SHREE GURU GOBIND SINGH TRICENTENARY UNIVERSITY
FACULTY OF SCIENCE
DEPARTMENT OF CHEMISTRY
Ph.D. Chemistry Course Work
W.e.f the academic session Aug 2019
Techniques in Chemistry

Time: 3 hrs.

Max. Marks: 100
Formative Assessment   : 20
Summative Assessment : 80

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 unit and the candidates will be required to attempt one question from each unit. All questions will carry equal marks.

UNIT-I
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.

UNIT-II
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.

UNIT-III
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.

Differential scanning calorimetry (DSC) : Theories of DSC , factors affecting DSC , instrumentation and application of DTA

UNIT-IV
MEASUREMENT OF THERMODYNAMIC PROPERTIES

Excess thermodynamic function e.g. Excess chemical potential, Excess Gibbs free energy, Excess entropy and Excess enthalpy. Experimental determination of excess function. Determination of fugacity by graphical method. Method of determination of heat and enthalpy i.e. Calorimetery. Measurement of Gibbs free energy of mixtures . Techniques for measuring speed of sound by Ultrasonic Interferometer.

Entropy production and entropy flow in open system, Prigogine principle of minimum entropy production.

Reference Books:

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

SHREE GURU GOBIND SINGH TRICENTENARY UNIVERSITY

FACULTY OF SCIENCE

DEPARTMENT OF PHYSICS

Ph.D. Course Work

W.e.f the academic session Aug 2019

Concepts & Techniques in Physics

Time: 3 hrs.

Max. Marks : 100
Formative Assessment : 20
Summative Assessment : 80

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 unit and the candidates will be required to attempt one question from each unit. All questions will carry equal marks.

UNIT-I: MATHEMATICAL PHYSICS AND NUMERICAL TECHNIQUES

Vector spaces, Orthogonalization of bases, Matrix Algebra: spectrum and diagonalization, Linear ordinary differentials of first and second order, Definitions and properties of special functions: Bessel functions, Legendre polynomials, Hermite polynomials and Lageur repolynomials along with recurrence relations. Evaluation of real integrals using complex algebra, Properties & Uses of Fourier transform and Laplace transform. Introductory tensor classifications, Elements of computational techniques: root of function, interpolation, extrapolation, integration by trapezoidal and Simpson's rule, Solution of first order differential equation using Runge Kutta method, Finite differences method. (Hands on using MATLAB/Scilab)

UNIT-II: MECHANICS

Mechanics of a system of particles, constraints of motion, generalized coordinates, D'Alembert's Principle. Lagrangian formulation, Hamilton principle. Hamilton's equations of motion, Canonical transformation and Poisson's brackets. Review of Quantum Mechanics postulates with examples. Discussions of the exact solution of Hydrogen atom, Perturbation Theory, Variational method and WKB approximations, Scattering theory, Partial wave analysis, Optical theorem. Many particle symmetric and anti-symmetric wave functions, Slater determinant.

Classical and Quantum statistics, Ensemble Theory, Ideal Bose system and Fermi system, dynamical model of phase transitions, Critical indices, Ising model.

UNIT-III: SOLID STATE AND ELECTRONICS

Bravais lattice, Reciprocal lattice, Elements of crystal structure determination and structure factor, Bonding in solids, Phonons, lattice specific heat, Drude Model of electrical and thermal conductivity,

Hall effect, Band theory of Solids, Superconductivity and HTS, Dielectric constant and polarizability of solids, Clausius-Mossotti relation, Ferroelectricity, Piezoelectricity, Ferroelasticity. Quantum theory of paramagnetism, Ferromagnetism and anti-ferromagnetism; Weiss theory of ferromagnetism, The Heisenberg model, Ferromagnetic domains, Bloch wall.

Characteristics and types: p-n junction diode, Transistors, Op-amp: characteristics and applications. Fundamentals of Logic gates, De Morgan's laws, Logic families and their comparison.

UNIT-IV: ELECTROMAGNETISM AND NUCLEAR PHYSICS

Electromagnetic scalar and vector potentials, Maxwell's equations in terms of scalar and vector potentials, Non uniqueness of Electromagnetic potentials and concept of Gauge. Lorentz gauge and coulomb gauge. Wave equation, Reflection and Refraction of electromagnetic waves, Wave guides: TE and TM modes in rectangular wave guides; Moving point charges, Lienard- Wiechart potentials for a point charge.

Nuclear Models: Shell Model and Liquid drop model, Concept of magic numbers & spin-orbit coupling, Extreme single particle model and its predictions, Nuclear surface deformations, Electric quadrupole moments and it's significance.

Reference Books:

1. G. Arfken and H.J. Weber. Mathematical Methods for Physicists. San Diego: Academic Press.
2. B.S. Rajput. Mathematical Physics.
3. Classical Mechanics by H. Goldstein.
4. Schiff. Quantum Mechanics. New Delhi: Tata McGraw-Hill.
5. S. Gasiorowicz. Quantum Mechanics. New York: John Wiley.
6. Quantum Mechanics (2nd edition) by B. H. Bransden and Joachain
7. R.K. Patharia. Statistical Mechanics. 2nd ed. Oxford: Butterworth-Heinemann.
8. K. Huang. Statistical Mechanics. New Delhi: Wiley Eastern.
9. Introduction to Solid State Physics (7th edition) by Charles Kittel
10. Solid State Physics by Neil W. Ashcroft and N. David Mermin
11. J. Millman and C. C. Halkies, Integrated Electronics. Tata McGraw-Hill.
12. R. P. Jain. Modern Digital Electronics, Tata McGraw Hills.
13. Malvino and Leach, Digital Electronics
14. Introduction to Electrodynamics by D. J. Griffiths.
15. R. R. Roy and B. P. Nigam, "Nuclear Physics: Theory and Experiment", Wiley Eastern Limited, 1993.
16. M. K. Pal, "Theory of Nuclear Structure", Affiliated East-West Press, New Delhi.

SHREE GURUGOBIND SINGH TRICENTENARY UNIVERSITY
FACULTY OF SCIENCE
DEPARTMENT OF ENVIRONMENTAL SCIENCE
Ph.D. ENVIRONMENTAL SCIENCECOURSE WORK
W.e.f the academic session Aug 2019

Techniques in Environmental Science

Time: 3 hrs.Max. Marks: 100

Formative Assessment : 20
Summative Assessment : 80

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 unit and the candidates will be required to attempt one question from each unit. All questions will carry equal marks.

UNIT-I
ENVIRONMENTAL BIO-TECHNOLOGY

Introduction, scope and importance of biotechnology, Applications, Genetic engineering, techniques – Electrophoresis, Isolation and purification of DNA, PCR, Biosensors, Bioremediation, Fermentation.

UNIT-II
SOLID WASTE TREATMENT

Treatment processes, Aerobic and anaerobic treatment methods – Role of microbes, methanogens, acetogens, fermentative bacteria, biofilms, and Waste management: Solid waste composting and vermi-composting, Xenobiotic compounds, Biodegradation.

UNIT-III
REMOTE SENSING

Remote sensing, EMR interaction with earth surface materials, Spectral signatures of vegetation, water bodies, ground truth data collection, operational remote sensing satellites. Remote Sensing Applications.

UNIT-IV
ANALYTICAL TECHNIQUES

Spectrophotometer, Flame photometer, Atomic Absorption Spectrophotometer, High pressure Liquid Chromatography, Gas Chromatography, XRD, SEM (Scanning Electron Microscope), TEM(Transmission Electron Microscope).

Reference Books:

1. Bruce Rittman, Perry L. McCarty (2000) Environmental Biotechnology: Principles and Applications, 2nd Edition, McGraw-Hill.
2. Joseph, George. 2005. Fundamentals of Remote Sensing, 2nd Edition. University Press India.
3. Lillisand, Thomas, Ralph W. Kiefer and Jonathan Chipman. 2007. Remote Sensing and Image Interpretation. Wiley India.

Shri Guru Gobind Singh Tricentenary University
Faculty of Science
Department of Forensic science

Pre-PhD (Course Work) in Forensic science
Academic Session: 2019-20

Techniques in Forensic Science

Time: 3 hrs. Max. Marks: 100

Formative Assessment: 20
Summative Assessment: 80

INSTRUCTIONS FOR THE PAPER SETTER

The question paper will consist of five sections A, B, C, D and E. Section A will consist of ten short answer type questions which willcover the entire syllabus uniformly. Short answer type questions shall carry two marks each. Section B, C, Dand E will have two questions from the respective sections of the syllabus carrying equal marks.

INSTRUCTIONS FOR THE CANDIDATE

Candidates are required to attempt all the questions of Section A (Compulsory) and one question each from the sections B, C, D and Eof the question paper.

UNIT-I:Introduction to Forensic Science
Forensic Science Laboratories, Need and Scope of Forensic Science, Basic Principles of Forensic Science, Branches of Forensic science, and Future research perspectives in Forensic Science.

UNIT II:Advanced Forensic Chemical Techniques
Need of chemical analysis in Forensic investigations, Brief Introduction toChromatographic techniques: TLC, HPLC, HPTLC and GC techniques, with specialreference to qualitative and quantitative analysis. Brief Introduction to Spectroscopictechniques: Overview, Instrumentation and Forensic applications of UV-VIS and FTIR,Forensic Applications: Mass Spectrometry, AAS and X-ray techniques in forensicanalysis.

UNIT- III:Advanced Forensic Biological Techniques
Need of biological analysis on Forensic Science,Electrophoretic Techniques: Theory, General Principles and Forensic applications.DNA Fingerprinting Techniques: PCR,RT-PCR and RFLP, AFLP, CombinedDNA Index System (CODIS).

UNIT- IV:Advanced Forensic Physical Techniques
Role of Microscopy in Forensic Science Investigation: Light and ScanningMicroscopes, Comparison Microscopy, Profiling and Automated Finger printIdentification Systems (AFIS), Video spectral comparator (VSC), Introduction toNIBIN and IBIS, Advanced

Computer and Cyber forensic tools, ForensicPsychological techniques and their legal prospectus, methods of Criminal investigations.

Reference Books:

1. Douglas Skoog, James Holler, Stanley Crouch. Principles of Instrumental Analysis (7th Edn). Cengage Learning, 2017.
2. Ellen D. The scientific examination of Documents, Methods and techniuqes (2ndEdn). Taylor & Francis Ltd., 1997.
3. GR Chatwal, SK Anand. Instrumental Methods of Chemical Analysis. Himalaya Publ. House, 2004.
4. G.R Chatwal. Analytical Spectroscopy (2nd Edn). Himalaya Publishing House, 2002.
5. Hobart Willard. Instrumental Methods of Analysis. Wadsworth Publishing Company, 1988.
6. James W. Robinson, Eileen Skelly Frame, George M. Frame II. Undergraduate Instrumental Analysis (7th Edn). CRC Press, 2014.
7. JM Butler. Forensic DNA Typing. Elsevier Academic Press, 2005.
8. Khandpur RS. Handbook of Analytical Instruments, Tata McGraw Hill Pub. Co. New Delhi, 2004.
9. Li Richard. Forensic Biology, Taylor & Francis Group LLC. 2008.
10. Nanda BB, Tewari RK. Forensic Science in India: A vision for the twenty first century. Select Publisher, New Delhi, 2001.
11. R.S Khandpur. Handbook of Analytical Instruments. Tata Mac Graw Hill Publ. Co., 2004.
12. Robinson JW. Atomic Spectroscopy (2nd Edn). Marcel Dekkar, Inc, New York, 1996.
13. Saferstein R. Handbook of Forensic Science (Vol-I to III). Prentice Hall Inc.USA. 1976.
14. Settle FA. Handbook of Instrumental Techniques for Analytical Chemistry. Prentice Hall, 1997.
15. Sharma BR. Forensic Science in Criminal Investigation and Trials. Central Law Agency, Allahabad, 1974.
16. Willard HH, Lynne L. Merrett, J Dean, A Frank, A Settle. Instrumental Methods of Analysis (7th Edn). CBS pub. & Distributors, New Delhi, 1988.

SUBJECT: MATHEMATICS　　　　　　　　**SUBJECT CODE : 0000103**
L-P-C: 4-0-0　　　　　　　　　　　　**CREDITS: 04**

S.N	Topic	Domain	Hours as per UGC
1	*Concept of Residues, Cauchy's Residue Theorem , Evaluation of integral, Branches of many values function .Bilinear Transformation and their properties and classification,* *Conformal mapping. Spaces of Analytic function , Hurwitz theorem, Montel theorem*	Must Know Nice to know	10
2	*Wave equation in one space dimention ,Classical and Weak solution,Duhamels principle Laplace equation, Fundamental solution ,* *Maximum principle and mean valueformuleProperties of Harmonic function ,Green function*	Must Know Nice to know	10
3	*Different types of OR Model, Graphical method ,Simplex Method ,Big-M Method, Two phase Method, Dualty theory , Dual simplex method, Sensitivity Analysis ,Integer program ;cutting plane and branch ,bound techniques for all integer*	Must Know Nice to know	10
4	*Definition and Application of order statistics, Discrete , Continuous joint and Marginal distribution of the order statistics, Distribution of range .* *Recurrence and Identities for moment of order statistics. Review of latest liiteratures*	Must Know Nice to know	10

Reference Books:

1. L.V Ahlform Complex Analysis, McGraw Hill Inc,1996
2. A.R Shastri, Complex Analysis,2010
3. Robert C Mcowen,Partial Differential Eqution:Method and Application Pearson Education Inc
4. Lawrence C Evans,PartialDiffrentialEqution,American Mathematical Society
5. Pant,J .C Introduction to Optimization,Jain Brother,New Delhi
6. David, H.A and Nagaraja , H.N (2003): Order Statistics, Third Edition, John Wiley