# THE BHAWANIPUR EDUCATION SOCIETY COLLEGE

A MINORITY RUN COLLEGE. AFFILIATED TO UNIVERSITY OF CALCUTTA
RECOGNISED UNDER SECTION 2(F) & 12 (B) OF THE UGC ACT, 1956

## B.SC. MID - TERM EXAMINATION SCHEDULE & SYLLABUS, SESSION 2017 - 2018

**It is hereby notified to all B.Sc. 1st year and 3rd year students that their Mid-term Examination for Honours & General papers will be held as per schedule given below.**

| Routine for B.Sc. (Honours) 1st Year Mid-term test- 2017 | | | | |
|---|---|---|---|---|
| **Honours Subjects** | **Room No.** | **Days & Dates** | **Timings** | **Full Marks** |
| Chemistry | 418 | Wednesday, 1/11/2017 | 11:00am-3:00pm | 80 |
| Physics | 516 | | | 80 |
| Mathematics | 527 | | | 80 |
| Economics | 429, 425 | | | 80 |
| Computer Science | 410 | | | 80 |

| Routine for B.Sc. (General) 1st Year Mid-term test- 2017 | | | | |
|---|---|---|---|---|
| **General Subjects** | **Room No.** | **Days & Dates** | **Timings** | **Full Marks** |
| Mathematics | 418,410,425,430 | Monday, 6/11/2017 | 11:00am-1:00 pm | 50 |
| Physics | 418,410 | Tuesday, 7/11/2017 | | 50 |
| Statistics, Electronics, Chemistry | 418,410,425 | Wednesday, 8/11/2017 | | 50 |
| Computer Science | 418,410 | Thursday, 9/11/2017 | | 50 |

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## B.SC. MID - TERM EXAMINATION SCHEDULE & SYLLABUS, SESSION 2017 - 2018

| Routine for B.Sc. (Honours) 3rd Year Mid-term test- 2017 | | | | |
|---|---|---|---|---|
| **Honours Subjects** | **Room No.** | **Date** | **Timings** | **Full Marks** |
| Chemistry | 430 | Wednesday/1/11/2017 | 11.00am-3.00pm | 80 |
| Physics | | | | 80 |
| Mathematics | | | | 80 |
| Economics | | | | 80 |
| Computer Science | | | | 80 |

| Routine for B.Sc. (General) 3rd Year Mid-term test- 2017 | | | | |
|---|---|---|---|---|
| **General Subjects** | **Room No.** | **Date** | **Time** | **Full Marks** |
| Mathematics | 430 | Monday, 6/11/2017 | 11.00am-1.00pm | 50 |
| Physics | | Tuesday, 7/11/2017 | | 50 |
| Economics | | Wednesday, 8/11/2017 | | 50 |
| Statistics, Electronics, Chemistry | | Thursday, 9/11/2017 | | 50 |
| Computer Science | | Friday, 10/11/2017 | | 50 |

## *Syllabus for Mid Term Examination*

***Chemistry(Hons.)***
***1st Year***

### Inorganic Chemistry

Acid-Base reactions:

Acid-Base concept: Arrhenius concept, Bronsted-Lowry's concept, relative strength of acids, Pauling rules. Amphoterism. Lux-Flood concept, Lewis concept. Superacids, HSAB principle. Acidbase equilibria in aqueous solution and pH. Acid-base neutralisation curves; indicator, choice of indicators

Covalent bonding:

Lewis structures, formal charge. Valence Bond Theory,
directional character of covalent bonds, hybridizations, equivalent and non-equivalent hybrid orbitals, Bent's rule, VSEPR theory, shapes of molecules and ions containing lonepairs and bond pairs (examples from main groups chemistry), Partial ionic Character of covalent bonds, bond moment, dipole moment and electro negativity differences. Concept of resonance, resonance energy, resonance structures

### Organic Chemistry

Acyclic stereochemistry:

Representation of molecules in saw horse, Fischer, flying-wedge and Newman formulae and their inter translations, Bonding and physical properties: Valence bond theory: concept of hybridisation, resonance (including hyper conjugation), resonance energy, orbital pictures of bonding (sp3, sp2, sp: C-C, C-N & C-O system). Inductive effect

General treatment of reaction mechanism:

Mechanistic classification: ionic, radical and pericyclic; heterolytic bond cleavage and heterogenic bond formation, homolytic bond cleavage and homogenic bond formation; representation of mechanistic steps using arrow formalism.

Reactive intermediates: carbocations (cabenium and carbonium ions), carbanions, carbon radicals, carbenes – structure using orbital picture, electrophilic/nucleophilic behaviour, stability, generation and fate (elementary idea).

Reaction thermodynamics: free energy and equilibrium, enthalpy and entropy factor, intermolecular & intramolecular reactions. Application of thermodynamic principles in tautomeric equilibria [keto-enol tautomerism, composition of the equilibrium in different systems (simple carbonyl, 1,3 and 1,2- dicarbonyl systems, phenols and related system), substituent and solvent effect]. Concept of acids and bases: effect of structure, substituent and solvent on acidity and basicity.

**Physical Chemistry**

Kinetic theory and the gaseous state:

Concept of pressure and temperature. Nature of distribution of velocities in one, two and three dimensions. Maxwell's distribution of speeds. Kinetic energy distribution in one, two and three dimensions, calculations of average, root mean square and most probable values in each case; calculation of number of molecules having energy ≥ ε, Principle of equipartition of energy and its application to calculate the classical limit of molar heat capacity of gases.

Thermodynamics – I:

Importance and scope, definitions of system and surroundings; type of systems (isolated, closed and open). Extensive and intensive properties. Steady state and equilibrium state. Concept of thermal equilibrium and the zeroth-law of thermodynamics. Thermodynamic coordinates, state of a system, equation of state, state functions and path functions. Partial derivatives and cyclic rule. Concept of heat and work (IUPAC convention). Graphical explanation of work done during expansion and compression of an ideal gas. Reversible and irreversible processes and work done.

Chemical kinetics:

Introduction of reaction rate in terms of extent of reaction; rate constants, order and molecularity of reactions. Reactions of zero order, first order, second order and fractional order. Pseudo first order reactions (example using acid catalyzed hydrolysis of methyl acetate). Determination of order of a reaction by half-life and differential method. Rate-determining and steady-state approximation – explanation with suitable examples. Opposing reactions, consecutive reactions and parallel reactions (with explanation of kinetic and thermodynamic control of products; all steps first order). Temperature dependence of rate constant: Arrhenius equation, energy of activation.

***Chemistry (Hons)***

**3rd Year**

**Inorganic Chemistry**

**Chemistry of coordination compounds**

Isomerism, reactivity and stability: Determination of configuration of cis- and trans- isomers by chemical methods. Labile and inert complexes, substitution reaction on square planer complexes, trans effect (example and applications).

**Organometallic Compounds**

18-electron rule and its applications to carbonyls (including carbonyl hydrides and carbonylates), nitrosyls, cyanides, and nature of bonding involved therein. Simple examples of metal-metal bonded compounds and metal clusters. Metal-olefin complexes: zeises salt (preparation, structure and bonding)

**Organic Chemistry**

**Carbocycles and Heterocycles**

Polynuclear hydrocarbons: syntheses and reactions of naphthalene, anthracene and phenanthrene.

**Spectroscopy UV, IR, NMR (elementary)**

UV Spectra*:* Electronic transition (σ-σ*, n-σ*, π-π* and n-π*), relative positions of λmax considering conjugative effect, steric effect, solvent effect, red shift (bathochromic shift), blue shift (hypsochromic shift), hyperchromic effect, hypochromic effect (typical examples).

IR Spectra: Modes of molecular vibrations, application of Hooke's law, characteristic stretching frequencies of O-H, N-H, C-H, C-D, C=C, C=N, C=O functions; factors effecting stretching frequencies (H-bonding, mass effect, electronic factors, bond multiplicity, ring size).

## Physical Chemistry

### Properties of solids, interfaces and dielectrics

Crystal, crystal planes, law of rational indices, Calculation of fraction occupied for simple cubic, bcc, and fcc. Miller indices. Bragg's law and its applications for the determination of crystal structure for cubic system single crystal. Crystal structures of NaCl and KCl.

### Laws of photochemistry

Grotthus-Draper law, Stark-Einstein law of photochemical equivalence and Lambert-Beer's law; quantum yield and its measurement for a photochemical process, actinometry. Photostationary state. Photosensitized reactions. Kinetics of HI decomposition, H2-Br2 reaction, dimerisation of anthracene.

### Phase equilibrium and colligative properties

Definitions of phase, component and degrees of freedom. Phase rule and its derivations. Definition of phase diagram. Phase equilibria for one component system – water, CO2. First order phase transition and Clapeyron equation; Clausius-Clapeyron

equation - derivation and use. Liquid vapour equilibrium for two component systems. Ideal solution at fixed temperature and pressure. Principle of fractional distillation. Duhem-Margules equation. Henry's law. Konowaloff's rule. Positive and negative deviations from ideal behaviour. Azeotropic solution. Liquid-liquid phase diagram using phenol-water system. Solid liquid phase diagram. Eutectic mixture. Nernst distribution law. Solvent extraction.

ΔG, ΔS ΔH and ΔV of mixing for binary solutions. Vapour pressure of solution. Ideal solutions, ideally diluted solutions and colligative properties. Raoult's law. Thermodynamic derivation of colligative properties of solution (using chemical potentials) and their inter-relationships. Abnormal colligative properties.

## *Economics (Hons)*

## *1st Year*

**Paper IA: Microeconomic Principles**

Unit 1: The Economic Way of Thinking

1.1 Normative Economics and Positive Economics - Methodology 1.2 Wants, Scarcity, Competing Ends and Choice - Defining Economics 1.3 Basic Economic Questions, Microeconomics and Macroeconomics. 1.4 Principles of Microeconomics – principles of individual decision making and principles of economic interactions – Introduce trade Off, Opportunity Cost, Efficiency, Marginal Changes and Cost-Benefit, Trade, Market economy, Market failure, Externality and Market power. 1.5 Interdependence and the Gains from Trade – production possibilities frontier and increasing costs, absolute and comparative advantage, comparative advantage and gains from trade.

Unit 2: Market and Adjustments

2.1 The Evolution of Market Economies. Price System and the Invisible Hand. 2.2 The Decision-takers – households, firms and central authorities 2.3 The Concepts of Markets – individual market, separation of individual markets, interlinking of individual markets. Difference among markets – competitiveness, goods and factor markets, free and controlled markets. Market and non-market sectors, public and private sectors, economies – free market, command and mixed. 2.4 Different Goods: Public goods, Private goods, Common resources and Natural Monopolies, 2.5 Market and competition; Demand and its determinants; Supply and its determinants; relation of Quantity Demand with Price (using arguments of income and substitution effects); relation of Quantity Supply with Price (using increasing costs argument); Laws of Demand and Supply; Demand and Supply as Planning Curves; movement along and shift of the curve; Demand, Supply and Other factors. 2.6 Equilibrium and Disequilibrium 2.7 Market Adjustment without Government (with illustrations)

**Paper IB: Macroeconomic Principles**

Unit 1: Nature and Scope of Macroeconomics

1.1 Distinction between Macro economics and Microeconomics - Aggregation and Macroeconomics 1.2 Goals and Instruments of Macroeconomics 1.3 Supply and Demand in Macroeconomics Introduce Economic growth, GNP gap, booms, recessions, depressions, business cycles, fiscal policy, monetary policy, international economic policy, macro equilibrium, exchange rate, inflation and deflation, stagflation, supply shock and tight money. 1.4 Brief history and Schools of Macroeconomics – Keynesian, Classical, New Keynesian and New Classical.

Unit 2: Accounting Output and Income

2.1 The Circular Flow Explication - Measuring Output – Gross National Product - Nominal GNP, Real GNP and GNP Deflator. 2.2 The Two Approaches to measure GNP - The Final Goods Approach and Income Approach. 2.3 Intermediate goods and value added approach 2.4 Flow Statistics and Stock Statistics –Investment –Consumption –Capital stock 2.4 GNP, Gross Domestic product, Net National product, National Income and Disposable Income. 2.5 GNP and Economic Well Being.

**Paper II A: Statistics for Economics**

Unit 1: Data Presentation
Unit 2: Central Tendency (Mean, Median and Mode)
Unit 3: Dispersion (Absolute and Relative Measures)

**Paper IIB: Mathematics for Economics**

Unit 1: Introduction to Functions and Graphs
Unit 2: Derivatives and its uses in Single variable calculus
Unit 6: Difference Equations
Unit 7: Differential Equations

***Economics (Hons)***

***3rd Year***

**Paper VA: International Economics**

Unit 1: Basic Models of Trade

1.1Ricardian Model: Comparative advantage. 1.2 One factor economy: production possibility frontier, relative demand and relative supply and autarkic terms of trade. 1.2 Trade in Ricardian world: determination of international terms of trade, complete specialiszation, gains from trade.

Resources, Comparative Advantage, and Income Distribution

2.1 Model of two factor economy: Assumptions, Factor prices and commodity prices (Stolper-Samuelson effect)-correspondence, Resources & output, Rybzynski effect. 2.2 Effects of International Trade between two factor economies, Relative prices and and the pattern of Trade, Trade and distribution of Income, Factor Price Equalization. 2.3 Empirical studies - Leontief Paradox.

**Paper VB: Public Finance**

Unit 1: Introduction to public economics

1.1 The nature, scope and significance of public economics

Unit 2: Forms and Functions of Government

2.1 Different forms of government – unitary and federal. Tiers of government in the federal form- Central, State, Local (Introductory discussion with examples). 2.2 Functions of Government - Economic functions -allocation, distribution and stabilization. 2.3 Regulatory functions of the Government and its economic significance

Unit 3: Federal Finance

3.1 Federal Finance: Different layers of the government, Inter governmental transfer—horizontal vs. vertical equity. 3.2 Grants—merits and demerits of various types of grants—unconditional vs. conditional grants, tied grants, matching grants.

Unit 4: Public Goods and Public Sector

4.1 Concept of public goods—characteristics of public goods, national vs. local public goods, determination of provision of public good 4.2 Externality, concept of social versus private costs and benefits, merit goods, club goods. 4.3 Provision versus production of public goods. Market failure and public provision. Pricing of public goods—vertical summation

**Paper VIA: Comparative Development Experience**

Unit 1: International comparisons of development

1.1Differences in initial conditions of development of less developed countries and present day developed countries. 1.2 Nature of development gap prevailing at present between developed and less developed countries.

Unit 5: Development and underdevelopment as historical processes

5.1 Dependency Approach. 5.2 Unequal exchange.

**Paper VIB: Contemporary Economic Issues: India and West Bengal**

**Group A: Contemporary Economic Issues: India**

Unit 1: Economic Reforms in India since 1991

**Group B: Contemporary Economic Issues: West Bengal**

Unit 5: West Bengal Economy: An Overview

**Paper VIIA: Statistics & Basic Econometrics**

Unit 1: Joint Probability distribution
Unit 2: Sampling theory
Unit 5: Elementary Econometrics
Classical Linear Regression Model (Specification of The Model, Assumptions, Estimation of Parameters)

**Paper VIIB: Mathematical Economics**

Unit 1: Theory of the Consumer (Utility Maximization, Lagrangian Multiplier, Indirect Utility)
Unit 2: Theory of the Firm
Unit 7: Application of Difference and Differential Equations.

**Paper VIIIA: Indian Economic History**

Unit 1: Economic Condition in India on the eve of British rule
Unit 3: Impact of British rule on India:
(a) Deindustrialisation,(b) Commercialisation of agriculture, (c)Economic Drain

## *Physics (Hons)*
## *1st Year*

Functions of several real variables - partial differentiation, Taylor's series.

Transformation properties of vectors; Differentiation and integration of vectors; Line integral, volume integral and surface integral involving vector fields; Gradient, divergence and curl of a vector field; Gauss' divergence theorem, Stokes' theorem, Green's theorem - application to simple problems.

Hermitian adjoint and inverse of a matrix; Hermitian, orthogonal, and unitary matrices; Eigenvalue and eigenvector (for both degenerate and non-degenerate cases); Similarity transformation; diagonalisation of real symmetric matrices.

Solution of second order linear differential equations with constant coefficients and variable coefficients by Frobenius' method (singularity analysis not required); Solution of Legendre and Hermite equations about x=0; Legende polynomials - orthonormality properties. LHO.

Free and forced vibrations. Damping. Resonance. Sharpness of resonance. Acoustic, optical, and electrical resonances: LCR circuit as an example of the resonance condition.

p-n junction diode, I-V characteristics, Zener diode and its applications, optoelectronic diodes: LED, photo diodes.

Basic assumptions of kinetic theory, Ideal gas approximation, deduction of perfect gas laws. Maxwell's distribution law (both in terms of velocity and energy), root mean square and most probable speeds. Finite size of molecules : Collision probability, Distribution of free paths and mean free path from Maxwell's distribution.

## ***Physics (Hons)***
## ***3rd Year***

Motion under central force; Nature of orbits in an attractive inverse square field; Kepler's laws of planetary motion. Rutherford scattering as an example of repulsive potential

Generalised coordinates, constraints and degrees of freedom; D'Alembart's principle; Lagrange's equation for conservative systems (from D'Alembert's principle; variational principle not required) and its application to simple cases; Generalised momentum; Idea of cyclic coordinates, its relation with conservation principles;

Definition of Hamiltonian, Hamilton's equation (derivation by Legendre transformation) and its application to simple cases.

Galilean transformation and invariance of Newton's laws of motion, non-invariance of Maxwell's

equations. Michelson-Morley experiment and explanation of the null result.

Concept of inertial frame. Postulates of special theory; simultaneity; Lorentz transformation along one of the axes – length contraction, time dilatation and velocity addition theorem, Fizeau's experiment. Four vectors. Relativistic dynamics : variation of mass with velocity; energy momentum relationship.

Good quantum numbers, and selection rules. Stern-Gerlach experiment and spin as an intrinsic quantum number. Incompatibility of spin with classical ideas. Bohr-Sommerfeld model. Fine structure. Study of fine structure by Michelson interferometer.

Magnetic moment of the electron, Lande g factor. Vector model – space quantization. Zeeman effect. Explanation from vector atom model.

Crystalline and amorphous solids, translational symmetry. Elementary ideas about crystal structure, lattice and bases, unit cell, reciprocal lattice, fundamental types of lattices, Miller indices, lattice planes, simple cubic, f.c.c. and b.c.c. lattices. Laue and Bragg equations. Determination of crystal structure with X-rays.

Classical description in terms of phase space and quantum description in terms of wave functions.

Hypothesis of equal *a priori* probability for microstates of an isolated system in equilibrium. Interactions between two systems – thermal, mechanical and diffusive. Statistical definition of temperature, pressure, entropy and chemical potential.

Eigenstates, normalization and orthonormality. One dimensional potential well and barrier, boundary conditions, bound and unbound states. Reflection and transmission coefficients for a rectangular barrier in one dimension – explanation of alpha decay. Free particle in one dimensional box, box normalization, momentum eigenfunctions of a free particle. Linear harmonic oscillator, energy eigenvalues from Hermite differential equation, wave function for ground state, parity of wave function.

## ***Computer Science (Hons)***

## ***1st Year***

**Group A: Computer Fundamentals**

Introduction to Computer and Problem Solving: Information and Data.
Hardware: CPO, Primary and Secondary storage, I/O devices
Software: Systems and Application.
Generation of Computers: Super, Mainframe, Mini and Personal Computer.
Introduction to Programming Languages: Machine Language, Assembly Language, High Level Language.
Problem Solving: Flow Charts, Decision Tables and Pseudo codes.
Number Systems and Codes:
Number representation: Weighted Codes, Non-weighted codes, Positional, Binary, Octal, Hexadecimal, Binary Coded Decimal (BCD), Conversion of bases. Complement notions. Binary Arithmetic, Binary Codes: Gray, Alphanumeric, ASCII, EBCDIC; Parity Bits. Single Error-Detecting and Correcting Codes, Hamming Codes

**Group B: Introduction to Basic Electronics**

Elementary circuit theory: Kirchhoff's Laws with simple applications, Statement and illustration of Thevenin's & Norton's theorems (without proof) in resistive network only& its simple applications.
Elementary Physics of semi-conductors: Intrinsic and Extrinsic semiconductors, P & N type, Diode & its Applications: Types of diodes, P-N Junction diodes, Biasing of a junction diode, Depletion region & its effect, Zener diodes & its applications, Diode as a rectifier, LED

Bipolar .junction Transistor: Principle of junction transistor, current components of transistor, modes of a transistor (CB, CE and CC) and their properties, I/O characteristics of a transistor in CE mode. Relation between α & β parameters of transistor, biasing of a transistor: Q point, load line, Inverters using Transistors: Transfer characteristics

**Group C: Digital System Design**

*Combinational Circuits:* Realization of AND and OR Gates using diodes and NOT Gate using transistors, Standard Gate Assemblies, IC chips packaging nomenclature, Half and Full Adder(3 bits), Multi-bit adders - Ripple carry and Carry Look Ahead Adder, Adder/subtractor, BCD-Adder, Data selectors/multiplexers expansions, reductions, function realization, universal function realization, multi-function realization,
Decoders/Demultiplexers: function realization, De-multiplexer and function realization, Encoder, Priority Encoder

**Group - D: Computer Organization - I**
*Basic Computer Organization* - IAS Computer, Von Neumann Computer, System Bus. Instruction Cycle, Data Representation, CPU Organization, CPU Registers, Instruction Registers, Program Counter, Stack Pointer.
*Instruction:* Operation Code and Operand. Zero, One, Two and Three address instruction. Instruction types. Addressing modes. Stack organization

**PAPER-II**

**Group - A**

*System Software Fundamentals:* Different System Software:

*Introduction to Operating Systems:* What is OS? Multiprogramming, Multitasking OS, Concepts of processes, Files, Shell, System Calls; Structures: Monolithic, Layered, Virtual, Client Server and Distributed Model.
*Introduction:* Concepts of Data types, Elementary structures, Data types and their interpretation.
*Arrays:* Types, Memory Representation, Address Translation, Functions of single and multi-dimensional arrays with examples.'
*Linked Structures:* Singly and doubly linked list (non-circular and circular), List manipulation with pointers: Searching, Insertion and deletion of elements.

## *Computer Science (Hons)*

### *3rd Year*

**PAPER V**

**Group - A: Microprocessor**

Evolution of Microprocessor: Architecture of 8 bit and 16 bit microprocessor Machine Language Instructions, Addressing Modes, Instruction Formats, Instruction Sets, Instruction Cycle, Clock Cycles, Timing Diagrams,

**Group- B: Computer Organization - II:**

*ALU* - Combinational ALU, 2's Complement Addition, Subtraction Unit, Booth's Algorithm for multiplication and division. *Memory Hierarchy:* CPU Register, Cache Memory, Primary Memory) (DRAM, SRAM, SAM, PAL PLA). Secondary Memory and Virtual Memory, Associative memory.

**PAPER VI**

**Group - B: Software Engineering**: Software Life Cycle, Different Models: Waterfall, Spiral: Software Requirement Analysis & Specification, Structured Analysis, DFD, Data Dictionary, Structured Design. Structure Charts. Software Testing: White Box and Black Box Testing, Software Quality Assurance.

**Group - D: Data Base Management System**

Basic concept, File Management Systems, Advantages of DBMS, ANSI/SPARC Architecture, Physical, Conceptual and External Models, ER Diagram; Data Models: Relational, Hierarchical. Network

## *Mathematics (Hons)*

### *1st Year*

Classical Algebra– Complex Numbers, Theory of Equations

Modern Algebra I– Group Theory

Analytical Geometry of Two Dimensions– Transformation of Axes, Pair of Straight Line

Analysis I – Real Number System, Sets in R (except Perfect and Dense Sets)

Evaluation of Integrals – Reduction Formula

Linear Algebra– Vector Space: Up to Replacement Theorem

## *Mathematics (Hons)*

### *3rd Year*

Analysis III – Bounded Variation, Riemann Integral (Up to Continuous Functions are Riemann Integrable)

Linear Algebra – Upto Rank-Nullity Theorem

Graph Theory – Entire

Vector Calculus II – Line, Surface, Volume Integral

Hydrostatics – Gases, Equilibrium of Fluids, Thrusts on Plane Surface, Centre of Pressure Metric Space

Probability – First Chapter

Numerical Analysis – Up to Numerical Integration