DEGREE PROGRAM

B.Sc.VSem.

SUBJECT CODE	Category	SUBJECT NAME	TEACHING &EVALUATION SCHEME								
			THEORY			PRACTICAL		Th	T	P	CREDITS
			End Sem Uni-versity Exam	Two Term Exam	Teachers As-sess-ment *	End Sem Uni-versi-ty Exam	Teachers As-sessment*				
BSPH502	DC	**QUANTUM MECHANICS**	60	20	20	30	20	3	1	4	6

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit;
Q/A – Quiz/Assignment/Attendance, MST MidSem Test.
*Teacher Assessment shall be based on following components: Quiz/Assignment/ Project/Participation in class (Given that no component shall be exceed 10 Marks)

Course Objectives:-

1. To develop the comprehensive understanding of laws of physics related to Quantum Mechanics and ability to apply them for laying the foundation for research and development.
2. To work ethically as member as well as leader in a diverse team.

Course Outcomes:-

1. Student will be able to understand and solve the problems related toQuantum Mechanics,
2. Student will be able to determine physical parameter experimentally with optimal usage of resources and complete the assignments in time.

QUANTUM MECHANICS

UNIT-I

Particles and waves inadequacies in classical physics, Blackbody radiation: quantum theory of light. Photoelectric effect, Compton Effect, Wave nature of matter: de Broglie hypothesis. Wave-particle duality, Davisson-germer experiment, Wave description of particles by wave packets.Group and phase velocities and relation between them, Two-slit experiment with electrons. Probability, Wave amplitude and wave functions

UNIT-II

Heisenberg's uncertainty principle (uncertainty relations involving canonical pair of variables): derivation from wave packets. Energy, momentum and Hamiltonian operators, Time-independent Schrodinger wave equation for stationary states, Properties of wave Function. Interpretation of wave function, Probability density, Conditions for physical acceptability of wave functions, .Linearity and superposition Principles, Eigen values and Eigen functions

UNIT-III

Expectation values, Wave function of a free Particle. Applications of Schrödinger wave equation: Eigen functions and Eigen values for a particle in a one dimensional box. general features of a bound Particle system, (1) one dimensional Simple harmonic oscillator: energy levels and wave Functions. Zero point energy, (2) Quantum theory of hydrogen atom: particle in a spherically symmetric potential.

UNIT-IV

Schrodinger wave equation, Separation of variable, .Radial solutions and principal quantum Number, orbital and magnetic quantum numbers, Quantization of energy and Angular Momentum, Space quantization, Electron probability Density.

UNIT-V

Finite Potential Step: Reflection and Transmission. Stationary solutions, Probability current, Attractive and repulsive potential Barriers (2) Quantum phenomenon of tunneling: tunnel effect. Tunnel diode (qualitative Description) (3) Finite potential well (Square well)

Suggested books:

1. L. I. Schiff, quantum mechanics, 3rd Edition, (McGraw hill book co., New York 1968).

2. E. Merzbacher, quantum mechanics, 3rd Edition, (john Wiley & sons, inc1997)

3. J.l. Powell & b. Crasemann, quantum mechanics, (Addison-Wesley pubs.co., 1965)

4. A. Ghatak& s. Lokanathan, quantum mechanics: theory and applications, 5th Edition, (Macmillan India, 2004)

5. E. M. Lifshitz and l. D. Landau, quantum mechanics: non-relativistic theory (course of Theoretical physics, vol 3), 3rd Edition, butterworth-heinemann (1981).

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Bachelor of Science (PCM, LS, BT)

SEMESTER V

COURSE CODE	CATEGORY	COURSE NAME	L	T	P	CREDITS	TEACHING & EVALUATION SCHEME				
							THEORY		PRACTICAL		
							END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*
BSCH 503	**DC**	Organic Chemistry I	3	1	4	6	60	20	20	30	20

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Course Objectives:

The course aims is not only the continuation study of basic principles of organic chemistry, but it will also provide the important topics in Organic chemistry functional groups including (aromatic compounds, phenols, carboxylic acids and its derivatives, aldehydes and ketones, amines, and malonic ester synthesis). This helps students to gain experience to predict the functional group transformations, simple reaction mechanisms, and the synthesis of organic molecules by multi-step synthesis strategies. In addition of that, the course will also help students to understand the reaction mechanism subjects in later stages of their study.

The general concept of the practical part of this course is to train students the fundamental laboratory skills. This includes the practical work of extraction, purification and separation techniques with some simple organic preparations which are required for experimental chemistry.

Course Outcomes:

By the end of the course the student should be able to:

- Recognize various organic functional groups.
- Understand the types of reactions in Organic Chemistry.
- Name the organic compounds commonly and systematically.
- Outline the preparation and reactions of various organic compounds.
- Draw the structure of organic compounds and curly arrows correctly.
- Suggest the reaction mechanisms of some simple organic reactions.

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SEMESTER V

Syllabus:

UNIT I

Electromagnetic Spectrum Absorption Spectra

Ultraviolet (UV) absorption spectroscopy – absorption laws (Beer-Lambert law); molar absroptivity, types of electronic transitions, effect of conjugation. Concept of chromophore and auxochrome, Bathochromic, hypsochromic, hyperchromic and hypochromic shifts. U.V. spectra of conjugated enes and enones.

Infrared (I.R.) absorption spectroscopy – molecular vibrations, Hooke's law, selection rules, intensity and position of I.R. bands, measurement of I.R. spectrum, fingerprint region, characteristic absorptions of various functional groups and interpretation of I.R. spectra of simple organic compounds.

UNIT II

Mechanism of Organic Reactions:

Inclusion compounds, clatherates, charge transfer complexes, resonances, hyperconjugation, aromaticity, inductive and field effects, hydrogen bonding.

Curved arrow notation, drawing electron movements with allows, half-headed and double-headed arrows, homolytic and heterolytic bond fission, Types of reagents – electrophiles and nucleophiles, Types of organic reactions, Energy considerations. Reactive intermediates – Carbocations, carbanions, free radicals, carbenes, arynes and nitrenes (with examples). Assigning formal charges on intermediates and other ionic species. Methods of determination of reaction mechanism (product analysis, intermediates, isotope effects, kinetic and stereochemical studies).

UNIT III

Alkanes and Cycloalkanes:

IUPAC nomenclature of branched and unbranched alkanes, the alkyl group, classification of carbon atom in alkanes, Isomerism in alkanes, sources methods of formation (with special reference to Wurtz reaction, Kolbe reaction, Corey-House reaction and decarboxylation of carboxylic acids), physical properties and chemical reactions of alkanes, Mechanism of free radical halogenation of alkanes: orientation, reactivity and selectivity. Cycloalkanes – Nomenclature, methods of formation, chemical reactions, Baeyer's strain theory and its

limitations. Ring strain in small rings (cyclopropane and cyclobutane), theory of strain less rings. The case of cyclopropane ring, banana bonds.

UNIT IV

Alkenes and Cycloalkenes:

Nomenclature of alkenes, methods of formation, mechanisms of dehydration of alcohols and dehydrohalogenation of alkyl halides, regioselectivity in alcohol dehydration, The Saytzeff rule, Hofmann elimination, physical properties and relative stabilities of alkenes. Chemical reactions of alkenes – mechanism involved in hydrogenation, electrophilic and free radical additions, Markownikoff's rule, hydroborationoxidation, oxymercuration-reduction. Epoxidation, ozonolysis, hydration, hydroxylation and oxidation with $KMnO_4$, Polymerization of alkenes, Substitution at the allylic and vinylic positions of alkenes, Industrial applications of ethylene and propene. Methods of formation, conformation and chemical reactions of cycloalkenes;

UNIT V

Dienes and Alkynes:

Nomenclature and classification of dienes : isolated, conjugated and cumulated dienes, Structure of allenes and butadiene, methods of formation, polymerization, chemical reaction – 1, 2 and 1, 4 additions, Diels-Alder reaction. Nomenclature, structure and bonding in alkynes, Methods of formation, Chemical reactions of alkynes, acidity of alkynes, Mechanism of electrophilic and nucleophilic addition reactions, hydroboration-oxidation, metal-ammonia reductions, oxidation and polymerization.

Reference Books:

1. Robert Thornot Morrison and Robert Neilson Boyd, “Organic Chemistry”, Prentice Hall of India Pvt Ltd, New Delhi, Sixth Edition, 1992.
2. Bhupinder Mehta, Manju Mehta, “Organic Chemistry”, Prentice Hall of India Pvt Ltd, New Delhi, 2005.
3. James B Hedrickson Donald J. Cram and George S. Hammond, “Organic Chemistry”, Mc-Graw-Hill Kogakusha,Ltd., Third Edition.
4. Arun Bahl, B. S. Bahl, “Advance Organic Chemistry”, S. Chand & Company Ltd., New Delhi, First Edition, 2003.
5. I. L. Finar, “Organic Chemistry”, Pearson Education Pet Ltd, New Delhi, First Edition, 2002.
6. G. Marc Loudon, “Organic Chemistry”, Oxford University Press, Forth Indian edition, 2010.
7. P.S.Kalsi, “Text book of Organic Chemistry”, MacMillan of India Pvt. Ltd., 1999.
8. P.S. Kalsi, “Spectroscopy of Organic Compounds”, New Age International Pvt. Ltd. Publishers,

2006.

9. C.N. Banwell, “Fundamentals of Molecular Spectroscopy”, McGraw-Hill, 1994.

10. Y.R. Sharma, “Elementary Organic Spectroscopy (Principles and Chemical Applications)”, S. Chand, 2007.

Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

Name of the Program: B. Sc. (Plain)

SUBJECT CODE	Category	SUBJECT NAME	TEACHING & EVALUATION SCHEME								
			THEORY			PRACTICAL		Th	T	P	CREDITS
			END SEM	MST	Q/A	END SEM	Q/A				
BSMA 504	DC	**Numerical Methods & Linear Programming**	60	20	20	-	-	3	1	-	4

Course Objective

To introduce the students with the Fundamentals of the Numerical Methods & Linear Programming.

Course Outcomes

After the successful completion of this course students will be able to

1. *understand and solve problems of the straight lines in 3D.*
2. *solve the problems of the planes.*
3. *know the solution of the problems of the spheres.*
4. *understand and apply the concepts of the algebra of the Right circular cone.*

Course Content:

UNIT – I

Approximate numbers, Significant figures, Rounding off numbers. Error – Absolute, Relative and Percentage. **Operators** - Δ , ∇ and E (Definitions and some relations among them).**Interpolation :** The problem of Interpolation, Equispaced arguments – Difference Tables, Deduction of Newton's Forward Interpolation Formula. Remainder term (expression only). Newton's Backward Interpolation formula (statement only) with remainder term. Unequally – spaced arguments –Lagrange's Interpolation Formula (statement only). Numerical problems on Interpolation with both equi- and unequally-spaced arguments.

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UNIT – II

Number Integration: Trapezoidal and Simpson's ⅓rd formula (statement only). Problems on Numerical Integration. **Numerical Solution of Equation:** To find a real root of an algebraic or transcendental equation. Location of root (Tabular method), Bisection method. Newton-Raphson method with geometrical significance. Numerical problems.

UNIT – III

Linear Programming: Motivation of Linear Programming problem. Statement of L.P.P. formulation of L.P.P. Slack and Surplus variables. L.P.P. is matrix form. Convex set, Hyperplane, Extreme points, Convex Polyhedron, Basic solutions and Basic Feasible Solutions (B.F.S.) Degenerate and Non-degenerate B.F.S. The set of all feasible solutions of an L.P.P. is a convex set. The objective function of an L.P.P. assumes its optimal value at an extreme point of the convex set of feasible solutions. A B.F.S. to an L.P.P. corresponds to an extreme point of the convex set of feasible solutions.

UNIT – IV

Fundamental Theorem of L.P.P. (Statement only). Reduction of a feasible solution to a B.F.S. Standard form of an L.P.P. Solution by graphical method (for two variables), by simplex method and method of penalty. Concept of duality. Duality theory. The dual of the dual is the primal. Relation between the objective values of dual and the primal problems. Dual problems with at most one unrestricted variable, one constraint of equality.

UNIT – V

Transportation and Assignment problems and their optimal solutions.

Texts:

1. Numerical methods – E. Balagurusamy (Tata McGraw Hill).
2. Introduction to numerical analysis – F. B. Hilderbrand (TMH Edition).
3. Numerical Analysis – J. Scarborough.
4. Introduction to numerical analysis – Carl Erik Froberg (Addison Wesley Publishing).
5. Numerical methods for science and engineering – R. G. Stanton (Prentice Hall).
6. Linear Programming : Method and Application – S. I. Gass.
7. Linear Programming – G. Hadley.

8. An Introduction to Linear Programming & Theory of Games – S. Vajda.

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Name of the Program: B. Sc. (Plain)

SUBJECT CODE	Category	SUBJECT NAME	TEACHING & EVALUATION SCHEME								
			THEORY			PRACTICAL		Th	T	P	CREDITS
			END SEM	MST	Q/A	END SEM	Q/A				
BSMA 505	DC	**Any one of the following groups : Group A : Analytical Dynamics Group B : Probability & Statistics**	60	20	20	-	-	3	1	-	4

Group A: Analytical Dynamics

Course Objective

To introduce the students with the Fundamentals of the Analytical Dynamics.

Course Outcomes

After the successful completion of this course students will be able to

1. *understand and solve problems of the motion of a particle.*
2. *solve the problems of the motion under forces.*
3. *understand and apply the concepts of the motion in 2D.*

Course Content:

UNIT – I

Velocity and Acceleration of a particle. Expressions for velocity and acceleration in rectangular Cartesian and polar co-ordinates for a particle moving in a plane. Tangential and normal components of velocity and acceleration of a particle moving along a plane curve.

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UNIT – II

Concept of Force: Statement and explanation of Newton's laws of motion. Work, power and energy. Principles of conservation of energy and momentum. Motion under impulsive forces. Equations of motion of a particle (i) moving in a straight line, (ii) moving in a plane.

UNIT – III

Study of motion of a particle in a straight line under (i) constant forces, (ii) variable forces (S.H.M., Inverse square law, Damped oscillation, Forced and Damped oscillation, Motion in an elastic string). Equation of Energy. Conservative forces.

UNIT – IV

Motion in two dimensions : Projectiles in vacuo and in a medium with resistance varying linearly as velocity. Motion under forces varying as distance from a fixed point.

UNIT – V

Central orbit. Kepler's laws of motion. Motion under inverse square law.

Texts:

1. An Elementary Treatise on the Dynamics of a Particle & of Rigid bodies – S. L. Loney (Macmillan).
2. Dynamics of Particle and of Rigid Bodies – S. L. Loney.

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Name of the Program: B. Sc. (Plain)

Group B: Probability & Statistics

Course Objective

To introduce the students with the Fundamentals of the Probability & Statistics.

Course Outcomes

After the successful completion of this course students will be able to

1. *understand and solve problems of the motion of a particle.*
2. *solve the problems of the motion under forces.*
3. *understand and apply the concepts of the motion in 2D.*

Course Content:

UNIT – I

Elements of Probability Theory: Random experiment, Outcome, Event, Mutually Exclusive Events, Equality like and Exhaustive, Classical definition of Probability, theorems of Total Probability, Conditional Probability and Statistical Independence. Bayes' theorem. Problems. Shortcomings of the classical definition. Axiomatic approach –Problems. Random Variable and its Expectation. Theorems on mathematical expectation. Joint distribution of two random variables. Theoretical Probability Distribution – Discrete and Continuous (p.m.f. pd.d.f.) Binomial, Poisson and Normal distributions and their properties.

UNIT – II

Elements of Statistical Methods. Variables, Attributes, Primary data and secondary data. Population and sample. Census and Sample Survey. Tabulation – Chart and Diagram, graph, Bar diagram, Pie diagram etc. Frequency Distribution – Un-grouped and grouped cumulative frequency distribution. Histogram, Frequency curve, Measure of Central Tendencies – Average : AM, GM, HM, Mean, Median and Mode (their advantages and disadvantages). Measures of Dispersions – Range, Quartile Deviation, Mean Deviation, Variance/S.D., Moments, Skewness and Kurtosis.

UNIT – III

Sampling Theory: Meaning and objects of sampling. Some ideas about the methods of selecting samples. Statistic and Parameter, Sampling Distribution – standard error of a statistic (e.g. sample mean, sample proportion). Four fundamental distributions derived from the normal **:** (i) Standard Normal Distribution, (ii) Chi-square distribution, (iii) Student's distribution, (iv) Snedecor's F-distribution.

UNIT – IV

Estimation and Test of Significance. Statistical Inference. Theory of estimation – Point estimation and Interval estimation. Confidence Inter/Confidence Limit. Statistical Hypothesis – Bull Hypothesis and Alternative Hypothesis. Level of significance. Critical Region. Type I and Type II error. Problems. Bivariate Frequency Distribution. Scatter Diagram, Correlation co-efficient –Definition and properties. Regression lines.

UNIT – V

Time Series : Definition. Why to analyze Time series data? Components. Measurement of Trend – (i) Moving Average Method, (ii) Curve Fittings (linear and quadratic curve). (Ideas of other curves, e.g. exponential curve etc.). Ideas about the measurement of other components. **Index Number :** Meaning of Index Number. Construction of Price Index Number. Consumer Price Index Number. Calculation of Purchasing Power of Rupee.

Texts:

1. The elements of probability theory and some of its applications - H. Cramer.

2. An introduction to probability theory and its applications (Vol. 1) – W. Feller.

3. Mathematical methods of statistics – H. Cramer.

4 Theory of probability – B. V. Gnedenko.

5. Mathematical probability – J. V. Uspensky.