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

Scheme of Examination
B.Sc.
Semester-V
(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 501 HE**	10+05=15	05	50+35=85	28	-	-	100
	Basics of Computer & Information Technology - I **FCS 502 EP**	15	05	35	12	-	-	50
B.Sc. Mathematics	MATHEMATICS **BSM 501 T**	25	08	125	42			150
	CHEMISTRY **BSC502 T**	15	05	85	28	50	17	150
	CHEMISTRY **BSC502 P**	-	-	-	-	50	17	50
	PHYSICS **BSP503 T**	15	05	85	28	50	17	100
	PHYSICS **BSP503 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: - V Semester

Subject: - Physics (BSP 503T)

Paper: - Quantum Mechanics and Spectroscopy

Marks 85+15 CCE

Unit-I: QUANTUM MECHANICS-1

Particles and Waves: Photoelectric effect. Black body radiation. Compton effect. De Broglie hypothesis. Wave particle duality. Davisson-Germer experiment. Wave packets. Concept of phase and group velocity. Two slit experiment with electrons. Probability. Wave amplitude and wave functions. Heisenberg's uncertainty principle with illustrations. Basic postulates and formalism of Schrodinger's equation. Eigenvalues. Probabilistic interpretation of wave function. Equation of continuity. Probability current density. Boundary conditions on the wave function. Normalization of wave function.

Unit-II: QUANTUM MECHANICS-2

Time independent Schrodinger equation: 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. Quantum phenomenon of tunneling. Free particle in one-dimensional box, eigen functions and eigen values of a free particle. One-dimensional simple harmonic oscillator, energy eigenvalues from Hermite differential equation, wave function for ground state. Particle in a spherically symmetric potential. Rigid rotator. Orbital angular momentum, azimuthal quantum numbers and space quantization. Radial solutions and principle quantum number. Hydrogen atom.

Unit-III: ATOMIC SPECTROSCOPY

Atoms in electric and magnetic fields: Quantum numbers, Bohr model and selection rules. Stern-Gerlach experiment. Spin as an intrinsic quantum number. Incompatibility of spin with classical ideas. Orbital angular momentum. Fine structure. Total angular momentum. Pauli exclusion principle. Many particles in one dimensional box. Symmetric and anti-symmetric wave functions. Atomic shell model. Spectral notations for atomic states. Spin-orbit coupling, Vector model L-S and J-J coupling. Doublet structure of alkali spectra. Zeeman effect. Continuous and characteristic X-rays. Mossley's law.

Unit-IV: MOLECULAR SPECTROSCOPY

Spectra: Various types of spectra. Rotational spectra. Intensity of spectral lines and determination of bond distance of diatomic molecules. Isotope effect. Vibrational energies of diatomic molecules. Zero point energy. Anharmonicity. Morse potential. Raman effect, Rotational Raman spectra and Vibrational Raman spectra. Stokes and anti-Stokes lines and their intensity difference. Electronic spectra. Born-Oppenheimer approximation. Frank-Condon principle, singlet and triplet states. Fluorescence and phosphorescence.

Unit-V: NUCLEAR PHYSICS

Interaction of charged particles and neutrons with matter, working of nuclear detectors, G-M counter, proportional counter, Scintillation counter, Cloud chamber.
Basic properties of nucleus: Shape, Size, Mass and Charge of the nucleus. Stability of the nucleus and Binding energy. Alpha particle spectra – velocity and energy of alpha particles. Geiger-Nuttal law. Nature of beta ray spectra. The neutrino. Energy levels and decay schemes. Positron emission and electron capture. Selection rules. Beta absorption and range of beta particles. Kurie plot. Nuclear reactions, pair production. Q-values and threshold of nuclear reactions. Nuclear reaction cross-sections. Examples of different types of reactions and their characteristics. Compound nucleus, Bohr's postulate of compound nuclear reaction, Semi empirical mass formula, Shell model, Liquid drop model, Nuclear fission and fusion (concepts).

References:

1 Quantum Mechanics: V. Devanathan, Narosa Publishing House, New Delhi, 2005.

2 Quantum Mechanics: B. H. Bransden, Pearson Education, Singapore, 2005.

3 Quantum Mechanics: Concepts and Applications, Nouredine Zettili, Jacksonville State University, Jacksonville, USA, John Wiley and Sons, Ltd, 2009.

4 Introductory Quantum Mechanics & Spectroscopy: K.M. Jain, South Asian Publications.

5 Physics of Atoms & molecules: B.H. Bransden & C.J. Joachaim, Pearson Education, Singapore, 2003

6 Fundamentals of Molecular Spectroscopy: C.M. Banwell & M. McCash, McGraw Hill (U.K. edition)

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B.Sc. Under Graduate Semester wise Syllabus

(w.e.f. session 2016 onwards)

Class: - B.Sc.

Semester: - V Semester

Subject: - Mathematics (BSM 501T)

Paper: - Linear Algebra Numerical Analysis

Unit-I

Definition and examples of vector spaces, subspaces, Sum and direct sum of subspaces, Linear span, Linear dependence, independence and their basic properties, Basis, Finite dimensional vector spaces, Existence theorem for basis, Invariance of the number of elements of a basis set, Dimension, Dimension of sums of vector subspaces.

Unit- II

Linear transformations and their representation as matrices, The algebra of linear transformations, The rank- nullity theorem, Eigen values and eigen vectors of a linear transformation, Diagonalisation, Quotient space and its dimension.

Unit-III

Approximations, Errors and its types, Solution of Equations: Bisection, Secant, Regula Falsi, Newton- Raphson Method and their order of convergence, Roots of second degree Polynomials, Interpolation: Lagrange interpolation, Divided Differences, Interpolation formulae using Differences and derivations of Interpolation formula.

Unit-IV

Linear Equations: Direct Methods for Solving Systems of Linear Equations, Gauss elimination, Gauss Jordan Method, LU Decomposition, Cholesky Decomposition, Iterative Methods: Jacobi Method , Gauss - Seidel Method, Relaxation Method, Methods Based on Numerical Differentiation.

Ordinary Differential Equations: Euler Method, Eulers Modified Method, Single-step Methods, Runge-Kutta's Method, Multi-step Methods, Milne Method, Numerical Quadrature, Newton-Cote's Formulae, Gauss Quadrature Formulae, Methods Based on Numerical Integration with their derivation.

Text Books :

1. K. Hoffman and R. Kunze, Linear Algebra, 2nd Edition. Prentice Hall Englewood Cliffs, New Jersey.1971.
2. C E Frooerg. Introduction to Numerical Analysis, (Second Edition L Addison-Wesley - 1979,

3. M K Jain, S.R.K. Iyengar, R. K. Jain. Numerical Methods Problems and Solutions, New Age International (P)Ltd. 1996.

Reference Book:-

1. E. Balaguruswamy- Numerical Method Tata Mc Graw_ Hill Pub.Com. New Yark
2. K.B. Datta. Matrix and Linear Algebra, Prentice hall of India Pvt Ltd., New Delhi, 2000.
3. S.K. Jain, A. Gunawardena & P.B. Bhattacharya. Basic Linear Algebra with MATLAB Key college Publishing (Springer-Verlag) 2001
4. S. Kumarsaran, Linear Algebra, A Geometric Approach Prentice – Hall of India, 2000

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B.Sc. Under Graduate Semester wise Syllabus

(W.e.f. session 2016 onwards)

Class: B.Sc.

Semester: V Semester

Subject: Chemistry (BSC502T)

Marks 85+15 CCE

Unit-I

Organic Compounds of Nitrogen:

Preparation, properties and chemical reactions of nitroalkanes and nitroarenes. Mechanism ofnucleophilic substitution in nitroarenes and their reduction in acidic neutral and alkaline media, picric acids. Halonitroarenes; structure and nomenclature, and their activity. Amines structure, and nomenclature, physical properties and stereochemistry, separation of mixture of primary, secondary and tertiary amines. Structural features affecting basicity of amines. Amine salts as phase transfer catalysts. Preparation of alkyl and aryl amines (reduction of nitro compounds, nitriles), reductive amination of aldehydic and ketonic compounds, Gabriel –phthalamide reaction, Hoffmann bromamide reaction, Reaction of amines, electrophilic aromatic substitution in aryl amines, reaction of amines with nitrous acid synthetic transformation of aryl diazonium salts, azo coupling.

Unit-II

Carbohydrates-I

Classification and nomenclature, monosaccharide, mechanism of osazone formation, chain lengthening and chain shortening of aldoses, epimerization, configuration of monosaccharide, erythro, threo diasterioisomers. Formation of glycosides, ethers and esters, determination of ring size of monosaccharide, cyclic structure of D(+) glucose, mechanism of mutarotation. Structure of ribose and deoxyribose.

Carbohydrates-II

An introduction to glycosidic linkages in di and polysaccharides. Reducing and non-reducing sugars.

Unit-III

(a) Photochemistry: Electromagnetic radiation, range of different regions of the spectrum, different expression units for energy, wavelength and frequency Interaction of radiation with matter, difference between thermal and photochemical process. Laws of photochemistry – Grotthus-Draper law, Stark-Einstein law, Beer-Lambert law. Electronic transitions, Jablonski diagram depicting various quantum yield.

(b) UV Spectroscopy: Electronic excitation, elementary idea of instrument used, Application to organic molecules. Woodward-Fieser rule for determining _max of enes, polyenes and _, 1-unsaturated carbonyl compounds.

Unit-IV

Bioinorganic Chemistry - I

Essential and trace elements in biological processes, metalloporphyrins with special reference to haemoglobin and myoglobin, Biological role of alkali and alkaline earth metal ions with special reference to Ca^{2+}.

Bioinorganic Chemistry - II

Role of metal ions in biological process, nitrogen fixation, oxygen-uptake proteins, cytochromes and ferredoxins.

Unit-V

Hard and Soft Acids and Bases (HSAB) Classification of acids and bases as hard and soft, Pearson's HSAB concept, symbiosis.

Analytical Chemistry: Errors, their classification, minimization of errors, precision and accuracy, gravimetric estimation - concept, method and precautions, gravimetric

estimation of barium and copper.

Inorganic Polymers: Introduction and scope of inorganic polymers, special characteristics, classification and their applications. Structure and nature of bonding in Silicones and triphosphonitrilic chloride.

Books suggested:-

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 Uni v er s i t y 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
23. Inorganic Chemistry – Huheey, Harper Collins Pub. USA
24. Inorganic Polymer – G.R. Chhatwal, Himalaya Pub.House
25 मध्य प्रदेष हिन्दी ग्रन्थ अकादमी भोपाल द्वारा प्रकाषित रसायन विज्ञान की पाठ्यपुस्तक।
26 मध्य प्रदेष हिन्दी ग्रन्थ अकादमी भोपाल द्वारा प्रकाषित प्रायोगिक रसायन की पाठ्यपुस्तक।

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B.Sc. Under Graduate Semester wise Syllabus

(W.e.f. session 2016 onwards)

Class: B.Sc.

Semester: - V Semester

Subject: Chemistry (BSC502P)

M.M. 50 **Time: 6 Hours**

Inorganic Chemistry **12 Marks**

Analysis of inorganic mixture containing five redicals with at least one interfering radical of typical combination.

Gravimetric analysis : **12 Marks**

Barium as barium sulphate

Organic Chemistry **12 Marks**

Preparation :

- **(i) Acetylation**
- **(ii) Benzoylation**
- **(iii) Meta-Dinitrobenezene**
- **(iv) Picric acid**

Viva **06 Marks**

Sessional **08 Marks**