Dr. A.P.J. Abdul Kalam University, Indore (M.P)

Scheme of Examination
B.Sc.
Semester-IV
(w.e.f. July 2016 Onwards)

(Non Grading)

Course Name	Subject	Theory Max. Marks				Practical Max Marks		Total
		Internal		External		Max Marks	Min Marks	
		Max	Min	Max	Min			
Foundation Courses	HINDI+ ENGLISH **FCS 401 HE**	10+05=15	05	50+35=85	28	-	-	100
	Environmental Science **FCS 402 EP**	15	05	35	12	-	-	50
B.Sc Mathematics	MATHEMATICS **BSM 401 T**	25	08	125	42	-	-	150
	CHEMISTRY **BSC402 T**	15	05	85	28	-	-	100
	CHEMISTRY **BSC402 P**	-	-	-	-	50	17	50
	PHYSICS **BSP403 T**	15	05	85	28	-	-	100
	PHYSICS **BSP403 P**	-	-	-	-	50	17	50
Total								**600**

Dr. A.P.J. Abdul Kalam University, Indore (M.P)

B.Sc. Under Graduate Semester wise Syllabus

(w.e.f. session 2016 onwards)

Class: - B.Sc.

Semester: - IV Semester

Subject: - Physics (BSP 403T)

Paper: - Electrostatics, Magnetostatics and Electrodynamics

Marks 85+15 CCE

Unit-1

Electrostatics

Coulombs law in vacuum expressed in vector forms, calculations of electric field **E** for simple distributions of charge at rest, dipole and quadruple fields. Work done on a charge in an electrostatic field expressed as a line integral, conservative nature of the electrostatic field. Relation between electric field & electric potential ($\mathbf{E} = -\nabla V$), torque on a dipole in a uniform electric field and its energy, flux of the electric field, Gauss's law and its application for finding **E** for symmetric charge distributions, Gaussian pillbox, fields at a surface of a conductor, screening of **E** field by a conductor.

Capacitors, electrostatic field energy, force per unit area of the surface of a conductor in an electric field, conducting sphere in a uniform electric field, point charge in front of a grounded infinite conductor. Dielectrics, parallel plate capacitor with a dielectric, dielectric constant, polarization and polarization vector **P**, relation between displacement vector **D**, **E** and **P**. Molecular interpretation of Claussius-Mossotti equation, boundary conditions satisfied by **E** and **D** at the interface between two homogenous dielectrics, illustration through a simple example.

Unit-2

Magnetostatics

Force on a moving charge, Lorentz force equation and definition of **B**, force on a straight conductor carrying current in a uniform magnetic field, torque on a current loop, magnetic dipole moment, angular momentum and gyromagnetic ratio, Biot and Savart's law, calculation of **H** for simple geometrical situations such as Solenoid, Anchor ring. Ampere's Law, $\nabla \times \mathbf{B} = \mu_0 \mathbf{J}$, $\nabla . \mathbf{B} = 0$. Field due to a magnetic dipole, free and bound currents, magnetization vector (**M**), relationship between **B**, **H** and **M**. Derivation of the relation $\nabla \times \mathbf{M} = \mathbf{J}$ for non-uniform magnetization.

Unit-3

Current Electricity and Bio electricity

Current Electricity: Steady current, current density **J**, non-steady currents and continuity equation, Kirchoff's laws and analysis of multiloop circuits, growth and decay of current in LR and CR circuits, decay constants, LCR circuits. AC circuits, complex numbers and their Applications in solving AC circuits problems, complex impedance and reactance, series and parallel resonance. Q-factor, power consumed by an A.C. circuit, power factor, Y and networks and transmission of electric power.

Bioelectricity: Electricity observed in living systems, Origin of bioelectricity, Sodium and potassium transport, Resting potential and action potential, Nernst's equation, Conduction velocity, Origin of compound action potential, Neuron structure and function, An axon as cable, Membrane resistance and capacitance.

Unit-4

Motion of Charged Particles in Electric and Magnetic Fields

(Note: The emphasis here should be on the mechanical aspects and not on the details of the apparatus mentioned which are indicated as applications of principles involved.)

E as an accelerating field, electron gun, discharge tube, linear accelerator. **E** as deflecting field - CRO, Sensitivity of CRO. Transverse **B** field; 180° deflection, Mass spectrograph and velocity selector, Curvatures of tracks for energy determination for nuclear particles; Principle and working of Cyclotron.

Mutually perpendicular and parallel **E** & **B** fields; Positive ray parabolas, Discovery of isotopes, Elements of Mass Spectrographs, Principle of magnetic focusing **(**lenses**).**

Unit-5

Electrodynamics

Electromagnetic induction, Faraday's Laws, Electromotive force, Integral and differential forms of Faraday's laws, Self and mutual inductance, Transformers, Energy in a static magnetic field, Maxwell's displacement current, Derivations of Maxwell's equations, Electromagnetic field energy density.

Poynting vector, Electromagnetic wave equation, Plane electromagnetic waves in vacuum and dielectric media, Reflection at a plane boundary of dielectrics, Fresnel's Laws, Polarization by reflection and total internal reflection, Waves in a conducting medium, Reflection and refraction by the ionosphere.

References:

1. **Introduction to Electrodynamics:** David J. Griffiths, 4th Edition, Printice Hall.
2. **Classical Electrodynamics:** Jhon David Jackson, Jhon Wiley & Sons.
3. **Electrodynamics:** Emi Cossor & Bassin Lorraine, Asahi Shimbunsha Publishing Ltd.
4. **From Neuron to Brain:** Kuffler and Nicholas, Sinauer Associates, Inc Pub. Sunderland, Masschuetts *(Reference for topics of Bioelectricity)*

B.Sc. Under Graduate Semester wise Syllabus

(W.e.f. session 2016 onwards)

Class: - B.Sc.

Semester: - IV Semester

Subject: - Mathematics (BSM 401T)

Paper: - Abstract Algebra, Advanced Calculus Partial Differential Equations, Complex Analysis

UNIT-I

Group automorphisms, inner automorphism, Group of automorphisms, Conjugacy relation and centraliser, Normaliser, Counting principle and the class equation of a finite group, Cauchy's theorem for finite abelian groups and non- abelian groups.

UNIT-II

Introduction to rings, subrings, integral domains and fields, simple properties and examples, ring homomorphism, ideals and quotient rings.

UNIT-III

Maxima, Minima and saddle points of functions of two variables, Improper integrals and their convergence, Comparison test, Abel's and Dirichlet's tests, Beta and Gamma , Relation between β and γ function

UNIT-IV

Partial Differential equations of the first order, Lagrange's solution, Some special types of equations which can be solved easily by methods other than general methods, Charpit's general method of solution, Partial differential equations of second and higher orders, Homogeneous and non-Homogeneous equations with constant coefficients, Partial differential equations reducible to equations with constant coefficients.

UNIT-V

Continuity and differentiability of Complex functions, Analytical function, Cauchy Riemann equation, Harmonic function, Mobius transformations, fixed points, cross Ratio, Harmonic Conjugate function, Cauchy Integral formula.

Text Books:

1. I.N. Sneddon, Elemets of partial Differential equatiins Mc graw Hill, Co. 1988
2. Shanti Narayan, Theory of Functions of a Complex Variable, S. Chand & Co., New Delhi.
3. I.N. Herstein Topics in Algebra, Wiley Eastern Ltd., New Delhi, 1977.

4. Murray R. Spiegel, Theory and Problems of Advanced Calculus, Schaum Publishing Co., New York

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Reference Books:

1. T.M. Apostol, Mathematical Analysis Narosa Publishing House, New Delhi 1985
2. N. Piskunov , Differential and Integral Calculus, Peace Publishers, Moscow.
3. S.C. Malik, Mathematical Analysis, Wiley Eastern Ltd., New Delhi.
4. N. Jacobson, Basis Algebra, Vols, I & II. W.H. Freeman, 1980 (also published by Hindustan Publishing Company.)
5. Shanti Narayan, A Text Book of Modern Abstract Algebra, S. Chand & Co. New Delhi
6. P.B. Bhattacharya, S.K. Jain and S.R. Nagpaul, Basic Abstract Algebra, Wiley Eastern, New Delhi, 1997.
7. I. S. L.uther and I.B. S. Passi, Alegebra Vol- I , II, Narosa Publishing House.
8. R. V. Churchill & J.W. Brown, Complex Variables and Applications, 5th Edition, McGraw-Hili New. York. 1990
9. Mark; J. Ablowitz & A. S. Fokas. Complex Variables : Introduction and Applications, Cambridge University Press, South Asian Edition, 1998
10. Ponnuswamy : Complex Analysis, Narosa Publishing Co.

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B.Sc. Under Graduate Semester wise Syllabus
(W.e.f. session 2016 onwards)

Class: - B.Sc.

Semester: - IV Semester

Subject: - Chemistry (BSC402T)

Marks 85+15 CCE

UNIT-I

A. Phase equilibrium: statement and the meaning of terms: phase, component and the degree of freedom, thermodynamic derivation of the Gibbs phase rule, one component system: water, CO_2 and S system, two component system: solid-liquid equilibrium, simple eutectic system: Bi-Cd; Pb-Ag system, Desilverisation of lead.

B. Solid solution: Systems in which compound formation with congruent melting point (Zn-Mg) and incongruent melting point, (NaCl-H_2O) and ($CuSO_4$-H_2O) system, Freezing Mixtures: acetone-dry ice.

C. Liquid- Liquid mixtures: Ideal liquid mixtures, Raoult's and Henry's law. Non-ideal system, azeotrops; HCl-H_2O and ethanol water system.

D. Partial miscible liquids: Phenol-water, trimethylamine – water and nicotine-water system. Lower and upper consolute temperature. Immiscible Liquids, steam distillation, Nernst distribution law: thermodynamic derivation, applications.

UNIT II

Electrochemistry

A. Electrical transport: conduction in metals and in electrolyte solutions, specific conductance and equivalent conductance, variation of specific conductance and equivalent conductance with dilution, Migration of ions and Kohlrausch-law, Arrhenius theory of electrolyte dissociation and its limitations, weak and strong electrolytes, Ostwald's dilution law, its uses and limitations. Debye-Huckel Onsager's equation for strong electrolytes (elementary treatment only). Transport number: Definition and determination by Hittorf method and moving boundary method.

B. Types of reversible electrodes: Gas metal ion, metal-meal ion, metal-insoluble salt anion and redox electrodes. Electrode reactions, Nernst equation, derivation of cell EMF and single electrode potential, standard hydrogen electrode- reference electrodes-standard electrode, standard electrode potential. EMF of a cell and its measurements, computation of cell EMF, calculation of thermodynamic quantities of cell reaction (DG, DH, K). Solubility product and activity coefficient, potentiometric and conductometric titration. Definition of pH and pK, determination of pH using hydrogen, quinhydrone and glass electrodes by potentiometric methods.

UNIT-III

A. Aldehydes and Ketones : Nomenclature and structure of the carbonyl group. Synthesis of aldehydes and ketones with particular reference to the synthesis of aldehydes and ketones from acid chlorides, synthesis of aldehydes and ketones using. 1,3 dithianes, synthesis of ketones from nitriles and from carboxylic acids. Physical properties. Mechanism of nucleophilic additions to carbonyl group with particular emphasis on Benzoin, Aldol Perkin and Knovenagel condensations. Condensation with ammonia and its derivatives. Wittig reaction, Mannich reaction, use of acetals as protecting group. Oxidation of aldehydes, Baeyer-villiger oxidation of ketones, Cannizaro reaction. Meerwein Pondroff- Verley, Clemmesen, Wolf Kishner, $LiAlH_4$ and $NaBH_4$ reduction.

B. Carboxylic acids: Nomenclature, structure and bonding, physical properties, acidity of carboxylic acids, effects of substituents on acid strength. Preparation of carboxylic, reaction of carboxylic acids. Hell Volhard Zelinsky reaction. Synthesis of acid chlorides
ester and amides reduction of carboxylic acids, mechanism of decarboxylation.

UNIT IV

A. Carboxylic acids derivatives: structure and nomenclature of acid chlorides, esters amides and acid anhydrides. Physical properties, interconversion of acid derivative by nucleophilic acyl substitution, preparation of carboxylic acid derivatives, chemical reactions. Mechanism of esterification and hydrolysis (acidic and basic).

B. Coordination Chemistry: MOT (molecular orbital theory) diagram for tetrahedral, square planar and octahedral complexes.

C. Green Chemistry: Principles, 12 tenets, their description with examples.

UNIT V

A. Chemistry of Lanthanides: Electronic structure, oxidation states, ionic radii and lanthanide contraction, complex formation, occurrence and isolation of lanthanide compounds.

B. Chemistry of Actinides: General features and chemistry of actinides, chemistry of separation of Np, Pu and Am from U, Similarities between the later actindies and later lanthanides. Lectures

Suggested Books

1. Physical Chemistry-Puri, Sharma and Pathania, Vikas Publications, New Delhi
2. Physical Chemistry- G.M. Barrow, International Student Edition, McGraw Hill.
3. The Elements of Physical Chemistry, P.W. Atkins, Oxford University Press
4. Physical Chemistry, R.A. Alberty, Wiley Eastern Ltd.
5. Physical Chemistry Through problems, S.K. Dogra and S. Dogra, Wiley Eastern
6. Organic Chemistry, Morrison and Boyd, Prentice Hall.
7. Organic Chemistry, L.G. Wade Jr. Prentice Hall

8. Fundamentals of Organic Chemistry Solomons, John Wiley.
9. Organic Chemistry, Vol. I, IL IIL S.M. Mukherji, S.P. Singh and R.P. Kapoor,
10. Organic Chemistry, F.A. Carey, McGraw-Hill Inc.
11. Introduction to Organic Chemistry, Streitwiesser, Heathcock and Kosover, Macmillan.
12. Vogel's Qualitative & Quantitative Analysis Vol- 1, 2, 3, ELBS.
13. Advanced Organic chemistry, I. L. Finar, ELBS.
14. Basic Concepts of Analytical chemistry, S M Khopker, New Age International Publishers.
15. Analytical Chemistry, R.M. Verma, CBS Publication.
16. Analytical Chemistry, Skoog & West, Wiley International.
17. Essentials of Physical Chemistry, B.S. Bahl, Arun Bahl & G.D. Tuli, S. Chand & Company Ltd.
18. Atomic structure and Molecular spectroscopy, Manas Chanda, New Age International Publishers.
19. Molecular Spectroscopy, Sukumar, MJP Publishers.
20. Organic Chemistry, Mac Murrey, Pearson Education
21. Inorganic Chemistry – J.D. Lee, John Wiley
22. Inorganic Chemistry – Cotton and Wilkinson, John Wiley

Class : B.Sc. Semester IV
Subject : Chemistry
Paper : Practical

M.M. 50

Time : 6 hour

Organic Chemistry **12 Marks**

Qualitative analysis

Identification of an organic compound through the functional group analysis, determination of melting point and preparation of suitable derivatives.

Physical Chemistry **12 Marks**

A.Transition temperature

1. Determination of transition temperature of given substance by theromometric, dialometric method (e.g.) ($MnCl_2$, $4H_2O$/$SrBr_2$, $2H_2O$)

B.Phase equilbrium

1. To study the effect of solute (e.g. NaCl, succinic acid) on the critical solution temperature of two partially miscible liquid (e.g., phenol water system).
2. To construct the phase diagram of two component (e.g., diphenylamine benzopheone) by cooling curve method.

C.Thermochemistry

1. To determine the enthalpy of neutralization of weak acid/weak base versus strong acid/strong base and determine the enthalpy of ionization of the weak acid/base.

Inorganic chemistry-Quantitative Volumetric Analysis 12 Marks

1. Estimation of ferrous and ferric by dichromate method.
2. Estimation of copper using thiosulphate.

Viva **6 Marks**

Record **8 M**