

BACHELOR OF SCIENCE (B.Sc.) :

Duration : **Three Years.**

Eligibility : **Any 12th Passed student can take admission to B.Sc. course.**

Medium of Instructions : **English.**

- PO1:** The graduates will become successful professionals by demonstrating logical and analytical thinking abilities.
- PO2:** The graduates will work and communicate effectively in inter-disciplinary environment, either independently or in a team, and demonstrate leadership qualities.
- PO3:** The graduates will engage in life-long learning and professional development through self-study, continuing education or professional and doctoral level studies.
- PO4:** The graduates will recognize the need to engage in lifelong learning through continuing education and research.
- PO5:** The graduates of the program will become technically competent to pursue higher studies.
- PO6:** The graduates of the program will collaborate with multi-disciplinary teams and will be able to become leaders in their organization, their profession and in society.
- PO7:** The graduates of the program will be able to communicate effectively in both verbal and written form in industry and society.

First Year (SEMESTER-I)

Subjects
1. Compulsory English
2. Compulsory Language- Hindi/Marathi/Gujarati Supplementary English (Any one)
3. Mathematics (Two Papers) 4. Physics (Two Papers & Practical) 5. Chemistry (Two Papers & Practical) OR Computer Science (Two Papers & Practical)

First Year (SEMESTER-II)

Subjects
1. Compulsory English
2. Compulsory Language- Hindi/Marathi/Gujarati Supplementary English (Any one)
3. Mathematics (Two Papers) 4. Physics (Two Papers & Practical) 5. Chemistry (Two Papers & Practical) OR Computer Science (Two Papers & Practical)

Students offering Supplementary English will have to pay an extra tuition fee of Rs. 600/-

Second Year (SEMESTER-III)

Subjects
1. Mathematics (Two Papers) 2. Physics (Two Papers & Practical) 3. Chemistry (Two Papers & Practical) 4. Computer Science (Two Papers & Practical)

Second Year (SEMESTER-IV)

Subjects
1. Mathematics (Two Papers) 2. Physics (Two Papers & Practical) 3. Chemistry (Two Papers & Practical) 4. Computer Science (Two Papers & Practical)

Third Year (SEMESTER-III)

Subjects
1. Mathematics (Two Papers) 2. Physics (Two Papers & Practical) 3. Chemistry (Two Papers & Practical) 4. Computer Science (Two Papers & Practical)

Third Year (SEMESTER-IV)

Subjects
1. Mathematics (Two Papers) 2. Physics (Two Papers & Practical) 3. Chemistry (Two Papers & Practical) 4. Computer Science (Two Papers & Practical)

Note : Changes, if any, in the syllabus will be subject to those made by Rashtrasant Tukadoji Maharaj Nagpur University.

Course outcome (B. Sc. Chemistry)	
Semester – I	
Ch-101:	Paper – I (Inorganic Chemistry)
CO1:	To enable students to know about the structure of atoms, ions and subatomic particles.
CO2:	To enable students to understand chemical bonding concept and predict molecular geometry.
CO3:	To make students to understand the concept of ionization energy, metallic and non-metallic characteristics of elements.
CO4:	To enable students to know about various boron derivatives, its structural properties and application in various fields.
Ch-102: Paper – II (Physical Chemistry)	
CO 1:	To enable students to know about ideality of gases, deviation of real gases from ideality and their liquefaction.
CO2:	To enable students to know about crystals, crystal planes, symmetries in the crystals and methods of determination of crystal structures.
CO3:	To enable students to know about liquid crystals, properties of liquids, their determination and applications.
CO4:	To make students to understand the properties of solid and liquid surfaces and their mechanism.
Ch-103: Laboratory Course.	
CO 1:	To enable students to know essential facts, concepts and principles in the analysis of radicals.
CO2:	To enable students to gain skill in monitoring by observation and measurements of chemical and physical properties.

Semester – II	
Ch-201: Paper – I (Inorganic Chemistry)	
CO 1:	To enable students to know about hybridization and reactivity along with mechanisms for organic reaction.
CO2:	To make students to understand about the orientation and reactivity of organic reactions.
CO3:	To enable students to know the methods of preparations of compounds and their applications in different fields of science and medicine.
CO4:	To enable students to gain knowledge of unsaturated hydrocarbons and reactivity to explain addition and substitution reactions.
Ch-202: Paper – II (Physical Chemistry)	
CO1:	To enable students to know maximum conversion of heat into work, change in free energy entropy and criteria of spontaneity.
CO2:	To enable students to know about phases, components and degrees of freedom of system their properties and applications.
CO3:	To enable students to know about the conductance, its variation with dilution and the determination of conductance with different methods.
CO4:	To enable students to know about the velocity of chemical reaction of different types and the theories related to it.
CH-203: Laboratory Course	
CO1:	To enable students to know the characteristics of organic compounds and their identification.
CO2:	To enable students to know the relationship of various thermodynamic parameters and their relationship to electrophiles and nucleophiles.

B.Sc.-II . Semester-III

CH-301: Paper-I (Inorganic Chemistry)

CO1:	To make students to gain knowledge about general information and properties of molecular orbitals and synthesis of tetra nitride and poly halides compounds.
CO2:	To enable students to know about general information and properties of first transition series members. and redox and precipitation reaction
CO3:	To enable students to know about general information and properties of compounds of 2 nd and 3 rd transition series compounds.
CO4:	To enable students to knowabout the quantitative assessment of scientific data.

CH-302: Paper- II (Organic Chemistry)

CO1:	To enable students to know about the structural, chemical and physical properties of different organic halides
CO2:	To enable students to knowabout the structural, synthesis, chemical and physical properties along with classification of alcohols and phenols
CO3:	To enable students to knowabout the structural, chemical and physical properties of aldehydes and ketones.
CO4:	To enable students to knowabout the structural, chemical and physical properties of carboxylic acids and its derivatives

CH- 303: Laboratory Course

CO1:	To enable students to knowabout quantitative analysis by volumetric methods and able to learn the applications of types of titrations.
CO2:	To enable students to knowabout the steps involved in the identification of organic compounds

B.Sc. –II , Semester – IV

CH – 401:Paper- I (Inorganic Chemistry)

CO1:	To enable students to understand about the different types of coordination compounds and its various aspects.
CO2:	To enable students to know about isomerism in coordination compounds and able to recognize and understand various redox reactions.
CO3:	To enable students to understand metal-ligand bond related to valence bond theory and CFT.
CO4:	To enable students to know about the role of metal in various biological processes and classification of acids and base.

CH – 402: Paper- II (Physical Chemistry)

CO1:	To enable students to understand about the application of 2 nd law of thermodynamics, entropy and its relation with free energy.
CO2:	To make students to gain knowledge of different types of cells, calculation of thermodynamic quantities of cell reactions, pH and various types of reversible electrodes.
CO3:	To enable students to understand about the nuclear reactions and its applications. They will also able to study the application of electric dipole moment.
CO4:	To enable students to understand about the various types of spectra, rotational , vibrational and electronic energy levels

CH-403: Laboratory Course

CO1:	To enable students to understand the gravimetric analysis and basic knowledge of separation of binary mixtures using chromatography technique
CO2:	To enable students to understand various types of titrations like conductometric. and potentiometric titration.

B.Sc. –III, Semester – V

CH- 501:Paper- I (Organic Chemistry)

CO1:	To enable students to understand about various types of nitrogen, its derivatives, synthesis; and their properties.
CO2:	To enable students to know about the synthesis and chemical properties of various heterocyclic compounds.
CO3:	To enable students to gain information about various quantitative analytical methods and various organometallic compounds.
CO4:	To enable students to understand various aspects, laws and applications of spectroscopic methods

CH- 502:Paper- II (Physical Chemistry)

CO1:	To enable students to understand about the various aspects of quantum chemistry, and its various theories.
CO2:	To understand about the various aspects of quantum chemistry, atomic orbital and its various theories along with applications.
CO3:	To enable students to understand about different properties and theories related solution. They will also get the knowledge about magnetic properties, its measurements.
CO4:	To enable students to understand about basic concept of photochemistry and Raman spectra.

CH-503: Laboratory Course

CO1:	To enable students to understand about the estimation of various organic compounds using different methods.
CO2:	To enable students to understand about the various applications' of laws related to physical parameters and their verifications.

B.Sc-III, Semester –VI

CH-601: Paper-I (Inorganic Chemistry)

CO1:	To enable students to understand about interaction of metal complexes with various ligands and their electronic spectra.
CO2:	To enable students to understand about the magnetic, thermodynamic and kinetic parameters of metal complexes.
CO3:	To enable students to understand about the various application of spectroscopic and separation techniques like chromatography, ion-exchange and solvent extraction methods.
CO4:	To enable students to understand about the inorganic polymers their types, synthesis and properties.

CH- 602: Paper- II (Organic Chemistry)

CO1:	To enable students to understand about the various aspects NMR and its applications.
CO2:	To enable students to understand about organic synthesis and carbohydrates it's types and properties.
CO3:	To enable students to gain an understanding about amino acids, peptides, proteins, nucleic acids, fats, oils and detergents
CO4:	To enable students to gain an understanding about synthetic dyes, drugs and polymers.

CH-603: Laboratory Course

CO1:	To enable students to gain the knowledge about synthesis of various complexes and study their properties using various methods.
CO2:	To enable students to understand about binary mixture separation and identification of various compounds

Course Outcomes of Computer Science (Part of B.Sc. Program)	
SEMESTER - 1	
Paper-1	C Programming
CO1	Able to understand and develop well-structured programs using C language.
CO2	Able to understand the concept of problem solving and expression of solution through flow chart and algorithm.
CO3	Able to use the concept of different memory allocation methods.
CO4	Can Classify the various parts of program -data types , variables ,operators , conditional & looping statements , functions , Pointers , Arrays, File handling.
Paper-2	Computer Fundamentals
CO1	Understand the meaning and basic components of computer system.
CO2	Can distinguish hardware and software components of computer systems.
CO3	Can describe various generations of computer systems.
CO4	Able to identify the various input and output units and their purpose.
SEMESTER - 2	
Paper-1	Programming in C++
CO1	Able to understand the concept of Object Oriented design & program implementation.
CO2	Able to use the concept of constructor and destructor , operator overloading.

CO3	Able to apply the knowledge of Inheritance and its types.
CO4	Able to describe the type of Exception handling methods.
Paper-2	System Analysis and Design
CO1	Able to describe the organizational and business context of systems development.
CO2	Learn to explain and apply system development methodologies, model, tools and techniques for developing quality software.
CO3	Learn to describe , organize and structure the components of system ,including decisions about the system's hardware, software and network environment.
CO4	Learn about implementation, software testing, and deployment issues.
SEMESTER - 3	
Paper-1	Data Structures
CO1	Analyze algorithms correctness
CO2	Use searching and sorting techniques
CO3	Describe the concept of stack, queue and linked lists operations
CO4	Apply the knowledge of tree and graphs concepts
Paper-2	Operating System
CO1	Understand the concept of Operating System.

CO2	Perform the analysis of performance comparison and understand the concept of deadlock and determine the solution of it.
CO3	Describe the various memory management techniques.
CO4	Classify various file allocation methods and able to use the concept of protection mechanism.
SEMESTER - 4	
Paper-1	Programming in Java
CO1	Understand the concept of Java programming.
CO2	Apply the knowledge of programming constructs.
CO3	Discuss the various packages , applets , threads and exception handling.
CO4	Perform the analysis of event driven java programming with graphics and controls using AWT tool kit.
Paper-2	Linux Operating Systems
CO1	Understand the concept of Linux Operating System its file structure and shell.
CO2	Discuss the various basic commands.
CO3	Understand the working of vi editor.
CO4	Manage user accounts, changing password and access to the files.
SEMESTER - 5	

Paper-1	VB Programming
CO1	Understand the working and basic of VB programming language.
CO2	Understand the concept of learn concept of arrays, procedures, functions and modules.
CO3	Apply the knowledge of designing menus and database using built in tools.
CO4	Explain the types of Database handling and Error handling.
Paper-2	Database Management Systems
CO1	Understand the concept of basic of DBMS.
CO2	Perform the analysis of working with ER models.
CO3	Understand the working of relational model.
CO4	Describe the type of functional dependancy and normalization
SEMESTER - 6	
Paper-1	Compiler Constructions
CO1	Understand the working principle of Compiler design.
CO2	Understand the working of Top - down & Bottom - up parsing techniques.
CO3	Able to apply the knowledge of algorithms and implementation techniques for type-checking , code-generation and optimization.

CO4	Classify the various internal form of source program-semantic analysis , symbol tables , error detection and recovery and directed acyclic graph.
Paper-2	SQL /PL/SQL
CO1	Understand the working principles of Codd rules, DDL,DML,TCL.
CO2	Use the concept of views and programming constructs.
CO3	Explain the types of Exception handling and procedures cursors
CO4	Discuss the various functions and triggers

Course Outcomes of B.Sc. Mathematics	
SEMESTER - 1	
Paper-1	M1
CO1	Students will be able to understand the concept of rank of matrix, solution of equations using matrix.
CO2	Student will understand the working principle of solution of cubic and bi-Quadratic equations
CO3	Students will be able to understand DE Moivre's theorem and its applications.
CO4	Students will be able to understand the concept if group.
Paper-2	M2
CO1	To make students able to apply the knowledge of limit, continuity, differentiation and Leibnitz's theorem.
CO2	Students will understand the Maclaurian, and Taylor series expansions, the application of L' Hospitals rule.
CO3	To make students understand the concept of partial derivative and to and apply Euler's theorem.
CO4	To unable students to handle the various methods of Integration.
SEMESTER - 2	
Paper-1	M3
CO1	To make students able to know about sphere, cone, cylinder analytically.
CO2	To describe to the students various method of solutions of first order differential equations.

CO3	To enable students to determine the solution of higher order linear differential equation.
CO4	To explain to the students the types of difference equations.
Paper-2	M4
CO1	To make students able to understand Vector Differentiation.
CO2	To enable students to understand the evaluation and application of double Integration.
CO3	To make students able to understand evaluation and application of triple Integration.
CO4	To make students to understand the concept of improper Integrals.
SEMESTER - 3	
Paper-1	M5
CO1	To enable the students to understand the principle of Mean Value Theorem and Taylor's Theorem.
CO2	To enable the students to understand the concept and application of Maxima and Minima of functions of two variables.
CO3	To enable the students to use the knowledge of sequences.
CO4	To enable the students to use the knowledge of series.
Paper-2	M6
CO1	To enable the students to understand the types and properties of Bessel's and Legendre's Equations.

CO2	To enable the students to know the working principle of Laplace Transform.
CO3	To enable the students to determine the solution of Ordinary Differential Equations.
CO4	To enable the students to use the concept of Normal Sub-groups, Group Homomorphism etc.
SEMESTER - 4	
Paper-1	M7
CO1	To enable the students to understand and determine the solution of simultaneous differential equations.
CO2	To enable the students to understand the concept of Lagranges Equation.
CO3	To enable the students to determine the solution of Partial Differential Equations.
CO4	To enable the students to understand the concept of functional.
Paper-2	M8
CO1	To enable the students to apply the knowledge of equilibrium of Coplanar Forces.
CO2	To enable the students to discuss about Velocity and acceleration along given directions.
CO3	To enable the students to discuss the mechanics of particle.
CO4	To enable the students to discuss equivalent one body problem.
SEMESTER - 5	

Paper-1	M9
CO1	To enable the students to understand the concept of Fourier Series.
CO2	To enable the students to understand the concept of RieMann-Stieltjes Integral.
CO3	To enable the students to get the knowledge of differentiability of complex function.
CO4	To enable the students to explain the types of elementary function, mappings.
Paper-2	M10
CO1	To enable the students to understand the concept of cuntiality and metric space.
CO2	To enable the students to get the knowledge of compactness.
CO3	To enable the students to understand the concept of Ring.
CO4	To enable the students to get the knowledge of working of Complex Integration.
SEMESTER - 6	
Paper-1	M11
CO1	To enable the students to understand the concept of Auto-morphism.
CO2	To enable the students to understand the concept of Vector Spaces.
CO3	To enable the students to get the knowledge of linear transformations

CO4	To enable the students to understand the principle of matrix associated with linear map.
Paper-2	M12
CO1	To enable the students to get the knowledge of basic principle of Relativity.
CO2	To enable the students to understand the concept of Relativistic Velocity and acceleration.
CO3	To enable the students to get knowledge of Tensors.
CO4	To enable the students to understand the concept of Relativistic Mass and Energy.

Course Outcomes of Physics (Part of B.Sc. Program)	
SEMESTER - 1	
Paper-1	
CO1	In this semester the student will be able to learn the basics of elastic properties of materials their applications in bridges, beams and cantilevers.
CO2	Properties of fluids like viscosity which effect the motion of aircraft if the medium is air, the lubrication of machineries if the medium is liquid.
CO3	Properties like Surface Tension which has application in daily life like soap solutions for better washing, why some liquids wet containers while other liquids do not wet.
CO4	Mechanics chapter will teach a student application like rocket propulsion, motion of bodies, rotation of bodies.
Paper-2	
CO1	Interaction of charges, different governing laws and basics of electric fields
CO2	Dielectric materials, capacitors, different theories related to the capacitances and Claussius Mossotti equation
CO3	Phenomenon of Electromagnetic induction, Faradays Laws, Self and Mutual induction. Transformers and its application to various aspects of daily life.
CO4	Electric currents especially Alternating Currents their complex form like j-operator, resonance, power factor and application of A.C circuits in daily life.
SEMESTER - 2	
Paper-1	
CO1	This paper enables a student to learn about oscillations, wave motion, damped oscillations.
CO2	Simple Oscillations in different systems and Kinetic theory of gases in detail.

CO3	Transport phenomena in gases and introduction to thermodynamics
CO4	Thermodynamics in detail and applications are dealt with clarity.
Paper-2	
CO1	Theory of Gravitation, Kepler's Laws of Planetary motion and relation between G and g.
CO2	Astrophysics: Big bang theory, measuring distance of planet/star from Earth, measuring diameter of a planet if distance is known. Details of Sun and temperature of Sun and Cosmological theories of Universe.
CO3	Magnetism: Theory of magnetism, different types of magnetic materials.
CO4	Magnetostatics: Forces due to magnetic materials on different materials. Theories behind them, magnetization vector, magnetic vectors.
SEMESTER - 3	
Paper-1	
CO1	Waves in different media, human audibility, different musical instruments, theory of human ear.
CO2	Applied Acoustics: Building an echoless halls, theory behind reverberation, reproduction of sound.
CO3	Ultrasonic waves, piezoelectric effect, magnetostriction, SONAR and deep sea investigation using ultrasonic waves.
CO4	Power Supplies, rectification by diodes, filters, regulated power supply.
Paper-2	
CO1	Interference of light, reflection, refraction, transmission of light through different media.

CO2	Diffraction of light, narrow edge, grating diffraction, theories behind the diffraction.
CO3	Polarization of light, theory behind polarization, studies on different crystals which exhibit polarization phenomena.
CO4	Electromagnetic waves, leading equations that support it, Poynting vector, Electromagnetic wave velocity.
SEMESTER - 4	
Paper-1	
CO1	Solid State Physics, different crystal systems, lattices, effect of different crystal structures on the properties of materials
CO2	X-rays, applications, Interaction of X-rays with matter, Different laws governing with X-rays.
CO3	Solid state physics, theory of diffraction of X-rays. Bragg's spectrometer
CO4	Lasers, productions, properties, applications.
Paper-2	
CO1	Solid State Electronics, LEDs, transistors, thermal runaways, biasing circuits.
CO2	FETs, JFETs, MOSFETs, structure, properties and applications
CO3	Molecular Physics: Spectra due to Diatomic molecules, vibration spectra, Rotation Spectra.
CO4	Raman Spectrometer, Application of Raman Spectroscopy, NMR, ESR and other applications
SEMESTER - 5	

Paper-1	
CO1	Atomic Physics, Zeeman spectra, singlet, doublet, quantum numbers, selection rules
CO2	Free electron theory, Band theory of solids, Fermi Energy, Fermi Temperature, Hall Effect
CO3	Statistical Physics, Maxwell Boltzmann distribution, Fermi dirac Statistics.
CO4	Black body radiation, Planck's law studies, Bose Einstein Condensation.
Paper-2	
CO1	Quantum Mechanics, Compton Effect, Uncertainty Equation, deBroglie Hypothesis
CO2	Schrodinger's equation, Eigen Value, Eigen Function, Application to Free particle in one and three dimensional potential box,
CO3	Nano Materials, preparation, characterization,
CO4	Nano Technology, BET, SEM, TEM and particle analyser, application of nano materials in various fields.
SEMESTER - 6	
Paper-1	
CO1	Relativity, time dilation, length contraction, Michelson Morley Expt, Mass-Energy Equivalence, Mass variation with speed of light.
CO2	Nuclear Physics, nuclear reactor, cosmic rays, elementary particles, nuclear fusion, Shell model
CO3	Alpha decay, beta decay, Gamma Radiation, Geiger Nuttal law, Magnetic spectrometer for measuring energy of Alpha particle.

CO4	Bio-Physics, EEG, ECG, Blood pressure measurement, Sonography, Electroretinogram for retina treatment, pH of blood
Paper-2	
CO1	Amplifiers, different classes of amplifiers, oscillators, applications of Amplifiers and Oscillators
CO2	Fiber Optics, fabrication, properties, application, graded index concept, losses and bandwidth
CO3	Communication: Powers and currents in modulations, AM, FM, modulation index, band width, merits and demerits.
CO4	Number Systems, decimal system, hexadecimals, octadecimals, Universal gates, OR gates, NOR gates and deMorgan Theorem