Program Outcomes, Program Specific Outcomes and Course Outcomes

Programme Outcomes: Bachelor of Science (B. Sc.)

PO1: To introduce the fundamentals of science education

PO2: To enrich students' knowledge in all basic sciences

PO3: To develop interdisciplinary approach amongst students

PO4: To inculcate sense of scientific responsibilities and social & environment awareness

PO5: To help student to build-up a progressive and successful career in academics and industry

PO6: To motivate the students to contribute in the development of Nation

Shri R. R. Lahoti Science College, Morshi

Department of Physics

PROGRAMME OUTCOMES: B.Sc. PHYSICS

Dept. of Physics	After successful completion of three year degree programme in Physics, a student should be able to;
Programme outcomes	PO-1: Demonstrate, solve and an understanding of major concepts in all disciplines of Physics.
	PO-2: Solve the problem and also think methodically, independently and draw a logical conclusion
	PO-3: Employ critical thinking and the scientific knowledge to design, carry out, record and analyze the results of Physics experiments.
	PO-4: Create an awareness of the impact of Physics on the society and development outside the scientific community.
	PO-5: To inculcate the scientific treatment in the students and outside the scientific community.
	PO-6: Use modern techniques, descent equipments and different softwares.
Programme Specific Outcomes	PSO-1: Gain the knowledge of Physics through theory and practical's.
	PSO-2: Understand good laboratory practices and safety.
	PSO-3: Develop research oriented skills.
	PSO-4: Make aware and handle the sophisticated instruments/equipments.
Course Outcomes B.Sc. Physics Semester-I	
Course	**Outcomes** After the completion of these courses students should be able to;
PH-111: Gravitation	CO-1: Know the Newton's law of gravitation. CO-2: To study variation of acceleration due to gravity at different places.. CO-3: To study Kepler's laws of planetary motion. CO-4: To understand above concepts through experiments in laboratory. CO-5: To develop numerical solving technique in students. (Numericals based on syllabus)
PH-112: Rotational Motion	CO-1: Know the translational, vibrational & rotational motion. CO-2: To find out moment of inertia of different body shapes. CO-3: To understand the concept of linear & angular momentum. CO-4: To understand above concepts through experiments in laboratory. CO-5: To develop numerical solving technique in students. (Numericals based on syllabus)

PH-113: Oscillation I	CO-1: Know the concept of simple harmonic motion CO-2: To derive & solve differential equation of S.H.M. CO-3: To study examples of S.H.M. like Compound pendulum, Kater's pendulum, etc. CO-4: To understand above concepts through experiments in laboratory. CO-5: To develop numerical solving technique in students. (Numericals based on syllabus)
PH-114: Oscillations-II	CO-1: Know the damped & forced harmonic motion. CO-2: To understand resonance & its types. CO-3: To study superposition of two S.H.M.s (parallel & perpendicular) CO-4: To understand above concepts through experiments in laboratory. CO-5: To develop numerical solving technique in students. (Numericals based on syllabus)
PH-115: Elasticity	CO-1: Know the concept of elasticity & plasticity CO-2: To understand different elastic constants. CO-3: To determine elastic constant by different methods. CO-4: To understand above concepts through experiments in laboratory. CO-5: To develop numerical solving technique in students. (Numericals based on syllabus)
PH-116: Viscosity	CO-1: Know the viscous properties of fluid. CO-2: To understand Bernoulli's theorem, Raynold's number. CO-3: To study property of matter:surface tension. CO-4: To understand above concepts through experiments in laboratory. CO-5: To develop numerical solving technique in students. (Numericals based on syllabus)
Course Outcomes B.Sc. Physics **Semester-II**	
PH-121: Ideal gas, Real gas & Transport phenomenon	CO-1: Know the kinetic theory of gases. CO-2: To understand Brownian motion, Avagadro,s number & specific heat. CO-3: To study Transport phenomenon in gases. CO-4: To understand above concepts through experiments in laboratory. CO-5: To develop numerical solving technique in students. (Numericals based on syllabus)
PH-122: Laws of thetrmodynamics	CO-1: Know the laws of thermodynamics. CO-2: To understand Carnot's heat engine & Carnot's theorem. CO-3: To study Entropy. CO-4: To understand above concepts through experiments in laboratory. CO-5: To develop numerical solving technique in students. (Numericals based on syllabus)
PH-123: Liquification of gases	CO-1: Know the Joule-Thomson effect. CO-2: To understand liquification of hydrogen & helium. CO-3: To study thermodynamic variables. CO-4: To understand above concepts through experiments in laboratory. CO-5: To develop numerical solving technique in students. (Numericals based on syllabus)

PH-124: **Motion of charged particles**	CO-1: Know the motion of charged particle in electric & magnetic fields. CO-2: To understand working principle of electron gun, Discharge tube & mass spectrograph. CO-3: To study linear accelerator & Cyclotron. CO-4: To understand above concepts through experiments in laboratory. CO-5: To develop numerical solving technique in students. (Numericals based on syllabus)
PH-125: **Network theorems**	CO-1: Know the network theorems. CO-2: To understand Ballistic galvanometer. CO-3: To study Varying current. CO-4: To understand above concepts through experiments in laboratory. CO-5: To develop numerical solving technique in students. (Numericals based on syllabus)
PH-126: **Alternating current**	CO-1: Know the concept of alternating current. CO-2: To understand applications of j-operator & complex number. CO-3: To study resonance & transformer. CO-4: To understand above concepts through experiments in laboratory. CO-5: To develop numerical solving technique in students. (Numericals based on syllabus)
Course Outcomes B.Sc. Physics **Semester-III**	
PH-231: **Mathematical background & electrodynamics**	CO-1: Know the Scalar & Vector fields. CO-2: To understand Gradient, Divergence & Curl. CO-3: To study Ampere's law. CO-4: To understand above concepts through experiments in laboratory. CO-5: To develop numerical solving technique in students. (Numericals based on syllabus)
PH-232: **Magnetostatics & Maxwell's equation**	CO-1: Know the Faraday's law. CO-2: To understand Maxell's equation. CO-3: To study Poynting theorem. CO-4: To understand above concepts through experiments in laboratory. CO-5: To develop numerical solving technique in students. (Numericals based on syllabus)
PH-233: **Solid state electronic devices-I**	CO-1: Know the se miconductors. CO-2: To understand Hall effect. CO-3: To study different types of diodes. CO-4: To understand above concepts through experiments in laboratory. CO-5: To develop numerical solving technique in students. (Numerical based on syllabus)
PH-234: **Solid state electronic devices-II**	CO-1: Know the BJT. CO-2: To understand types & applications of FET. CO-3: To study IC OP-AMP. CO-4: To understand above concepts through experiments in laboratory. CO-5: To develop numerical solving technique in students. (Numerical based on syllabus)

PH-235: **Special theory of relativity**	CO-1: Know the special theory of relativity. CO-2: To understand length contraction, Time dilation. CO-3: To study Einstein's mass-energy relation. CO-4: To understand above concepts through experiments in laboratory. CO-5: To develop numerical solving technique in students. (Numerical based on syllabus)
PH-236: **Atmosphere &** **Geophysics**	CO-1: Know the structure of earth. CO-2: To understand Atmosphere. CO-3: To study earthquakes. CO-4: To understand above concepts through experiments in laboratory. CO-5: To develop numerical solving technique in students. (Numerical based on syllabus)

Course Outcomes B.Sc. Physics
Semester-IV

PH-241: **Geometrical** **Optics**	CO-1: Know the lens system. CO-2: To understand interference in thin films. CO-3: To study Newton's ring. CO-4: To understand above concepts through experiments in laboratory. CO-5: To develop numerical solving technique in students. (Numericals based on syllabus)
PH-242: **Diffraction**	CO-1: Know the types of diffraction. CO-2: To understand diffraction through plane transmission grating. CO-3: To study zone plates. CO-4: To understand above concepts through experiments in laboratory. CO-5: To develop numerical solving technique in students. (Numerical based on syllabus)
PH-243: **Polarization**	CO-1: Know the Polarization. CO-2: To understand Brewster's law. CO-3: To study Nicol's prism. CO-4: To understand above concepts through experiments in laboratory. CO-5: To develop numerical solving technique in students. (Numericals based on syllabus)
PH-244: **Laser**	CO-1: Know the mechanism of Laser. CO-2: To understand types & applications of laser. CO-3: To study concept of holography. CO-4: To understand above concepts through experiments in laboratory. CO-5: To develop numerical solving technique in students. (Numericals based on syllabus)
PH-245: **Fiber optics**	CO-1: Know the mechanism of Optical fiber. CO-2: To understand types & applications of optical fiber. CO-3: To study optical communication system. CO-4: To understand above concepts through experiments in laboratory. CO-5: To develop numerical solving technique in students. (Numericals based on syllabus)

PH-246: **Renewable energy sources**	CO-1: Know the types of renewable energy sources. CO-2: To understand concept of solar energy. CO-3: To study photovoltaic cell. CO-4: To understand above concepts through experiments in laboratory. CO-5: To develop numerical solving technique in students. (Numericals based on syllabus)

Course Outcomes B.Sc. Physics
<u>Semester-V</u>

PH-351: **Quantum mechanics-I**	CO-1: Know the black body radiation. CO-2: To understand Plank's radiation law & photoelectric effect. CO-3: To study Compton effect & Heisenberg's uncertainty principle. CO-4: To understand above concepts through experiments in laboratory. CO-5: To develop numerical solving technique in students. (Numericals based on syllabus)
PH-352: **Quantum mechanics-II**	CO-1: Know the Schrodinger's wave equation. CO-2: To understand mathematical operator's. CO-3: To study motion of particle in rectangular box. CO-4: To understand above concepts through experiments in laboratory. CO-5: To develop numerical solving technique in students. (Numericals based on syllabus)
PH-353: **Atomic & molecular Physics**	CO-1: Know the different atomic models. CO-2: To understand quantum numbers. CO-3: To study Raman effect. CO-4: To understand above concepts through experiments in laboratory. CO-5: To develop numerical solving technique in students. (Numericals based on syllabus)
PH-354: **Nuclear Physics**	CO-1: Know the theory of nucleus. CO-2: To understand alpha & beta decay. CO-3: To study Nuclear reaction & reactor. CO-4: To understand above concepts through experiments in laboratory. CO-5: To develop numerical solving technique in students. (Numericals based on syllabus)
PH-355: **Hybrid parameters**	CO-1: Know the h-parameters. CO-2: To understand concept of amplifier. CO-3: To study Noise & distortion in amplifier. CO-4: To understand above concepts through experiments in laboratory. CO-5: To develop numerical solving technique in students. (Numericals based on syllabus)
PH-356: **Feedback in amplifier**	CO-1: Know the concept of feedback. CO-2: To electronic oscillators. CO-3: To study multivibrators. CO-4: To understand above concepts through experiments in laboratory. CO-5: To develop numerical solving technique in students. (Numericals based on syllabus)

Course Outcomes B.Sc. Physics **Semester-VI**	
PH-361: **Statistical** **mechanics-I**	CO-1: Know the phase space, unit cell, micro & macro states. CO-2: To understand Boltzmann's entropy relation. CO-3: To study Maxwell-Boltzmann statistics & its applications. CO-4: To understand above concepts through experiments in laboratory. CO-5: To develop numerical solving technique in students. (Numericals based on syllabus)
PH-362: **Statistical** **mechanics-II**	CO-1: Know the concept of boson & fermions. CO-2: To understand Bose-Einstein statistics & its applications. CO-3: To study Fermi-Dirac statistics & its applications. CO-4: To understand above concepts through experiments in laboratory. CO-5: To develop numerical solving technique in students. (Numericals based on syllabus)
PH-363: **Crystallography**	CO-1: Know the crystalline & amorphous solids. CO-2: To understand different crystal structures & X-ray diffraction. CO-3: To study crystal defects. CO-4: To understand above concepts through experiments in laboratory. CO-5: To develop numerical solving technique in students. (Numericals based on syllabus)
PH-364: **Electrical** **properties of** **materials**	CO-1: Know the concept of drift motion. CO-2: To understand Fermi energy. CO-3: To study band structure in solids. CO-4: To understand above concepts through experiments in laboratory. CO-5: To develop numerical solving technique in students. (Numericals based on syllabus)
PH-365: **Magnetic** **properties of** **materials**	CO-1: Know the concept of magnetism. CO-2: To understand types of magnetic materials. CO-3: To study Hysteresis. CO-4: To understand above concepts through experiments in laboratory. CO-5: To develop numerical solving technique in students. (Numericals based on syllabus)
PH-366: **Superconductivity** **& Nano technology**	CO-1: Know the concept of superconductors. CO-2: To understand types of superconductors & BCS theory. CO-3: To study Basic concepts of nanotechnology. CO-4: To understand above concepts through experiments in laboratory. CO-5: To develop numerical solving technique in students. (Numericals based on syllabus)

Department of Chemistry

Programme Outcomes – B.Sc.

Subject – Chemistry

Department of Chemistry	After successful Completion of B.Sc with Chemistry Students should able to
Programme Outcomes	PO-1 .Demonstrate, solve and an understanding of major concepts in all discipline of chemistry. PO-2.Solve the problem and also think methodically, independently and draw a logical conclusion. PO-3 Employ critical thinking and scientific knowledge to design, carryout, record and analyze the result of chemical analysis. PO-4. Create an awareness of the impact of chemistry on the environment, society and development outside the scientific community. PO-5. Find out green route for chemical reaction. For sustainable development. PO-6. To inculcate the scientific temperament in the students and outside the scientific community. PO-7. Use modern techniques, decent equipments and chemistry software.
Programme Specific Outcomes	PSO-1. Gain the knowledge of chemistry through theory and practicals PSO-2. To explain nomenaclture stereochemistry, structure, reactivity and mechanism of chemical reactions. PSO-3. Identify chemical formulae and solvenumerical problems. PSO-4. Use modern chemical tools Models Charts and equipments. PSO-5 Know structure activity relationship. PSO-6. Undrstand good laboratory Practices and safety. PSO-7. Develop research oriented skills PSO-8. Make aware and handle the sophisticated equipments.
Course outcomes of B.Sc Chemistry Semester –I	

Course outcomes of B.Sc Chemistry Semester –I	
Course Outcomes	**After completion of these coursese students should able to ;**
Inorganc Chemistry	CO-1. Get knowledge of periodic classification of elements. CO-2. Understand periodic Properties. CO-3. Know the periodic classification in S-block,P-block CO-4. Discuss different physical and chemical properties.
Organic Chemistry	CO-1.Get the knowledge of Inductive effect, electromric effect, resonance and hyper conjugation. CO-2 Aquaint about reactive intermediate. CO-3. Tostudy Aliphatic hydrocarbon and their properties. CO-4. Information about aromatic hydrocarbon.

Physical chemistry	CO-1. To get knowledge of Therodynamics CO-2. Solve numerical problems on thermodynamics CO-3. To understand gaseous state. CO-3 To solve the problem on gaseous state CO-4 To understand phase rule and different systems.
Organic Practicals	CO-1. To develop skill in student regarding different methods of organic preparation. CO-2. To develope new concept of green synthesis. CO-3. To develop skil of organic preparation.
Inorganic Qualitative Analysis	CO-1. Identify acidic and basic radicals from mixtures. CO-2. To develop skill of inorganic separation. CO-3 To develop idea about semimicro analysis

<table>
<tr><td colspan="2" align="center">Course outcomes B.Sc Chemistry
Semester II</td></tr>
<tr><td>Course Outcomes</td><td>After completion of these courses students able to</td></tr>
<tr><td>Inorganic Chemistry</td><td>CO-1. To understand the concept of polarization ,covalent bonding acid and bases.
CO-2. To get the knowledge of p-block and nobel gas elements.
CO-3. To understand concept of hybridization, type of hybridization, geometry.
CO-4 .Know information regarding gravimetric analysis.</td></tr>
<tr><td>Organic chemistry</td><td>CO-1. To get knowledge of alky halides, aryl halides preparation properties uses.
CO-2. To develope method of preparation of phenols, Ethers andEpoxide.
CO-3. To get newers method of synthesis.</td></tr>
<tr><td>Physical chemistry</td><td>CO-1. To understand concept of chemical kinetics Order, moleclarity, psuedounimolcular reaction
CO-2 To understand first, second orde reaction their characterestics example.
CO-3.Tostudy electrical properties for polar and nonpolar molecule
CO-4 to know magnetic properties paramagnetic diamagnetic,ferromagnetic and antiferromagnetic
CO-5.To measure magntic susceptibility.</td></tr>
<tr><td>Organic chemistry practicals</td><td>CO-1 Analysis of organic compound and to study different parameters like m.p., Element detection, functional group, derivatve preparation.
CO-2. -Analysis of Glucose, a-naphthol, b-naphthol Toludine, Anthracine, Benzoic acid, Salicylic acid.</td></tr>
<tr><td>Physical chemistry practicals</td><td>CO-1. To measure surface tension, Viscosity, Parachor value, Cleaning power of detergent.
CO-2. To determine activation energyof reaction between$K_2S_2O_8$ and KI</td></tr>
<tr><td colspan="2" align="center">

Course outcomes B.Sc Chemistry</td></tr>
</table>

Semester III	
Course Outcomes	After completion of these courses students able to
Inorganic Chemistry	CO-1. To understand the concept of covalent bonding,metallic bonding CO-2. To get the knowledge of VSPER theory. CO-3 Know frees electron theory, Valence bond theory and molecular orbital theory. CO-4. To understand concept of volumetric analysis. CO-5 .Know information regarding gravimetric analysis.
Organic Chemistry	CO-1 To get the information of different of aldehyde and caboxylic acid. CO-2. Understand the terms Optical isomerism and conformational isomerism. CO-3. To Know meaning of resolution ,enatomers Diasteromers, Rand S Configuration. CO-4. To understand the terms Newmans projection formula, Sawhorse projection formula.
Physical Chemistry	CO-1. To get the Knowledge Thermodynamic and Equilibrium. CO-2. To solve the numerical problem on thermodynamics. CO-3. To understand the concept of liquid state surface tension, Viscosity. CO-4. Understand measurement applicaton of suface tension and viscosity.
Practicals	CO-1. To understand principal of redox titration. CO-2. To inculcate importance of water, measurement of different parameters. CO-3 Importance of different analysis. CO-4 to develop skill based aptitude among the students
Inorganic Chemistry Practicals	CO-1.To develop concept among the students For prepation of different solution. CO-2.To performs redox titration, iodometry and iodimetric titration.
Physical Chemistry Practicals	CO-1.To develop skillforconstruction of phase diagram. CO-2.To devlope laboratory skill for study order of reaction.
Course outcomes B.Sc Chemistry Semester IV	
Course	**Outcomes After completion of these courses students able to**
Inorganic Chemistry	CO-1.Knowledge about 3d trasition series elements. CO-2. To develop skill among the students for extraction of elements. CO-3. To get the knowledge of metallurgy. CO-4. To understand inner trasition elements.
Organic Chemistry	CO-1. Information regarding olynuclear hydrocarbon. CO-2. To understand the chemistry of reactive methylene group. CO-3. To inculcate importance of carbohydrate. CO-4. To acquire importance of amino acids, diazonium salt and proteins.
Physical Chemistry	CO-1. To know the importace of colligative properties. CO-2. To solve numerical problems. CO-3.To understand crystalline state by using different models

	and video film.
	CO-4. To solve numerical problem on crystallography.
Inorganic Chemistry practicals	CO-1 To know various parameters of water like hardness of water and its estmation.
	CO-2 Estimation of $KMnO_4$ colorometrically and also copper
Physical Chemistry practicals	CO-1 Todevelope skill regarding separation of Casein, nicotine, caffeine.
	CO-2 Determination of equivalent weight of organic acid

Course outcomes B.Sc Chemistry
Semester V

Course	Outcomes After completion of these courses students able to
Inorganic Chemistry	CO-1. Know the meaning of various terms involved in coordination chemistry. CO-2. To understand Werners formulation of complexes and identify the type of valencies. CO-3. To get importance of electronic spectra of trasition series elements. CO-4. To solve numerical on crystal field theory.
Organic Chemistry	CO-1. Information regarding heterocyclic compound their synthesis, physical and chemical Properties. CO-2. Have the knowledge of various drugs their synthesis and application. CO-3. Knowledge about various pesticides and herbicides. CO-4.Acquaint about mode of action of drugs on various diseases.
Physical Chemistry	CO-1. Understand concept of photochemistry. CO-2.To understand different terms Lamberts law Beers law, Quantum yield ,Fluorescence, phosphorescence. CO-3.Derive expression for rotational spectra, vibrational spectra, band spectra. CO-4. Solve numerical on rotional and vibrational spectroscopy.
Inorganic Chemistry Practicals	CO-1. To develope skill for inorganic complex salt prepation. CO-2.Know idea for prepartion of complexes like tetrammine Cu(II) sulphate,hexamine Ni(II) chloride,prussian blue,Sodium thiosulphate.
Physical Chemistry	CO-1. To develop skill for handling various sophisticated equipments CO-2.To perform titration and estimation by conductometry,potetiometry,polriometrically.

Course out comes B.SC semester VI

Course	Outcomes After completion of these courses students able to
Inorganic Chemistry	CO-1.To get the knowledge of different reaction SN1 and SN2 substitution reaction . CO-2. To understand various concept of beers law verification beerslaw,expressions. CO-3. To understand chromatography types. CO-4. To get information of organometallic compound.

	CO-5. To know the role Na ,K,Ca,Mg haemoglobin myoglobin in biological system.
Organic Chemistry	CO-1.To understand different spectroscopic terms In electronic spectroscopy chromophore,auxochrome bathochromic shift,hypsochromic shift CO-2. Application of electronic specra for dienes unsaturated aldydes and ketones,aromatic compound. CO-3.To understand concept of NMR,Mass spectroscopy and their application in structure determination. CO-4.To solve numerical on spectroscopy.
Physical Chemistry	CO-1.To get information about redox potential, determination types of different electrode. CO-2 Determination pH of solutionby using hydrogen ,glass,quinhydrone electrode. CO-3.To understand different terms of nuclear chemistry Shell model,liquid drop model,meson theory. CO-4. Knoledge about nuclear fusion and fission,Q value CO-5.application of radioisotope in industries agriculture and medicine.
Organic chemistry practicals	CO-1 To develop skill among the students for performing titrations. CO-2. Know the idea to perform various titration formaldehyde,ascorbic acid,phenol ,aniline, urea CO-3. To develop skill based practicals like separation of mixtures of dyes.
Physical Chemistry practicals	CO-1.Togive knowledge to students for handling various sophisticated equipments. CO-2.To develop titration skill for conductometry,potetiometry ,pHmetry. CO-3.Toverify lamberts beers law by using colorimeter.

DEPARTMENT OF MATHEMATICS

Name of the Programme: B. Sc. Mathematics

Department of Mathmatics	After successful Completion of B.Sc with Mathematics Students should able to
Programme Outcomes	**PO-1**. Demonstrate, solve and an understanding of major concepts in all discipline of mathematics. **PO-2**. Solve the problem and also think methodically, independently and draw a logical conclusion. **PO-3**. Employ critical thinking and scientific knowledge to design, carryout, record and analyze the result of mathematical analysis. **PO-4**. Create an awareness of the impact of mathematics on the environment, society and development outside the scientific community. **PO-5**. To inculcate the scientific temperament in the students and outside the scientific community. **PO-6**. Use modern techniques, application of mathematics in various fields and for developing new software.

| Programme Specific Outcomes | **PSO-1**. A student should be able to recall basic facts about mathematics and be able to display knowledge of convensions such as notations, terminology and recognize basic geometrical figures and graphical displays, state important facts resulting from their studies.

PSO-2. A student should a relational understanding of mathematical concepts and concerned structures and should be able to follow the patterns involved, mathematical reasoning.

PSO-3. A student should get adequate exposure to global and local a concern that explores them many aspects of Mathematical Sciences.

PSO-4. Students are able to apply their skills and knowledge that translate information presented verbally into mathematical form, select and use appropriate mathematical formulae or techniques in order to process the information and draw the relevant conclusion.

PSO-5 Student should be able to made aware of history of mathematics and hence of its past, present and future role as part of our culture.
PSO-6. Develop research oriented skills |

Name of the Course: F.Y. B. Sc.

Sr. No.	Course Title	Course Content	Course Outcome
1	**Paper – I (Semester-I) Algebra & Trigonometry**	**Unit-I: De Moivre's theorem**,	CO-1, After completing this course students' apply the De Moivers' theorem in finding the roots. CO-2. Students know the Definition of hyperbolic function and inverse hyperbolic function. CO-3. Also the relation between hyperbolic functions and circular functions. CO-4. Students can find real and imaginary parts of the circular and hyperbolic functions of complex variables
		Unit-II: Trigonometric series:	CO-1 After completion of this course students are able to find the .Gregory series, Euler's series, Machin's series, Rutherford's series, summation of series, series based upon $\sin x$, $\cos x$, $\sinh x$, $\cosh x$, exponential series, logarithmic series and series based upon Gregory series.
		Unit-III: Elements of quaternion:	CO-1. After compelting these course students get the knowledge of quaternions its Definition. CO-2. They know the concept of Equality and addition, multiplication of quternions, complex conjugate of a quaternion, norm, inverse, CO-3. Students can find quaternion as a rotation operator, and its geometric interpretation. CO-4. Students have knowledge of a special quaternion product, operator algorithm, quaternion to matrices.
		Unit-IV: Theory of equations:	After completion of the course students are able to- CO-1. Know the relations between the roots and coefficients and can find roots of the polynomial CO-2. Use the transformation of equations CO-3. Solve the cubic equations using Cardon method CO-4. Solve biquadratic equations..
		Unit-V : Matrices:	After completing the course the students will be able to- CO-1. Find the rank of a matrix, row rank, column rank, CO-2. Find the eigenvalues, eigenvectors and the characteristic equation of a matrix. CO-3. Verify Cayley- Hamilton theorem and its application.
2	**Paper–II (Semester-I) Differential and Integral**	**Unit-I: Limits and Continuity of the functions**	After completing the course the students will be able to- CO-1. Understand the basic concept and definition of a limit of a function and continuity and the basic difference between them. CO-2. To prove the properties of limits and

	Calculus		continuity of functions. Co-3. To find the limit of the function and verify the continuity of the function. CO-4. Verify types of discontinuities and problems based on it.
		Unit-II: Successive Differentiation.	After completing the course the students will be able to- CO-1. Familier with the techniques finding the derivatives of any order using successive differentiation. CO-2 Study and Apply Leibnitz theorem for successive differentiation of multiplication of two different functions. CO-3. Identify and apply the L'hospital's rule in case of indeterminate form of the limits.
		Unit-III : Rolle's theorem, Lagrange's mean value theorem, Cauchy's mean value theorem, Maclaurin and Taylor series expansions.	After completing the course the students will be able to- CO-1. Verify Rolle's theorem, Lagrange's Mean Value Theorem, Cauchy's Mean value theorem and their appliction in solving problems. CO-2. Know the Maclaurin's and Taylor series expansions and their applications in solving problems for finding their power series expansion.
		Unit-IV : Partial derivatives and differentiation of real valued function of two variables, homogeneous functions, Euler's theorem on homogeneous functions.	After completing the course the students will be able to- CO-1. Develop knowledge of limit, continuity, differentiation of real valued function of two variables, CO-2. Define homogenous functions and study Euler's theorem for finding the differential equations.
		Unit-V: Chemistry	After completing the course the students will be able to- CO-1. Learn how to solve the integration of the form $\int \frac{P_n(x)}{\sqrt{Q}} dx$, CO-2. To find reduction formulas for $\int sin^n x dx$, $\int cos^n x dx$, and $Walli's$ $Formula$ $\int$ $\int cot^n x dx$, $\int sec^n x dx$, $\int cosec^n x dx$, $\int sin^n x cos^m x dx$, CO-3. Know the quadrature, rectification, CO-4. Have knowledge ofmethods and concepts of multiple integrals and their application
3	**Paper-III (Semester-II) Differential Equations: Ordinary and Partial**	**Unit-I : First Order Ordinary Differential Equations**	After completing this course students will be able to- CO-1. Determine Degree and order of a ordinary differential equation, CO-2. Solve linear differential equations and differential equations reducible to the linear form. CO-3. Verify and solve the exact differential equations.

			CO-4. Study and solve differential equations of first order and higher degree using the methods differential equations solvable for p and y, differential equations in Clairaut's form. CO-5. Define and find the orthogonal trajectories.
		Unit-II: Linear differential equations	After completing this course students will be able to- CO-1. Determine Second order linear differential equations with constant coefficients, CO-2. Find the Complementary function for the homogeneous linear differential equation and Particular integral of the linear ordinary differential equations, CO-3. Convert the equations reducible to homogeneous differential equations to find the primitive..
		Unit-III: Second order ordinary differential equations	After completing this course students will be able to- CO-1. Study and apply the reduction of order, transformation of the equation by changing the dependent variable and independent variable, CO-2. Learn the normal form (removal of first order derivative) CO-3. Apply method of variation of parameters. Co-4. Find the solution of Ordinary simultaneous differential equations.
		Unit-IV: Total differential equations or Pfaffin differential equations. **Partial differential equations of order one.**	After completing this course students will be able to- CO-1. Form partial differential equations, CO-2. Find the solution of total partial differential equations of the first order or Pfaffian using various methods. CO-3. Solve the Lagrange's method, some special types of equations which can be solved easily by methods other than the general method
		Unit-V: Compatible differential equations.	After completing this course students will be able to- CO-1. Solve Compatible differential equations. CO-2. Use Charpit's general method of solution, CO-3. Learn and find the solution of partial differential equations of second and higher orders. CO-4. Solve Homogeneous and non-homogeneous equations with constant coefficients.
4	**Paper-IV** **(Semester-II)** **Vector** **Analysis and**	**Unit-I: Scalar and vector product of three vectors, product of four vectors, vector differentiation and vector integration.**	After completing this course students will be able to- CO-1. Have knowledge of Scalar and vector product of three vectors, CO-2. Define and solve the product of four vectors, vector differentiation and vector integration.

	Solid Geometry	Unit-II: Differential Geometry	After completing this course students will be able to- CO-1. Have knowledge of the geometry of space curve t, n, b vectors, fundamental planes, CO-2. define and find the curvature, torsion, CO-3. Have knowledge Frenet-Serret formulae.
		Unit-III: Gradient, divergence and Curl. Line integral, double integral and triple Integration	After completing this course students will be able to- CO-1. Define and find the Gradient, divergence and Curl, directional derivative, line integral (existence and evaluation), CO-2. Find and evaluate the work done CO-3. Prove and apply the Greens theorem.
		Unit-IV: Sphere	After completing this course students will be able to- CO-1. Solve the problems of lines in three dimensions, planes of different forms of spheres. CO-2. Have the knowledge different forms of spheres. Section of a sphere by a plane and their geometry by using their algebraic equations. CO-3. Have the knowledge of intersection of sphere and a line. Condition of orthogonality of two intersecting spheres
		Unit-V: Cone and Cylinder	After completing this course students will be able to- CO-1. Study the equation of cone with guiding curve, equation of cone with vertex and origin. CO-2. Equation of right circular cylinder and its geometry.

Name of the Programme: B. Sc.

Course: S.Y. B. Sc.

Sr. No.	Course Title	Course Content	Course Outcome
1	**Semester-III 3S-Mathematics – Paper-V (Advanced Calculus) (Semester-III)**	**Unit-I : Sequence**	After completing this course student will be able to- CO-1. Knowledge and proofs of theorems on limits of sequences, bounded and monotonic sequences, CO-2. Knowledge and proofs of Cauchy's convergence criterion.
		Unit II: Series	After completing this course students will be able to- CO-1. Knowledge of Series of non negative terms, convergence of geometric series and the series $\sum \frac{1}{n^p}$ Comparison tests, CO-2. Use of Cauchy's integral test, Ratio test, Root test. CO-3. Understand the concept of absolute Convergent, conditional convergent, Leibnitz rule, Abel's test, Dirichlet's test
		Unit III: Limit and continuity of functions of two variables,	After completing this course students will be able to- CO-1. Limit and continuity of functions of two variables, Algebra of limits and continuity, Taylor's theorem for function of two variables.
		Unit IV: Maxima and minima, Lagrange's multipliers method. Jacobians.	After completing this course students will be able to- CO-1. Define and find the maxima and minima of functions of two variables CO-2. Apply the Lagrange's multipliers method to find the maxima and minima of the functions of two variables. CO-3. Evaluate the Jacobian of the function of two variables.
		Unit V: Double integral:	After completing this course students will be able to- CO-1. Define and evaluate the double integrals. CO-2. Change the order of integration in double integrals CO-3. Define and evaluate the triple integrals. CO-4. Prove and apply the Guass and Stoke's theorem.

2	Semester-III 3S- Mathematics – Paper-VI (Elementary Number Theory)	Unit I: Divisibility	After completing this course students will be able to- CO-1.Understand the concept and definition of the divisibility and their properties and results. CO-2. Prove division algorithm and its application in finding the results on greatest common divisor , CO-3. Methods of finding the gcd of more than two integers. CO-4. Define and find the least common multiple and its results. CO-5. Knowledge of Euclidean algorithm and its applications CO-6. Find the relation between the gdc and lcm CO-7. Find the lcm of more than two integers
		Unit II: Prime Numbers	After completing this course students will be able to- CO-1. Define and find Prime numbers, CO-2. Proove and apply the fundamental theorem of arithmetic or Unique factorization theorm, CO-3. Define and Find Fermat numbers, CO-4. Understand the concept of linear Diophantine equations
		Unit III: Congruence	After completing this course students will be able to- CO-1. Define the Congruence and its properties CO-2. Have the knowledge of special divisibility test, linear congruences, CO-3. Proof and application of Chinese remainder theorem.
		Unit IV: Arithmetic functions,	After completing this course students will be able to- CO-1. Define and understand the concept of Arithmetic functions, CO-2. Proove the apply Euler's theorem, CO-3. Define and find the σ and τ functions, Mobius μ function.
		Unit V: Primitive roots,	After completing this course students will be able to- CO-1. Define and find the Primitive roots, primitive roots for prime, polynomial congruences, the congruence $x^2 \equiv a(mod\ p)$, general quadratic congruence, quadratic residues.
3	Semester IV 4S Mathematics Paper-VII (Modern Algebra: groups and	Unit I: Group:	After completing this course students will be able to- CO-1. Define and verify a group with examples, properties of a group, subgroups, cyclic groups, order of a generator of a cyclic group, permutation groups even and odd permutations

		rings)	Unit II: Cosets and normal subgroups:.	After completing this course students will be able to- CO-1. Define and find Cosets, CO-2. Knowledge of Statement and proof of Lagrange's theorem, CO-3. Defination and Properties of normal subgroups, different characterization of normal subgroups, algebra of normal subgroups, quotient group
			Unit III: Homomorphism and isomorphism:	After completing this course students will be able to- CO-1. Define and verify Homomorphism, homomorphic image, kernel of homomorphism, isomorphism of a group, CO-2. State and prove Fundamental theorem on homomorphism of a group, natural homomorphism, second isomorphism theorem, third isomorphism theorem. And their applications.
			Unit IV: Ring, integral domain and field:	After completing this course students will be able to- CO-1. Define Rings, Integral domain and field and their results with examples. CO-2. Define and verify the Ring Homomorphism, homomorphic image, kernel of homomorphism, isomorphism of a group, Fundamental theorem on homomorphism of a group, natural homomorphism, second isomorphism theorem, third isomorphism theorem.
			Unit V: Ideal:	After completing this course students will be able to- CO-1. Define and verify left ideal, right ideal, examples, algebra of ideals, prime ideal, maximal ideal, principle ideal, quotient ring, ring homomorphism.
4	Semester-IV 4S Mathematics Paper-VIII (Classical Mechanics)		Unit I: Lagrangian Dynamics	After completing this course students will be able to- CO-1. Understand the concept of Constraints, generalized coordinates, CO-2. State and prove D'Alembert's principle and to derive Lagrange's equations of motion from it. CO-3. To construct the Lagrangian find to derive the Lagrange's equations of motion.
			Unit II: Central force motion:	After completing this course students will be able to- CO-1. Understand the concept of central force field, tyes of central force. Equivalent one body

			problem CO-2. Define Areal velocity, central orbit, CO-3. State and prove the Virial theorem, CO-4. State and prove the Kepler's laws of motion.
		Unit III: Calculus of variation:	After completing this course students will be able to- CO-1. Define functional, difference between function and functional. CO-2. Define and find the extremals, CO-3. Derive Euler's differential equation, CO-4. Find the solution of Brachistochrone problem, CO-5. Understands invariance of Euler's equation, CO-6. Derive and use Euler-Poisson equations for a functional dependent on higher derivatives, Euler-Ostrogradsky equations.
		Unit IV: Hamilton's principle,	After completing this course students will be able to- CO-1. Define Hamiltonian of the system. CO-2. Understand the concept of Hamilton's principle for conservative and nonconservative system. CO-3. Derive Hamilton's equations. CO-4. Derive Lagrange's equations for non-holonomic conservative system, CO-5. Follow Routh's procedure and least action principle.
		Unit V: Mechanics of Rigid body,	After completing this course students will be able to- CO-1. Find generalized co-ordinates of a rigid body, Eulerian angles, Euler's theorem, finite rotations, infinitesimal rotations.

Sr. No.	Course Title	Course Content	Course Outcome
1	**SemesterV 5S Mathematics Paper –IX (Mathematical Analysis)**	**Unit–I : Riemann Integral**	After completing this course student will be able to- CO-1. Define Riemann Integral and its properties. Integrability of continuous and monotonic functions, CO-2. To prove the fundamental theorem of integral calculus, mean value theorem of integral calculus. And to solve the examples.
		Unit II : Improper Integrals	After completing this course students will be able to- CO-1. Have the knowledge of improper integrals and their convergence, comparison and limit tests. CO-2. Learn Definations and properties of Beta and gamma functions and relation between them..
		Unit-III: Analytic Functions	After completing this course students develop knowledge in the limits, Continuity and differentiability of complex function, analytic function, Cauchy-Riemann equations, harmonic and conjugate functions, Milne-Thomson method.
		Unit-IV: Conformal Transformation and Mobius transformation	Afte completing this course students will have the knowledge of- CO-1, Elementary function, mapping by elementary function, CO-2. Mobius transformation, fixed point, cross ratio, inverse and critical points, conformal mapping.
		Unit-V: Metric spaces:	After completing this course students will be be able to- CO-1. Learn basic ideas of analysis, CO-2. Define and verify the examples of metric spaces, neighbourhood, limit point, interior point, open and closed sets, CO-3. Cauchysequences, completeness.
2	**Semester-V 5S Mathematics Paper –X (Mathematical**	**Unit-I: Legendre's equation, Legendre's polynomials, generating function of $P_n(x)$, recurrence formulae for $P_n(x)$, orthogonality of**	After completing this course students will be able to- CO-1. Define and solve Legendre's equation, Legendre's polynomials, generating function of $P_n(x)$, recurrence formulae for $P_n(x)$,

		Methods)	Legendre's polynomial, Rodrigue's formula.	orthogonality of Legendre's polynomial, Rodrigue's formula.
			Unit-II: Bessel's equation, solution of Bessel's equation, generating function for $J_n(x)$, Recurrence formulae for $J_n(x)$. Strun-Liouville boundary value problem.	After completing this course students will be able to- CO-1. Define and evaluate the Bessel's equation, solution of Bessel's equation, generating function for $J_n(x)$, Recurrence formulae for $J_n(x)$. Strun-Liouville boundary value problem.
			Unit-III: Fourier series,	After completing this course students will be able to- CO-1. Apply the fundamental concepts of Fourier series, Fourier series for odd and even functions, half-range Fourier sine series and half-range Fourier cosine series. CO-2. Find the Fourier Cosine and Fourier sine series to find the series representation of irrational numbers.
			Unit-IV: Laplace transform:	After completing this course students will be able to- CO-1. Learn the method and properties of Laplace transform of some elementary functions, existence of Laplace transform. properties of Laplace transform. Laplace transform of derivatives and integrals, multiplications of t^n and division by *t*, CO-2. Define inverse Laplace transform and their properties, convolution property, application of Laplace transform in solving ordinary and partial differential equations.
			Unit-V: Fourier Transform:	After completing this course students will be able to- CO-1. Apply the fundamental concepts of Finte Fourier transform, Fourier Sine Transform, Fourier Cosine Transform CO-2. Evaluate Improper Integrals. Infinite Fourier transform, infinite Fourier sine transform and cosine transform, properties of Fourier transform application to partial differential equations.
3	**Semester-VI 6S Mathematics Paper -XI (Linear Algebra)**	**Unit I : Vector Space :**		After completing this course student will be able to CO-1. Use the concept of vector spaces, CO-2. Define subspaces and proves using the theorems on it, CO-3. Define sum and direct sum of subspaces, prove theorms on it and solve the examples

			CO-4. Define linear span, linear dependence, independence and their basic properties, CO-5. Define and find the basis of a finite dimensional vector spaces, prove existence theorem for bases, invariance of the number of elements of a basis set, dimension.
		Unit II: Linear transformations:	After completing this course student will be able to- - CO-1. Apply the properties of linear transformations to linearity of transformations, kernel and rank of linear transformations using rank – nullity theorem, inverse transformations to solve the problems of matrix transformations, change of basis.
		Unit III : Dual Spaces:	After completing this course student will be able to CO-1. Define the Dual space, bidual space CO-2. State and prove the theorems on natural isomorphism, CO-3. Define the adjoint of a linear transformation, Eigen values and eigenvectors of a linear transformation and sole examples on it.
		Unit IV : Inner Product Spaces:	After completing this course student will be able to – CO-1. Use the concept of inner product spaces to find norm of vectors, distance between vectors, check the orthogonality of vectors, to find the orthogonal and orthonormal basis. CO-2. State and prove Cauchy-Schwarz inequality, orthogonal vectors, orthogonal complements, orthonormal sets and bases, Bessel's inequality for finite dimensional spaces, Gram Schmidt orthogonalisation process.
		Unit V: Modules:	After completing this course students will be able to- **CO-1.** Modules, submodules, quotient modules, homomorphism and isomorphism theorems.
4	**Semester- VI 6S Mathematics Paper- XII (Special Theory of Relativity) (Optional)**	**Unit -I: Review of Newtonian Mechanics.**	After completing this course students will be able to- **CO-1.** Understands Newton's laws of motion and their application CO-2. Have the knowledge of Inertial frames, speed of light and Galilean relativity, relative character of space and time, postulates of special theory of relativity, Lorentz transformation and its geometrical

		interpretation, group properties of transformation.
	Unit -II: Relativistic Kinematics.	After completing this course students will be able to- **CO-1.** Understand the concept of Composition of parallel velocities, length contraction, time dilation, transformation equation for components of velocities and acceleration of a particle, Lorentz contraction factor. The thermodynamics of moving systems : The two laws of thermodynamics for a moving system, the Lorentz transformation for thermodynamics quantities a) volume and pressure b) energy c) work d) heat e) entropy f) temperature
	Unit-III: Geometrical representation of space- time.	After completing this course students will be able to- **CO-1.** Understant the concept of Four dimensional Minkowskian space-time of relativity , time like and space like intervals , proper time , world line, four vectors and tensors in Minkowskian space-time ,past, present and future null cone ,basic tensors, covariant, contravariant, mixed , operations on tensors, outer product, inner product, quotient law.
	Unit-IV: Relativistic Mechanics.	After completing this course students will be able to- **CO-1.** Understands Variation of mass velocity, equivalence of mass and energy, transformation equation for mass, momentum and energy, relativistic force and transformation equations for its components, relativistic Lagrangian and Hamiltonian, the energy momentum tensor.
	Unit-V: Electromagnetism:	CO-1. After completion of this course students get the knowledge of electromagnetic theory mathematically. They will study Maxwell's equations of electromagnetic theory in vacuum, propagation of electric and magnetic field strengths, scalar and vector potential, transformation of electromagnetic four potential vector, transformation of charged density and current density, Lagrangian for a charged particle in electromagnetic field, the force on a moving charged- Lorentz force, Gauge transformation, four dimensional formulation of the theory, Maxwell's equation in tensor form, transformation for electric and magnetic field strength, energy momentum tensor of the electromagnetic field. component of T^{ij} in term of electric and magnetic strength.

BOTANY COURSE OUTCOME

BOTCO-I

- To understand plant diversity; lower group of plants; study of algae, bryophytes, fungi, pteridophytes; mechanism of reproduction in lower plants and microbes responsible for plant diseases and economic losses.

BOTCO-II

- To study paleobotany, gymnosperm classification, plant morphology such as study of roots, stem and leaves, Inflorescence, economic botany and the role of plants as a medicine, food, condiments etc.

BOTCO- III

- To understand the basis for classification of plants; plant taxonomy; plant families; plant anatomy and embryological study of the plants.

BOTCO-IV

- To know basic cell biology; cellular contents; chromosomal study, mechanism of inheritance; effects due to chromosomal changes and the biochemistry of the cell.

BOTCO-V

- To understand the basic physiology of plants as how a plant can prepare its own food material; how it can respire; Nutrition mechanism, Role of hormones in growth and development of plants; flowering mechanism, plant movements, ecology and ecosystem.

BOTCO-VI

- To understand the molecular biology of plants such as structure and functions of DNA, RNA, PROTEINS. Molecular mechanism of DNA Replication and protein synthesis. Control mechanisms of genetic system of the cell. Genetic engineering of the cell in order to create the new hybrid ones; new aspects in biological science and plant tissue culture mechanism for the conservation of rare plants.

BOT PRACT-CO

- The practical part of the syllabus is helpful to understand the basic plant morphology, anatomy, biochemistry, genetics, different aspects of tissue culture and biotechnology.
- It promotes the scientific temper among the students.
- It helps to develop practical skill of the students.
- Students gain scientific knowledge of day to day happenings around them.
- Students get interested in science related activities.

ZOOLOGY COURSE OUTCOME

Subject -Zoology
Course outcome

B.Sc I (Semester I) (Diversity of Non Chordates)

1) Students undergo scientific temper and Practical Skills.

2)Students learned how to Classify Non Chordates animals.

3) Students learn the habitats of different animals.

4) Students got knowledge of economical importance of some animals.

5) Students got the knowledge of which animals become the source of food.

6) Students got the knowledge of diseases and their prevention like malaria, amoebiasis, leismaniasis and trypanosomiasis.

B.Sc I (Semester II) (Cytology and Developmental Biology)

1) Students got the knowledge of structure of cell and cell organelles.

2) Students known the functions of different cell organelles.

3) Students got the knowledge of development process ie embryonic process in Amphioxus, Frog and Chick.

4) Students got the knowledge of stem cells and its significance.

5)) Students got the knowledge of parthenogenesis and regeneration.

6) Students practices incubation of chick egg.It will helpful them in poultry for how to hatch eggs.

7) Students understood the process of mitosis cell division.

B.Sc II (Semester III) (Diversity of Chordates)

1) Student undergoes Practical Skills.

2)Students learn how to Classify Chordates animals.

3) Students learned the habitats some Chordate animals.

4) Students got knowledge of economical importance of some animals.

5) Students got the knowledge of which animals become the source of human food.

6) Students got the knowledge of anatomy and physiology of Chordate animals.

B.Sc II (Semester IV) (Genetics and Evolution)

1) Students understood the molecular basis of cell.

2) Students understood the Mendelian Laws and Assortments of traits in plants and animals.

3) Students got the knowledge of genetic diseases and how these are transmitted.

4) Students got the knowledge of process of evolution.

5) Students got the knowledge of vestige organs, homologous organs and analogous organs.

B.Sc III (Semester V) (Animal physiology)

1) Students got the knowledge of physiological process in chordates ie physiology of circulation, osmoregulation, muscle physiology, nerve physiology ,reproductive physiology and endocrinology.

2) Students practices how to count WBCs, RBCs, Hemoglobin percentage , blood pressure in Human.

B.Sc III (Semester VI) (Advanced Genetics and ecology)

1)) Students understood the structure of DNA and its replication.

2) Students practices microtechnique , a very basic principle of research work.

3) Students understand blood groups and related diseases.

4) Students understood the different ecosystem ie water, forest, etc. and also got the knowledge of role plyed by different organisms in ecosystem.