency).

Sequences involved in a catalysed reaction, other terms used in catalysis, enantioselectivity, stereoselectivity, chemoselectivity, regioselectivity, Asymmetric synthesis using a catalyst. Sensor. Synthesis of Metal-catalyst (Pd, Ru, Cu and Fe) and their application in Sonogashira, Heck, Stille, Suzuki coupling and Click reaction.

Reference:

1. R. J. Farrauto & C. H. Bartholomew, Fundamentals of Industrial catalytic Processes, Blackie Academic & Professional, 1997
2. H. S. Fogler, Elements of Chemical reaction engineering, Prentice – Hall of India, 2002, Third edition.
3. J.J. Carberry, Chemical and catalytic reaction Engineering, Dover Publications, 2001
4. Chemistry of nanomaterials: Synthesis, properties and applications - CNR Rao et.al.
5. Nanoparticles: From theory to applications, Wiley Weinheim, 2004 - G. Schmidt.
6. The chemistry of nanomaterials: Synthesis, properties and applications, Wiley VCH VerlagGmbH & Co, Weinheim, 2004 - C.N.R.Rao, A. Muller, A. K. Cheetham (Eds).
7. D. Gupta, *Basic Organometallic Chemistry: Concepts, Syntheses and Applications*, Universities Press, 2011.
8. J. M. Thomas & W. J. Thomas, Principles and Practice of Heterogeneous Catalysis, VCH, 1997
9. J. M. Smith, Chemical Engineering Kinetics, McGraw-Hill Book Company, 1981

Course Name: Bioinorganic, Bioorganic and Electro Chemistry

Course Code: CHEM-EP-1.3

Full Marks: 50

Credit: 2

Course Contents:

Overview of Bioorganic Chemistry- Historical Connection Between Organic and Biological Chemistry; Weak Interactions in Organic and Biological World; Proximity Effect in Organic Chemistry; Molecular Recognition; Chemistry of the Living Cells; Analogy Between Biochemical and Organic Reaction. Nucleic acids, purine and pyrimidine bases, nucleosides, and nucleotides. Genetic code of life, replication, transcription and translation of DNA, genetic information transfer and heredity. Types of sugars, deoxy sugars, amino sugars and polysaccharides.

Occurrence and observation of tetrapyrrole ring in biology (Haemoglobin, myoglobin, cytochromes, chlorophyll, enzymes, Vitamin B12) and their activity. Model study. Example of metalloenzymes. Spin state of iron and its biological relevance. Experimental techniques for structural elucidation: MM, EPR, Mössbauer etc. Inorganic chemistry in medicine, platinum complexes, Mo=S complexes as anti-cancer drugs.

Activity coefficients of electrolyte solutions; Debye-Hückel-Onsager theory for electrical conduction in electrolyte solutions; limitation of Debye-Hückel-Onsager theory; Ion-atmosphere, Ion-solvent interaction, Enthalpy of Ion-solvent interaction and its calculation. Solvation and solvation number.

Reference:

1. Hermann Dugas: Bioorganic Chemistry-A chemical Approach to Enzyme Action; 3rd Edition.
2. The organic chemistry of enzyme-catalyzed reactions, by Richard B. Silverman, Academic Press, San Diego, 2000, 717 pp.
3. Principles of bioinorganic chemistry: By S J Lippard and J M Berg. pp 411. University Science Books, Mill Valley, California. 1994.
4. Bioinorganic Chemistry, By A. K. Das, Books & Allied (P) Ltd. Kolkata 2007.
5. Bioinorganic Chemistry, A Survey, By Ei-Ichiro Ochiai, 1st Edition, pp 360. Academic Press, Elsevier 2009
6. J.O'M Bockris, A.K.N Reddy and M.G. Aldeco, Modern Electrochemistry, Published by Springer.
7. Samuel Glasstone, An Introduction to Electrochemistry, East West Press Private, Limited

Course Name: Supramolecules, Natural products and Macromolecules

Course Code: CHEM-EP-1.4

Full Marks: 50

Credit: 2

Course Contents:

Fundamentals of Supramolecular Chemistry: Definition, History, Nature of supramolecular interactions.

Biomimetic systems and artificial receptors:

(a) Cation Binding Hosts -Podand, Crown Ether, Cryptand, Spherand; Nomenclature, Selectivity and Solution Behaviour; Alkalides, Electrides, Calixarenes and Siderophores.

(b) Anion binding hosts - Challenges and Concepts, Biological Receptors, Conversion of Cation Hosts to Anion Hosts, Neutral Receptors, Metal-Containing Receptors, Chelapods.

(c) Ion Pair Receptors - Contact Ion Pairs, Cascade Complexes, Remote Anion and Cation Binding Sites, Symport and Metals Extraction.

(d) Hosts for Neutral Receptors -Clathrates, Inclusion Compounds, Zeolites, Intercalates, Coordination Polymers, Guest Binding by Cavitands and Cyclodextrins, cucurbituril.

Alkaloids: Familiarity with methods of structure elucidation (chemical & spectroscopic method), synthesis and reaction of alkaloids (quinine, atropine, coniine and papaverine). Terpenoids: Structure elucidation, synthesis and reaction of Terpenoids (Abietic acid/ β -Carotene).

Structure, synthesis and reactions of steroids (cholesterol, testosterone, estrone, progesterone).

Structure, synthesis and reactions of flavonoids and coumarins. Structure and synthesis of porphyrins (haemoglobin, chlorophyll). Structure and synthesis of prostaglandins (PGE₂, PGF₂ α).

Introduction; Carothers' equation, average molecular weights and their determination; kinetics of addition and condensation polymerization, flexibility of polymer chain, statistics of polymer dimensions and configurations, effect of solvent on the average dimensions; theories of polymer solutions: excluded volume and Flory-Huggins theory.

Reference:

1. J. M. Lehn, *Supramolecular Chemistry*, VCH, Weinheim, 1995.
2. *Supramolecular Chemistry* by J. W. Steed & J. L. Atwood, 2nd Edn John Wiley, 2009.
3. *Crystal Engineering. The Design of Organic Solids* by G.R. Desiraju, Elsevier, 1989.
4. S. V. Bhat, B. A. Nagasampagi and M. Sivakumar, *Chemistry of Natural Products*, Narosa Publishing House, New Delhi, 2005.
5. S. P. Bhutani, *Chemistry of Biomolecules*, CRC Press, 2010.
6. X.-T. Liang and W.-S. Fang, *Medicinal Chemistry of Bioactive Natural Products*, John Wiley & Sons, 2006.
7. S. F. Sun, *Physical Chemistry of Macromolecules: Basic Principles and Issues*, John Wiley & Sons, New York, 1994.
8. C. Tanford, *Physical Chemistry of Macromolecules*, John Wiley & Sons, Inc, New York, 1961.
9. P. Ghosh, *Polymer Science and Technology of Plastic and Rubber*, Tata McGraw-Hill Publishing Company Limited. 2008.

Part B: Elective Paper (CHEM-EP-2):

Students have to submit a written report based on his/her **Review Work or Research Topic or Research Paper** under the supervision of his/her respective supervisor and finally one presentation should be given using Power Point on same topic.



BANKURA UNIVERSITY

EXAMINATION PATTERN

and

COURSE DESIGN

For C.B.C.S. Ph.D. Coursework in ENGLISH

To be implemented from the session 2017 – 2018 onwards

Ph. D. Coursework guidelines

- As per Bankura University Regulations Relating to Doctoral (Ph.D.) Degree 2017, after admission to PhD, a research scholar shall be required to undertake coursework for a minimum period of one semester. All candidates admitted to the Ph.D. programme shall be required to complete the coursework prescribed by the Department during the initial one or two semesters. Women candidates may be allowed a relaxation of two terms / semesters in case of maternity.
- Candidates already holding M. Phil. degree and admitted to the Ph.D. programme, or those who have already completed the course work in M.Phil. / Ph.D. and have been permitted to proceed to the Ph.D. in integrated course, may be exempted by the Department from the Ph.D. course work. All other candidates admitted to the Ph.D. programme shall be required to complete the Ph.D. course work prescribed by the Department.
- 75 % attendance for coursework classes is compulsory.
- Teaching work per credit is 16 hours. (This may include lectures, seminars, and tutorials).

Course Structure:

Subject Code	Name of Module / Course	Paper Type	Credits	Total Marks
PhD/E-01	Research Methodology [Part A: Common, Part B: Subject related Research Methodology]	Theory	4	100 [Part A: 70 + Part B: 30]
PhD/E-02	Subject specific topic (Assignment)	Assignment	2	50
PhD/E-03	Seminar on Research topic or Literature Review or Research Paper	Seminar Presentation	2	50
Total			08	200

Award of Grades:

- A Ph.D. scholar has to obtain a minimum of 55% of marks or its equivalent grade in the UGC 7-point scale (or an equivalent grade/CGPA in a point scale wherever grading system is followed) in the coursework in order to be eligible to continue in the programme and submit the dissertation/thesis.
- Maximum two chances shall be given to the scholar for clearing the coursework, failing which may lead to cancellation of admission.

Coursework Assessment

Subject Code	Name of Module / Course	Total Marks
PHD/E-01	Written Examination: 100 Marks	
	Research Methodology	Part A 20 <i>Objective type questions</i> x 2 = 40 5 <i>Short answer type questions</i> (out of 7) x 6 = 30
		Part B 2 <i>Descriptive type questions</i> (out of 4) x 15 = 30
PHD/E-02	Submission of Hardcopy: 50 Marks	
	Subject specific topic (Assignment)	<ul style="list-style-type: none"> • Topic for assignment should be related to scholar's Ph.D. subject / research area • Assignment shall be of a minimum of 5000 words
PHD/E-03	Submission of Hardcopy with presentation: 50 Marks	
	Seminar on Research topic or Literature Review or Research Paper	<ul style="list-style-type: none"> • 3500 -- 5000 words • Presentation and viva voce
Total		200

C.B.C.S. Syllabus for Ph.D. Coursework

Name of Module/ Course: Research Methodology

Subject Code: PhD/E-01

Credit: 4 Credit Hours / week

(4 x 16 teaching weeks = 64 credit hours per semester)

Course Objectives and Outcomes:

To identify and apply appropriate research methodology in order to plan, conduct and evaluate basic research. The Course will furthermore enable scholars to distinguish between the scientific method and common sense knowledge while laying the foundation for research skills at higher levels.

Part A (Common for all faculties)

1. Basics of Research:

Definition of research - Objectives of research - Scientific research - Social science research - Ethics in research, Plagiarism, How to write a research proposal

2. Types and Methods of Research:

Classification of Research- Pure and Applied Research - Exploring or Formulative Research - Descriptive Research - Diagnostic Research/Study - Evaluation Research/Studies - Action Research - Experimental Research - Analytical Study of Statistical Method - Historical Research - Surveys - Case Study - Field Studies

3. Literature Review:

Need for Reviewing Literature - What to Review and for What Purpose - Literature Search - Procedure - Sources of Literature

4. The Planning Process of Research:

Selection of a Problem for Research - Formulation of the Selected Problems - Hypothesis Formation - Measurement - Research Design/Plan, Research process

5. Computer Application in Research:

Introduction to MS Excel, Using Formulas and Functions, Hand on to SPSS, Features for Statistical Data Analysis, Generating Charts/Graphs, Introduction to MS Word, Features and Functions, Writing Report in MS Word, Introduction to Open Office or Latex, Creating Presentations in MS Power Point, Introduction to Internet Based Search, Use of Advanced Research Techniques

6. Report Writing:

Types of Reports - Planning of Report Writing - Research Report Format - Principles of Writing - Documentation - Data and Data Analysis in Thesis - Writing of Report - Typing of Report - Briefing - Preparation of Manuscript for Publication of Research

Paper - Pictures and Graphs, Citation styles, Writing a Review of Paper, Bibliography, Writing Synopsis & Thesis.

7. Literary Concepts and Theory

8. Seminar about literature review or research paper by research scholar

Suggested Readings List:

Research Methodology: An Introduction by CR Kothari, New Age International Publishers.

Research Methodology: Methods and Techniques by C. R. Kothari, New Age International Publishers.

Research Methodology for Business: A Skill Based Approach by Kumar, Shekaran (2009), New York, John Wiley Publishers.

Research Methodology-A Step-by-Step Guide for Beginners, Kumar, Ranjit. (2nd.ed), Pearson Education.

Sinha P.K., *Computer Fundamentals*, BPB Publishing.

Part B:

(Research Methodology as per faculty/subject requirement) (Shall be covered by respective supervisor)

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**SYLLABUS
OF
COURSEWORK FOR Ph.D. PROGRAMME
IN
GEOGRAPHY**

2020



RESEARCH COMMITTEE OF GEOGRAPHY

BANKURA UNIVERSITY

**MAIN CAMPUS (BESIDE NH-60)
P.O.-PURANDARPUR, DIST- BANKURA
PIN- 722155, WEST BENGAL**

Ph.D. Coursework and Course-End Examination

1. Ph.D. students have to undergo one semester coursework of six months duration. There shall be four papers of 50 marks each and 16 credits.
2. UGC Regulation, 2016 will be followed regarding coursework and its eligibility criteria.
3. A student has to complete his coursework before his/her final registration in Ph.D programme.
4. Each 50 marks paper is composed of 40 marks end semester examination and 10 marks of internal assessment.
5. Mode of internal assessment is variable to be announced by the Research Committee at the beginning of the course. It may be composed of seminar/presentation/assignment/group discussion/project work as may be deemed fit for the course.
6. A student must obtain 50% marks in the coursework to qualify for registration. The students who fails to obtain this required percentage of marks or fail to appear any of the paper(s) will be entitled to appear in back papers in the next regular course and examination(s); There shall be no separate supplementary examination.

Distribution of Marks and Credits of the Coursework

Course Code/Name	Title of Paper	Full Marks	Credits	Marks Break up
PHDGEO-101	Research Methodology	50	4	Int. Assessment- 10 End-SEM Exam-40
PHDGEO-102	Research Methodology in Geography	50	4	Int. Assessment- 10 End-SEM Exam-40
PHDGEO-103	Statistics in Geographical Research	50	4	Int. Assessment- 10 End-SEM Exam-40
PHDGEO-104	Literature Review and Thesis Organisation	50	4	Project File- 30 Presentation- 20

COURSE CODE: PHDGEO-101
RESEARCH METHODOLOGY
FULL MARKS: 50 (4 Credits)
[Internal Assessment- 10 + End SEM Examination- 40]

Exam Duration: 2 hours

Pattern of Questions: [(10x2=20) + (5x2=10) + (2x5=10)]

Unit-1.0: Conceptual Framework

Definition, Objectives, Significance of Research; Criteria of good research

Unit-2.0: Research Design

Meaning and necessity, Chief features, Research questions and hypotheses; Deductive and Inductive approaches in research; Qualitative and Quantitative Research

Unit-3.0: Research Report and Paper Writing

Layout of a good Research Proposal; Methods of searching information; ethical issues related to publishing

COURSE CODE: PHDGEO-102
RESEARCH METHODOLOGY IN GEOGRAPHY
FULL MARKS: 50 (4 Credits)
[Internal Assessment- 10 + End SEM Examination- 40]

Exam Duration: 3 hours

Pattern of Questions: [(10x2=20) + (5x2=10) + (2x5=10)]

Unit-1: Concepts and Approaches

Nature and characteristics of Geographical Data; Research Design in Geography; Basic criteria for geographical research

Unit-2: Geographical Data Analysis: Remote Sensing

Downloading and extraction of Satellite images; Image Sub-setting; Landuse-landcover Mapping; Exploring Google Earth Interface; Preparation of DEM from SRTM and ASTER; measurement of height and creation of elevation profile from the same

Unit-3: Geographical Data Representation: GIS

Georeferencing and Digitization; Editing ; Design and Layout of Thematic Maps, Use of statistical tools for spatial data

COURSE CODE: PHDGEO-103
STATISTICS IN GEOGRAPHICAL RESEARCH
FULL MARKS: 50 (4 Credits)
[Internal Assessment- 10 + End SEM Examination- 40]

Exam Duration: 3 hours

Pattern of Questions: [(10x2=20) + (5x2=10) + (2x5=10)]

Unit-1: Methods of Qualitative and Quantitative Data Analysis

Information and Data; Rating Scale: Types and Applications; Quantitative Data: Nature and Types; Usage of Census data, NSSO (National Sample Survey Organization) data, NFHS(National Family Health Survey), Sampling Techniques, Design and Size,

Unit-2: Working with Excel

Analyses: Basic Descriptive Statistics and Graphing representation of data;;

Unit-3: Working with statistical software

Contingency and Matrix Table; Correlation, Regression of Bivariate and Multivariate data type, Data Processing; Factor Analysis and Interpretation; Data Presentation; Exporting files to other Applications.

COURSE CODE: PHDGEO-104
LITERATURE REVIEW AND THESIS ORGANISATION
FULL MARKS: 50 (4 Credits)
[Internal Assessment- 10 + End SEM Examination- 40]

Exam Duration: 2 hours

Pattern of Examination: Project File- 30 Marks + Presentation- 20 Marks

Unit-1: Literature Review

Importance and Meaning of Literature Review: Review of Literature from at least 30 books and research articles on relevant topic according to own choice. Different available Referencing Systems

Unit-2: Thesis Organisation

Preparation of synopsis: tentative chapter scheme of the proposed work with specific objectives, methods and methodology, hypotheses, datasets within 10to 15 pages including flow chart, map(s) and diagram(s)

Unit-3: Presentation

The students have to present the literature review and thesis organization in power point slides of not more than 15 minutes in front of a panel of examiners duly constituted by the committee.

References

- Ahuja Ram (2001) Research Methods, Rawat Publications, Jaipur , India.
- Bajpai S. R. (1975) Methods of Social Survey and Research, Kitabghar, Kanpur.
- Best J. W. and Khan J. V. (2005) Research in Education New Delhi, Prentice Hall India.
- Bhattacharya, D. K. (2004) Research Methodology, New Delhi, Excel Books.
- Brymann, Alan and Carmer, D. (1995) Qualitative data analysis for social scientist, New York, Routledge Publication.
- Chandera A. and Sexena T. P. (2000) Style Manual, New Delhi, Metropolitan Book Comp. Ltd.
- Cunningham, J.B and Aldrich, J.O. (2012) Using SPSS: An Interactive Hands-On Approach, Sage Publications, New Delhi.
- Gautam, N. C. (2004) Development of Research tools, New Delhi, Shree Publishers.
- Gupta, S. (2005) Research Methodology and Statistical Techniques, Deep and Deep Publications.
- Hans Raj (1988) Theory and Practice in Social Research, Surjeet Publication, Kolhapur.
- Kothari, C. R. (2005) Quantitative Technique, New Delhi, Vikas Publication House.
- Krishnaswami O. R. (1988) Methodology of Research in Social Science, Himalaya Pub. House.
- Sadhu, Singh, Research Methodology in Social Science Bhandarkar, Research Methodology
- Shukla, J. J. (1999) Theories of Knowledge, Ahmadabad, Karnavati Publication.

HIST/PHD/C-1B: Research Methodology—Learning the Historian's Craft

The main aim of the course is to read and critically discuss a set of articles and book chapters to learn how historians use different kinds of sources, interrogate them and build up a narrative. It is designed as a 'reading' course (as opposed to lecture method), where the course instructor is only supposed to initiate the discussion. The participants need to read the essay before coming to the class and contribute to the general discussion.

Suggested Readings:

1. Georges Lefebvre, *The Great Fear of 1789: Rural Panic in Revolutionary France* (Selected chapters), 1973.
2. Indivar Kamtekar, 'The Shiver of 1942', *Studies in History*, Vol 18, no. 1, 2002.
3. Ranajit Guha, 'The Prose of Counter-Insurgency', *Subaltern Studies Vol. 2*, 1983
4. Robert Darnton, *The Great Cat Massacre*, 1984
5. Romila Thapar, 'The Image of the Barbarian in Early India', *Comparative Studies in Society and History*, Vol 13, Issue 4, 1971.
6. Shahid Amin, 'Gandhi as Mahatma: Gorakhpur District, Eastern UP, 1921-22', *Subaltern Studies Vol. 3*, 1984.
7. Sumit Sarkar, 'Kaliyuga', 'Chakri' and 'Bhakti': Ramakrishna and his Times', *EPW* Vol 27, Issue 29, July, 1992.
8. Urvashi Butalia, *The Other Side of Silence: Voices from the Partition of India* (Selected chapters), 2000.
9. Gyanendra Pandey, 'In Defense of Fragment'

HIST/PHD/C-2A: Traditions of History-Writing in India

- a. **Indian sense of the past**---the meaning of historical consciousness---the Indian perceptions---the concept of time in ancient India.
- b. **Sources of ancient India:** Vedic texts—the Buddhist and Jaina texts---the itihasa purana tradition---the early medieval expressions---the historical biographies---Harshacharita and Rajtarangini.
- c. **Sources of Medieval Indian Historiography**---Sanskrit, Persian and Arabic inscriptions of the Sultanate period—Imperial orders and edicts by princes and nobles---farmans, nishans and parwanas. Study of memoirs and biographies—Babarnama, Akbarnama, Jahangir nama.
- d. **Some Historians of Medieval India**--Sultanate period—Barani, Isami, Amir Khusrau. Historians and Histories of Mughal Empire under Akbar—Abul Fazl's ideas of history: *Ain-i-Akbari*—Khwaja Nizamuddin's treatment of History—Badauni's treatment of History. Travel Accounts of Ibn Batuta, Bernier, and Manucci
- e. **British attitude towards India and Indian Response:** William Jones, James Mill, Todd—W.W. Hunter—Moreland---V.Smith and others. Nationalist Approach---J.N.Sarkar, R.C.Majumdar, N.K.Sinha and others-- Marxist Approach---D.D. Kosambi, Irfan Habib, Romila Thapar and others.

HIST/PHD/C-2B: Historiography and Historical Practice in the Modern West

- a. Emergence of 'History' as a discipline in the nineteenth century in Europe. Positivism, Whig History. Writings of Ranke.
- b. Narratives and History. Facts and Events of History. Idea of 'Objectivity' in History.
- c. Structuralism and History. Marxist interpretation of History. British Marxist Historians and rise of social history: Thompson, Hill, Hobsbawm.
- d. Annales School: Early years—Marc Bloch and Lucien Febvre. Writing Total History: Fernand Braudel. History of *mentalite*: Emmanuel le Roy Ladurie.
- e. Small voice of History: Impact of Post-modernism and Post-colonialism on historiography. Micro-history and History of Everyday Life. Analysing Power and Discourse—Michel Foucault. Linguistic Turn in History.

SYLLABUS
For
Ph.D. Coursework in
MATHEMATICS
(in CBCS format)



(Effective from the academic session 2018 – 2019 and onwards)

DEPARTMENT OF MATHEMATICS
BANKURA UNIVERSITY
BANKURA

Bankura University
Department of Mathematics
Ph.D. Course Work Syllabus

Important points to be noted:

- ❖ Duration of Course Work: One Semester (6 Months)
- ❖ Total Marks: 200 (Two papers 100 marks each)
- ❖ Examination will be held at the end of the Semester.

Structure:

	Topics and the way of Evaluation			Marks Distribution (Credits)	Lectures per week
Paper – I Compulsory Units	Group A			50 (2)	2 hours
	Research Methodology (CODE : BKU/MATH/CW/CRM)				
	Group B			50 (2)	
	Computer Applications (CODE : BKU/MATH/CW/CCA)				
Paper-II A Elective units	Some Elective Papers to be Chosen such that their total Marks will be 50	Theory of Semi groups (CODE : BKU/MATH/CW/EU1)	25	50 (2)	2 hours
		Lattice Theory (CODE : BKU/MATH/CW/EU2)	25		
		Riemannian Manifolds (CODE : BKU/MATH/CW/EU3)	25		
		Contact Manifolds (CODE : BKU/MATH/CW/EU4)	25		
		General Relativity (CODE : BKU/MATH/CW/EU5)	25		
		Astrophysics & Accretion Phenomena (CODE : BKU/MATH/CW/EU6)	25		
		Mathematical Modeling of Biological Systems (CODE : BKU/MATH/CW/EU7)	25		
		Mathematical Modeling of Biological Events (CODE : BKU/MATH/CW/EU8)	25		
		Introduction to Fuzzy Sets (CODE : BKU/MATH/CW/EU9)	25		
		Introduction to Fuzzy Analysis (CODE : BKU/MATH/CW/EU10)	25		
		Higher order Methods for Flow Simulation and Optimization (CODE : BKU/MATH/CW/EU11)	50		
		Introduction to Iterative methods for Linear and Nonlinear Equations (CODE : BKU/MATH/CW/EU12)	25		
Part II B		Literature review		50 (2)	

N.B.: For **paper – I** (Group A), *in end semester examination, students have to answer 25 short type questions (out of 40 questions, each question carries on 2 marks, examination time: 2hrs)* and for **paper – I** (Group B), *in end semester examination, one presentation should be given which has to be prepared using LaTeX-Beamer or Powerpoint on some research topic in consultation with the supervisor(s) (together with Viva Voce).*

For **paper – II** (Group A), students to opt for **two elective units** out of the following elective units offered. *For a 25 marks paper students have to answer 5 questions of 5 marks each (8 questions will be given) (examination time: 2hrs for 50 marks)* and for **paper –II** (Group B), students have to submit a written report based on his/her review work under the supervision of his/her respective supervisor in the Mathematics Department of Bankura University.

Detailed Syllabus

Paper – I (Compulsory Course)

Group A: Research Methodology: [Total 25 Lectures, 50 marks]

Introduction to Research Methodology: Objectives of Research, Motivations in Research, Ethics in Research, Plagiarism, Pedagogical Research, Research Methods v/s Methodology: Zorne's Lemma, Axiom of Choice, Well ordering principle; Proposition, Theorem, Lemma, Corollary : their differences and relations, Evolution of Mathematical Research.

Defining the Research Problem: What is Research Problem? Selecting the problem, Necessity of - and -Techniques in defining the problem, writing a research proposal.

Review of Literature: Purpose of the Review, Identification of the related Literature, Organizing the related Literature, archive.

The Research Report: General format of the Research report, writing technical research report, writing a research paper, proof reading, Keywords and Phrases, Mathematical subject classification, References, cross-References, Fast Track Communication, Short Communication, Erratum, Science Citation Index. MathSciNet, Zentralblatt(Z-Math), Scopus, i-index, h-index, impact factor.

Group B: Computer Applications in Research Work (Both theoretical and Practical) [Total 25 Lectures; 50 marks]

- i. Basics of operating systems
- ii. Literature survey using web, handling search engines
- iii. Preparing presentations: (a) Research papers: Using word processing software – MS Word, Latex, (b) Drawing graphs and diagrams (c) Seminar presentations – oral and poster presentations.
- iv. Basic uses of Mathematica/Matlab/Maple.

Bankura University
Department of Mathematics
Ph.D. Course Work Syllabus

References:

1. C R Kothari , Research Methodology: Methods and Techniques , New Age International (P) Ltd. (2010) , New Delhi
2. Garg, B.L., Karadia, R., Agarwal, F. and Agarwal, U.K., 2002. *An introduction to Research Methodology*, RBSA Publishers.
3. Handbook of Communication and Social Interaction Skills by John O. Greene, Brant Raney Burleson.
4. Trochim, W.M.K., 2005. *Research Methods: the concise knowledge base*, Atomic Dog Publishing. 270p.
5. Ranjit Kumar, Research Methodology: A Step-by-Step Guide for Beginners, SAGE Publications
6. Inderpal Singh, Research Methodology and Statistical Methods, Kalyani Publishers, Ludhiana.
7. G Kanji 100 statistical tests, Sage Publications
8. A.S. Gaur & S.S. Gaur , Statistical Methods for Practice and Research (A Guide to Data Analysis using SPSS), Sage Publications
9. C. Boyer, History of Mathematics.
10. Stellwel.

Elective Courses

(CODE : BKU/MATH/CW/EU1)
Theory of Semi groups (25 Marks)

Introduction: Basic Definitions and Results: Congruences, Rees congruences, Ideals, Homomorphisms etc. Green's Equivalence Relations and Regular Semigroups. Completely Regular Semigroups : Characterization of completely regular semigroups as union of groups, semilattices of groups, Clifford Semigroups, Intra – regular Semigroups, Orthodox Semigroups, Inverse Semigroups etc.

References:

1. Introduction to semigroup theory: J. Howie
2. Semigroup theory: Clifford&Preston.

(CODE : BKU/MATH/CW/EU2)
Lattice Theory (25 Marks)

Types of Lattices, Postulates for Lattices, Distributive and Modular lattices, Structure and Representation Theory, Complete lattices, Lattice ordered groups, lattice ordered monoids, lattice ordered rings, vector lattices.

References:

1. Introduction to lattice theory: Davey&Priestley.

Bankura University
Department of Mathematics
Ph.D. Course Work Syllabus

(CODE : BKU/MATH/CW/EU3)
Riemannian manifolds: (Marks:25)

Riemannian manifolds, Riemannian connection, Semi-symmetric connection on Riemannian manifolds, Quarter symmetric connection on Riemannian manifolds, Einstein manifolds and its generalizations, Manifolds of constant curvature and its generalizations, Some transformations on Riemannian manifolds, Locally symmetric manifolds due to Cartan, Recurrent manifolds, Semi-symmetric manifolds, Pseudo symmetric manifolds, Ricci parallel manifolds, Ricci semi-symmetric manifolds, Ricci pseudo symmetric manifolds.

References:

- [1] M. P. Do Carmo, Riemannian Geometry, Birkhauser, Boston, 1992.
- [2] U. C. De and A. A. Shaikh, Differential Geometry of manifolds, Narosa Publishing House Pvt. Ltd.
- [3] Luther Pfahler Eisenhart, Riemannian Geometry, Princeton University Press.
- [4] W. H. Boothby, An introduction to Differentiable manifolds and Riemannian Geometry, Academic Press, New York, 1975.
- [5] John M. Lee, Riemannian manifolds: An introduction to curvature, Springer-Verlag, 1997.

(CODE : BKU/MATH/CW/EU4)
Contact manifolds: (Marks:25)

Almost contact and contact manifolds, Curvature of contact metric manifolds, k-contact and (k, μ) -contact metric manifolds, Sasakian manifolds, Kenmotsu manifolds, Trans-Sasakian manifolds, Para-Sasakian manifolds, LP-Sasakian manifolds, $(LCS)_n$ -manifolds, Sasakian-space-forms, Generalized Sasakian-space-forms, ϕ -symmetric contact metric manifolds and its generalized classes.

References:

- [1] D. E. Blair, Riemannian geometry of contact and symplectic manifolds, Progress in Mathematics.
- [2] U. C. De and A. A. Shaikh, Complex and contact manifolds, Narosa Publishing House Pvt. Ltd.

(CODE : BKU/MATH/CW/EU5)
General Relativity (Full Marks : 25)

Past and future Cauchy development, Cauchy surface. DeSitter and anti-de Sitter space-times. Robertson-Walker spaces. Spatially homogeneous space-time models. The Schwarzschild and Reissner – Nordstrom solutions. Kruskal diagram. Causal structure. Orientability. Causal curves. Causality conditions. Cauchy developments. Global hyperbolicity. The existence of Geodesics. The Causal boundary of space-time. Asymptotically simple spaces. Lie derivatives.

References :

- [1]The large scale structure of space-time - Hawking and Ellis (Camb. Univ. Press).
- [2]General Relativity – R.M. Wald (Chicago Univ. Press).
- [3]A first course in general relativity – B.F. Schultz (Camb. Univ. Press).
- [4]Gravitation and Cosmology – S. Weinberg (J. Wiley and Sons).

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- [5] General Relativity, Astrophysics and Cosmology – Raychaudhury, Banerji and Banerjee (Springer-Verlag).
[6] General Relativity – M. Luduigsen (Camb. Univ. Press).
[7] Introducing Einstein's Relativity – R d'Inverno (Clarendon Press, Oxford).

(CODE : BKU/MATH/CW/EU6)
Astrophysics & Accretion Phenomenon.(Full Marks : 25)

Astrophysics(18L)

Compact Objects, White dwarfs, Neutron stars and Black holes. Brief history of the formation and evolution of stars.

Schwarzschild exterior solution, Birkhoff's theorem, Schwarzschild singularity, Kruskal transformation, Schwarzschild Black hole. Motion of test particles around Schwarzschild black hole. Kerr metric and Kerr black holes (without deduction of solution). Horizons of Schwarzschild and Kerr black holes.

Laws of black hole thermodynamics (statements only).

Interior of Schwarzschild metric, massive objects, Openheimer – Volkoff limit, Gravitational lensing , Quasars , Pulsars, Supernova.

Openheimer-Snydder non static dust model, Gravitational collapse.

References:

- [1] The Structure of the Universe – J.V. narlikar
[2] Astrophysics – B. Basu
[4] Astrophysical Concept – M. Harmitt
[5] Galactic Structure – A. Blauaw & M. Schmidtw
[6] Large Scale Structure of Galaxies – W.B. Burton
[7] The Milky Way – B.T. Bok & P.F. Bok.
[8] Cosmic Electrodynamics – J.H. Piddington

Accretion Phenomenon(7L)

Plasma, black Body, Cherenkov & Synchrotron Radiation

Accretion as source of radiation

Quasar as source of radiation, Compton effect

Bremsstrahlung Radiation.

Accretion into compact objects, Boltzmann formula, Saha Ionization equation, H-R diagram.

References:

- [1] The Structure of the Universe – J.V. narlikar
[2] Astrophysics – B. Basu
[3] Astrophysical Concept – M. Harmitt
[4] Galactic Structure – A. Blauaw & M. Schmidtw
[5] Large Scale Structure of Galaxies – W.B. Burton
[6] The Milky Way – B.T. Bok & P.F. Bok.
[7] Cosmic Electrodynamics – J.H. Piddington

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(CODE : BKU/MATH/CW/EU7)
Mathematical Modeling of Biological Systems: 25 Marks
(Qualitative Theory)

Linear difference equations:

Difference equations, existence and uniqueness of solutions, linear difference equations with constant coefficients, systems of linear difference equations, qualitative behavior of solutions to linear difference equations, Applications.

Nonlinear difference equations (Map):

Steady states and their stability, the logistic difference equation, systems of nonlinear difference equations, stability criteria for second order equations, stability criteria for higher order system.

Qualitative Analysis of the Biological Models

Strictly dominant eigenvalues, Basic Reproduction Number, Stability criteria for various disease Models,

Cobwebbing Method and its Applications.

References :

- [1] F. Verhulst (1996): Nonlinear Differential Equations and Dynamical Systems, Springer Verlag.
- [2] W. G. Kelley and A. C. Peterson (1991): Difference Equations- An Introduction with Applications, Academic Press.
- [3] J.D.Murray (1990): Mathematical Biology, Springer and Verlag.

(CODE : BKU/MATH/CW/EU8)
Mathematical Modeling of Biological Events: 25 Marks

Models for Developmental Pattern Formation:

Background, model formulation, spatially homogeneous and inhomogeneous solutions, Turing model, conditions for diffusive stability and instability, pattern generation with single species model.

Delay Differential Equations:

Formulation of Delay Differential Equations, Properties, Stability Criteria, Butler's Lemma, Condition(s) for unique positive solutions, Periodic Solutions through trigonometric functions, Transversality Conditions, Hopf-bifurcation Analysis.

References:

- [1] L. Perko (1991): Differential Equations and Dynamical Systems, Springer Verlag.
- [2] L.A.Segel (1984): Modelling Dynamical Phenomena in Molecular Biology, Cambridge University Press.
- [3] J.D.Murray (1990): Mathematical Biology, Springer and Verlag.
- [4] Leach Edelstein-Keshet (1987): Mathematical Models in Biology, The Random House/Birkhauser Mathematics Series.

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(CODE : BKU/MATH/CW/EU9)
Introduction to Fuzzy Sets Marks: 25

A. Fuzzy set : Basic concepts

Definition of fuzzy set and α -cut, properties of α -cut, representation of a fuzzy set in terms of α -cut, Extension principle for fuzzy set. Image and pre-image of fuzzy set under a mapping. Operations on fuzzy set. Algebra of fuzzy sets. Fuzzy function: t-Norms and t-Conorms. (10 L)

B. Fuzzy logic:

Fuzzy logic in a narrow sense; Fuzzy logic in a wide sense. Concept of linguistic variables and their values—the term sets. Modifiers and linguistic hedges. Fuzzy connectives—their interpretations. Fuzzy rules--- quantification and qualification. Fuzzy rule-based inference—compositional rule of inference. Industrial applications of fuzzy logic. (10 L)

C. Fuzzy Arithmetic:

Fuzzy numbers: Representation of a fuzzy number in terms of a family of nested intervals. Triangular fuzzy number and interval number. Arithmetic operations on fuzzy numbers. (5 L)

References:

- [1] G. J. Klir, Bo Yuan, Fuzzy sets and fuzzy logic: Theory and Applications, Prentice-Hall India.
- [2] Pert Hajek, Mathematics of fuzzy logic, Academic Press.

(CODE : BKU/MATH/CW/EU10)
Introduction to Fuzzy Analysis Marks: 25

- Fuzzy topology :

Different types of fuzzy topology; Gradation of openness and closedness; Closure, Closure operator. Base and sub-base of fuzzy topology; fuzzy continuity of mappings; Gradation preserving maps, fuzzy homeomorphism. (10 L)

- Fuzzy Metric Spaces:

Different types of fuzzy metric (Kramosil & Michalek, Kaleva & Seikkala). Underlying topology of a fuzzy metric space, Sequence, Cauchyness and Convergence. Completeness of fuzzy metric space. Fixed point theorems (Banach, Edelstine etc.) in fuzzy metric space. (10 L)

- Fuzzy Normed linear spaces:

Different types of fuzzy norms (Katsaras, Felbin, Bag & Samanta). Decomposition theorems; Convergence and Cauchyness of sequences, completeness of fuzzy normed linear spaces. (5 L)

References:

- [1] A. Kaufman, Introduction to the theory of fuzzy subsets, Academic Press.
- [2] G. J. Klir, Bo Yuan, Fuzzy sets and fuzzy logic: Theory and Applications, Prentice-Hall India.
- [3] L. Y. Ming, L. M. Kang, Fuzzy topology, World Scientific.
- [4] S. C. Chang, J. N. Mordeson, Y. Yandong, Lecture Notes in Fuzzy Mathematics and Computer Science, Centre for Research in Fuzzy Mathematics, Creighton University, U.S.A.

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Higher order Methods for Flow Simulation and Optimization
(CODE : BKU/MATH/CW/EU11)
Marks : 50

(Details will be incorporated later.)

Introduction to Iterative methods for Linear and Nonlinear Equations
(CODE : BKU/MATH/CW/EU12) (Marks: 25)

Basic iterative Methods (review): Jacobi Gauss-Seidel and SOR methods, their convergence. Krylove Subspace methods: GMRES, Conjugate Gradient (CG), BCG and QMR algorithms; Methods related to Normal Equations; Preconditioned iterations: PCG methods; Multigrid methods; Newton's method and its variance.

References:

- [1] C. T. Kelly: Iterative Methods for Linear and Nonlinear Equations, SIAM, Phil., 1995.
- [2] Y. Saad: Iterative Methods for Sparse Linear Systems, SIAM, 2003.
- [3] P. Bastian: Lecture Notes on Parallel Solution of Large Sparse Linear Systems, IWR, University of Heidelberg, Germany.
- [4] W. Auzinger: Lecture Notes on Iterative Solution of Large Linear Systems, TU Wien, Austria.

PH.D COURSEWORK SYLLABUS
IN
PHILOSOPHY

(w.e.f. 2016)



BANKURA UNIVERSITY
BANKURA
WEST BENGAL
PIN 722155

(Internal Assignment: 10 marks and Written Examination: 40 marks)

[illegible]

Paper 1

Unit -I

Suggested Readings:

1. Norman Balaikie: Approaches to Social Enquiry, Cambridge: Polity Press, 1993
2. Chris Daly: An Introduction to Philosophical Methods, Broadview Press, 2010
3. C.R. Kothari: Research Methodology: Methods and Techniques 3rd Ed.

Paper 1

Unit -I

Suggested Readings:

1. Gautama: *Nyāyasūtra* with *Vātsyāyanabhāṣya*, Ed. By Phaṇibhuṣaṇa Tarkavāgiśa, Paschim Banga Rajya Pustak Parsad
2. Gautama: *Nyāyasūtra* with *Vātsyāyanabhāṣya*, Ed. By Gaṅgānāth Jha, Motilal Banarsidass
3. Th. Stcherbatsky: Buddhist Logic, Vol. 2
4. B. K. Matilal: Epistemology, Logic and Grammar in Indian Philosophy
5. Viśvanātha: *Bhāṣāpariccheda* with *Siddhāntamuktāvali*

Unit -II

Suggested Readings:

1. Plato: Theatetus Trd. And annotated by Conford or John McDowell
2. Plato: The Republic Tr. By Lee
3. R. Ackerman : Modern Deductive Logic
4. Bason & O'Connor: Introduction to Symbolic Logic
5. Carl Hempel: Philosophy of Natural Science
6. I.M. Copi: An Introduction to Logic

SYLLABUS
For
Ph.D. Coursework in
PHYSICS
(in CBCS format)



(Effective from the academic session 2019-2020 and onwards)

DEPARTMENT OF PHYSICS
BANKURA UNIVERSITY
BANKURA

Bankura University
Department of Physics
Ph.D. Coursework Syllabus

Important points to be noted:

- Duration of the Coursework: One Semester (6 months)
- Total marks: 200 (Two papers 100 marks each)
- Examinations will be held at the end of the semester

Structure:

Papers	Topics and the way of Evaluation	Marks Distribution (Credits)	Lectures per week
Paper-I Compulsory Units	Group-A Research Methodology	50 (2)	2
	Group-B Computer Applications	50 (2)	2
Paper-II	Group-A Advance Physics	50 (2)	2
	Group-B Term paper/ literature review	50 (2)	2

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Paper-I

Group-A: Research methodology in general

Meaning of scaling; Scales of measurement. Uncertainties in measurements, single-variable and multivariable function, propagation of errors, Analysis distribution, some statistical ideas, distribution and probabilities, continuous distribution, normal distribution, Gaussian distribution. Confidence limits and error bars. Least square fitting of some complex functions. Concept of research; Objective and motivation in research; Significance, Types and process of research; Different approaches of research; Salient points of good research; Research methodology in basic science. Writing literature review, effective poster presentation; writing scientific papers, Internet in scientific research. Procedure for obtaining a patent.

Group-B: Computer applications in physics

Introduction to Linux and FOSS software. Basic shell commands. Introduction to compiling and linking. Using IDE for coding.

Typesetting with LaTeX: Concept of LaTeX and contrast with word processors: WYSIWYG vs WYSIWYM. LaTeX Document Structure. Text and paragraph formatting, Lists and Tables. Math models. Figure environment and importing graphics. Review of procedural programming in C Sequential, selection and loop structure; Pointers and arrays; Functions and subprograms; Structures, unions and enumerated types; Data structures and linked lists.

Introduction to procedural programming in python

Basics of the python interpreter. Setting up and using python Modules, functions and lambdas in python. Variables and scoping.

Basic python objects and native datatypes: Basic arithmetic operations and operators. Control flow and decision control.

Lists in python. Errors and exceptions. Scientific computing in python using numpy/scipy, matplotlib.

References:

1. C R Kothari, Research Methodology: Methods and Techniques, New Age International (P) Ltd. (2010) , New Delhi
2. Garg, B.L., Karadia, R., Agarwal, F. and Agarwal, U.K., 2002. An introduction to Research Methodology, RBSA Publishers.
3. Handbook of Communication and Social Interaction Skills by John O. Greene, Brant Raney Burleson.
4. Trochim, W.M.K., 2005. Research Methods: the concise knowledge base, Atomic Dog Publishing. 270p.
5. Ranjit Kumar, Research Methodology: A Step-by-Step Guide for Beginners, SAGE Publications
6. Inderpal Singh, Research Methodology and Statistical Methods, Kalyani Publishers, Ludhiana.
7. G Kanji 100 statistical tests, Sage Publications
8. A.S. Gaur & S.S. Gaur, Statistical Methods for Practice and Research (AGuide to Data Analysis using SPSS), Sage Publications
9. C. Boyer, History of Mathematics.

Paper-II

Group-A

Advanced Physics:

Nuclear Physics:

Concept of atom to nucleus, Measurement of Nuclear size, Nuclear charge and mass distribution, Nuclear shape, Concept of Nuclear Binding Energy, Deuteron problem, Concept of Nuclear Force, Experimental techniques for studying nuclear physics, interaction of nuclear radiation with matter, detector physics, Nuclear reactor.

Nonlinear Dynamics:

Dynamical System, phase space, fixed points. Nonlinear dynamical systems. Dynamical equations and Stability for linear systems. Flow defined by nonlinear systems of ODEs, linearization and stable manifold theorem. Planar flows: saddle point, nodes, foci, centers and nonhyperbolic critical points. Bifurcation theory: saddle-node, pitch-fork, Hopf, period doubling, homoclinic bifurcations. Applications in: Laser model, population dynamics.

Limit cycle oscillations and Chaos: Concept of limit cycle, Poincare-Bendixon theorem; role of nonlinearity: From harmonic oscillator to Van der Pol oscillator, Chaos, Lorenz equation and Rossler equation. Applications in: Chaos in electronic oscillators, chaos in Laser system.

Discrete time nonlinear systems: logistic map, sine circle map, linear stability analysis; numerical analysis of the logistic map; universality and the Feigenbaum numbers; bifurcation and chaos, intermittency, crises; Applications in: population dynamics, discrete phase-locked loop system, power electronics.

General Theory of Relativity and Cosmology:

Equivalence principle and a metric for the space-time. Black Holes; FRW models; gravitational lensing.

Qualitative ideas of the large scale structure of the universe. Standard Cosmology, Friedmann metric, Hubble law.

Observational Parameters: deceleration parameter, equation of state parameter, redshift parameter, etc; temporal history for different curvatures, abundance of lighter elements, cosmic microwave radiation, cosmological singularity.

Problem with standard cosmology. Dark energy and Dark matter, observational evidence, models with cosmological constant, dynamical origin of cosmological constant, Inflationary models, structure formation (qualitative), Late time accelerating universe, Λ CDM model.

Quantum and Nonlinear Optics:

Quantum optics

Quantization of electromagnetic field, coherent state, squeezed state, nonclassicality of radiation field, witnesses and measures of nonclassicality.

Nonlinear Optics

Introduction, nonlinearities of the polarization, generation of second harmonic, D.C., sum and difference frequency generation, anharmonic oscillator model, Miller's rule, crystal symmetry, coupled amplitude equation, Manley-Rowe relation.

Second Harmonic Generation

Basic equation, conversion efficiency and parameters affecting doubling efficiency, various methods of enhancing conversion efficiency, second harmonic generation with Gaussian beam, intra-cavity second harmonic generation.

Higher Order Nonlinear Processes

Four wave mixing processes-third harmonic generation, resonance enhancement of nonlinear susceptibilities, different phase matching techniques.

References:

1. Introductory Nuclear Physics- K. S .Krane (Wiley India)
2. Nuclear Physics: Theory and Experiment- R. R. Roy and B. P. Nigam (John Wiley and Sons)
3. Techniques for Nuclear and Particle Physics Experiments - William R. Leo (Springer-Verlag Berlin Heidelberg GmbH). DOI 10.1007/978-3-642-57920-2
4. Stephen Wiggins, "Introduction to Applied Nonlinear Dynamical Systems and Chaos", Springer-Verlag, Second Edition
5. Steven Strogatz. "Nonlinear Dynamics and Chaos: With Applications to Physics, Biology, Chemistry, and Engineering", Levant Publishers, 1994.
6. Edward Ott, Chaos in Dynamical Systems, Cambridge University Press
7. Introduction to Cosmology – J.V.Narlikar (Cambridge University Press)
8. General Relativity, Astrophysics and Cosmology – A.K.Raychaudhuri, S.Banerji and A.Banerjee (Springer-Verla, 1992)
9. Quantum optics – G. S. Agarwal
10. Quantum optics: An Introduction – Mark S. Fox.

Group-B

Term Paper/ literature Review

Full marks: 50

Students are to produce a term paper/ literature Review on some suitable topic selected by Research Guide/Teacher and submit it. The student should create a presentation for this. The student has to present the term paper/ literature Review in front of all teachers as well as external examiner.



EXAMINATION PATTERN AND COURSE DESIGN

For

PH. D. COURSE WORK

(Under Choice Based Credit System)

IN POLITICAL SCIENCE

(to be effective from the academic year 2017-2018 onwards)

Ph. D. Coursework Guidelines:

- As per Bankura University Regulations Relating to Doctoral (Ph.D.) Degree 2017, after admission to PhD, a research scholar shall be required to undertake coursework for a minimum period of one semester. All candidates admitted to the Ph.D. programme shall be required to complete the coursework prescribed by the Department during the initial one or two semesters. Women candidates may be allowed a relaxation of two terms / semesters in case of maternity.
- Candidates already holding M. Phil. degree and admitted to the Ph.D. programme, or those who have already completed the course work in M. Phil. / Ph.D. and have been permitted to proceed to the Ph.D. in integrated course, may be exempted by the Department from the Ph.D. course work. All other candidates admitted to the Ph.D. programme shall be required to complete the Ph.D. course work prescribed by the Department.
- 75 % attendance for coursework classes is compulsory.

Course Structure:

Subject Code	Name of the Module/ Course	Paper Type	Credits	Total Marks
PHD/ PLS- 01	Research Methodology including Knowledge of Computer Application [Part A- Common; Part B- Subject Related Research Methodology]	Theory	4	100 [Part A- 70 + Part B- 30]
PHD/ PLS- 02	Recent Advances in Different Areas of Political Science	Theory	2	50
PHD/ PLS- 03	Review of Literature & Project Writing	Seminar Presentation	2	50

Award of Grades:

- A Ph.D. scholar has to obtain a minimum of 55% of marks or its equivalent grade in the UGC 7-point scale (or an equivalent grade/CGPA in a point scale wherever grading system is followed) in the coursework in order to be eligible to continue in the programme and submit the dissertation/thesis.
- Maximum two chances shall be given to the scholar for clearing the coursework, failing which may lead to cancellation of admission.

Course Title: Research Methodology including Knowledge of Computer Application

Course Code: PHD/ PLS- 01

Credits: 4

1. Logic of Research--- Epistemology and Ontology.
2. Selection of the Research Problem and Building Hypothesis.
3. Tools and Instruments of Enquiry--- Sampling Methods, Questionnaire, Interview, Observation and Experiment.
4. Data Analysis and Final Testing of Hypothesis on the Basis of Primary, Secondary and Tertiary Sources.
5. MS-Office, SPSS Software and Internet.

Course Title: Recent Advances in Major Areas of Political Science (*The Candidates will have to Select Any Two Areas, Each Carrying 1 Credit*)

Course Code: PHD/ PLS- 02

Credits: 2

A. Political Theory:

1. Positivism and Interpretativeism.
2. Post-Structuralism and Post-Modernism.

B. Comparative Politics:

1. Important Role-Players in the Developing Countries--- Institutional and non-Institutional--- Bureaucracy, Army, Religion, Industrial Houses, Trade & Business--- Problems of Globalisation, Neo-Terrorism and Climate Change.
2. India, Pakistan, Bangladesh, Myanmar, Sri Lanka, Syria, Iraq, Iran and North Korea.

C. Indian Politics:

1. Neo-Social Movement--- Dalit, Tribals and Anti-Development Theses.
2. Movement for Civil Society--- Accountability, Transparency and Local Dynamism.

D. International Relations:

1. Three Great Debates in the Theoretical Evolution of the Discipline.
2. Dependency Theory and Post-Modernism.

Course Title: Review of Literature and Project Writing

Course Code: PHD/ PLS- 03

Credits: 2

Bankura University

Department of Sanskrit

Syllabus of Ph.D. Course Work

Course Structure:

Paper	Name of the Course	Credits	Marks
1.	Part- A Research Methodology: a)Method of research and writing research paper or thesis b) Text editing c)Textual criticism d)Proof reading e) Handling of Manuscripts(general concept, elementary knowledge) f) preparation of Bibliography and Index g) Application of diacritic marks Part - B Computer Application Part –C Review of published existing literature in the relevant field Part- D Book Review	4	100 [part A: 50+ part B: 20+ part C:15+ part D: 15

There would be end semester examination of 50 marks on the part A. Using the methods of computer application students would submit two essays (minimum- 3000 words) on the topics of Part C and Part B.

Paper	Name of the Course	Credits	Marks
2.	<p>Studying texts/theories as per faculty/ subjects requirements which would help the students to prepare for Ph.D Degree. The areas may be as following:</p> <p>Vedas/Puraṇas/ Smṛtis/ Literature & poetics/ Grammar/ Philosophy/ Computational Linguistics.</p> <p>Two assignments: (Submission of Hard-Copies[5000-6000 words])</p> <p>Two Power point Presentations on above mentioned assignments.</p>	4	<p>100</p> <p>25+25= Assignments</p> <p>25+25=Power-point Presentations</p>

All the essays and presentations would be in Sanskrit or English Language.