VIVEKANANDA GOVERNMENT DEGREE COLLEGE,
VIDYANAGAR, HYDERABAD

(Affiliated to Osmania University)

Accredited by NAAC with "B" Grade ISO 9001:2015

Physical Sciences

Programme Outcomes
Programme Specific Outcomes
Course Outcomes

Department of Mathematics
Department of Physics
Department of Chemistry
Department of Statistics
Department of Statistics
Department of Computer Science

DEPARTMENT OF PHYSICAL SCIENCES
PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

PROGRAMME	PROGRAMME OUTCOMES(PO)
B.Sc. Physical Sciences	**PO1:** Capable of analysing and solving problems using reasoning skills based on concepts of Physics. **PO2:** Know and demonstrate understanding of the concepts from different branches of Mathematics **PO3:** Develop the knowledge, skills and attitudes necessary to pursue further studies in Mathematics and research in Mathematics. **PO4:** Understand the diverse applications of various fields of basic science and carry the knowledge and applications of basic sciences to community **PO5**: Students will be able to understand the fundamental theories, concepts and applications in four basic areas of research in chemistry (Analytical, Inorganic, Physical & Organic). Develop the ability to explore new areas of research in Chemistry and allied field of Life sciences. **PO6:** To provide comprehensive understanding of programming concepts and to understand software development as a part of Computer Science **PO6:** Demonstrate proficiency in problem-solving techniques using the computer **PO7:** Ability to analyse data by appropriately fitting, assessing, and interpreting a variety of statistical models **PO8:** Ability to manipulate data, implement statistical methods, document, and debug code in one or more profession statistical software programs **PO9:** Students will demonstrate proficiency with statistical analysis of data. Students will develop the ability to build and assess data-based models. Students will execute statistical analyses with professional statistical software. Students will demonstrate skill in data management
B.Sc. (Mathematical Sciences)	**PO1:** Various techniques to solve differential equations. **PO2:** How to use vector calculus in various physics problems.

	PO3: Relative motion. Inertial and non-inertial reference frames. **PO4:** Recognize the importance and value of mathematical and statistical thinking, training and approach to problem solving, on a diverse variety of disciplines; **PO5:** Ability to appreciate the benefits of experiential learning by inculcating good work habits, time management and self-discipline. **PO6:** Ability to apply critical thinking, decision making, and reasoning skills in the process of quality education
PROGRAMME	**PROGRAMME SPECIFIC OUTCOMES(PSO)**
B.Sc. (MPC)	**PSO1:** Know and integrate the knowledge of Maths, Physics and chemistry to succeed in graduate school. **PSO2:** Develop the knowledge, skills and attitudes necessary to pursue further studies in Mathematics, Physics and Chemistry **PSO3:** Understand the concepts from different branches of Mathematics (Calculus, Solid Geometrics, Abstract algebra, Linear Algebra, Fluid Mechanics, Number theory, Integral Transformations) and use appropriate mathematical concepts and skills to solve problems in real life. **PSO4:** Demonstrate an understanding of principles and theories of Physics such as Newtonian mechanics, Thermodynamics, Electromagnetism, optics Special and general theories of relativity, quantum mechanics, atomic Physics, Molecular Physics, nuclear and elementary particle physics, solid state physics and renewable energy management and acquire laboratory skills to analyse the measurements to draw valid conclusions. **PSO 5:** Acquire core competency in the subject Chemistry, and in allied subject areas. Understands the importance of the Periodic Table of the Elements, chemical bonding, and different states of matter, Organic and Inorganic compounds and their role in organizing chemical information and acquire laboratory skills, to Interpret and analyse quantitative data.

B.Sc. (MPS)	**PSO**1: Various techniques to solve differential equations **PSO**2: How to use vector calculus in various physics problems. **PSO**3: Relative motion. Inertial and non-inertial reference frames. **PSO**4: Recognize the importance and value of mathematical and statistical thinking, training and approach to problem solving, on a diverse variety of disciplines; **PSO5**: To inculcate knowledge on demonstrate understanding of basic concepts of probability and statistics embedded in their course.
PROGRAMME SPECIFIC OUTCOMES(PSO)	
B.Sc. (MPCS)	**PSO 1**: The M.P.CS programme provides students with an in-depth education in conceptual foundations of Physics and Computer Science with knowledge of hardware and fundamentals of software. **PSO 2:** It allows them to explore the connections between Physics and Computer Science. **PSO 3:** Combined with a strong education in Mathematics, it prepares students to be leaders in Electronics and Computer applications to other disciplines. **PSO 4:** Serve as the Programmers or the Software Engineers with the sound knowledge of practical and theoretical concepts for developing software. **PSO 5**: Serve as the Computer Engineers with enhanced knowledge of computers and its building blocks. **PSO6**: Work as the Hardware Designers/Engineers with the knowledge of Networking Concepts.

DEPARTMENT OF MATHEMATICS

S.No.	Course Code	Course Title	Course Outcomes (CO)
1.	BS104	Paper I Differential Calculus	On completion of this course, the students will be able to: **CO1:** By the time students completes the course they realize wide ranging Applications of the subject. **CO2:** Successive differentiation. **CO3:** Expansions of Functions- Mean value theorems **CO4:** Partial differentiation - Homogeneous functions **CO5:** Indeterminate forms - Curvature and Evolutes **CO6:** Maxima and Minima of functions of two variables. **CO7:** Lagrange's Method of multipliers – Asymptotes- Envelopes.
2.	BS204	**Paper II Differential Equations**	After learning the course, the students will be equipped with the various tools to solve few types differential equations that arise in several branches of science. **CO1:** The main aim of this course is to introduce the students to the techniques of solving differential equations **CO2**: Differential Equations of first order and first degree: **CO3:** Exact differential equations **CO4:** Differential Equations Reducible to Linear Form. **CO5:** Higher order linear differential equations: Solution of Homogeneous linear differential equations with constant coefficients -. **CO6:** Method of undetermined coefficients. **CO7:** Linear differential equations with non-constant coefficients –The Cauchy - Euler Equation. **CO8:** Formation and solution- Equations easily integrable – Linear equations of first order.

3.	**BS 304**	**Paper – III** **Real Analysis**	After the completion of the course students will be in a position to appreciate beauty and applicability of the course. **CO1:** Limits of Sequences- A Discussion about Proofs **CO2:** Limit Theorems for Sequences. **CO3:** Monotone Sequences and Cauchy Sequences -Subsequence's. **CO4:** Alternating Series and Integral Tests. **CO5:** Continuous Functions **CO6:** Properties of Continuous Functions **CO7:** Basic Properties of the Derivative - The Mean Value Theorem **CO8:** Fundamental Theorem of Calculus.
4.	**BS 401**	**Paper IV** **Algebra**	On successful completion of the course students will be able to recognize algebraic structures that arise in matrix algebra, linear algebra and will be able to apply the skills learnt in understanding various such subjects. **CO1:** Definition and Examples of Groups **CO2:** Elementary Properties of Groups-. **CO3:** Terminology and Notation - Subgroup Tests – Examples of Subgroups **CO4:** Properties of Cyclic Groups - Classification of Subgroups Cyclic Groups. **CO5:** Definition and Notation -Cycle Notation-Properties of Permutations **CO6:** Properties of Isomorphisms - Automorphisms-Cosets and Lagrange's Theorem **CO7:** Normal Subgroups-Factor Groups **CO8:** Definition and Examples – Fields Characteristics of a Ring.
5.	**BS 501**	**Paper V** **Linear Algebra**	After completion this course students appreciate its interdisciplinary nature. **CO1:** Vector Spaces and Subspaces **CO2:** Null Spaces, Column Spaces, and Linear Transformations.

			CO3: Linearly Independent Sets; Bases - Coordinate Systems –The Dimension of a Vector Space. **CO4:** Rank-Change of Basis – Eigen values and Eigenvectors **CO5:** The Characteristic Equation **CO6:** Diagonalization -Eigenvectors and Linear Transformations **CO7:** Complex Eigen values - Applications to Differential Equations. **CO8:** Inner Product, Length, and Orthogonality. -Orthogonal Sets - Orthogonal Projections -
6.	**BS:601/A**	**DSE-1F/A Numerical Analysis**	Students realize the importance of the subject in solving some Problems of algebra and calculus. **CO1:** Errors in Numerical Calculations- Solutions of Equations in One Variable: **CO2:** solution of Systems of Nonlinear Equations. **CO3:** Interpolation - Finite Differences - Differences of Polynomials –Newton's formula for Interpolation - **CO4:** Divided Differences -Newton's General Interpolation formula- Inverse Interpolation. **CO5:** Least Square Curve Fitting: Fitting a Straight Line **CO6:** Numerical Differentiation and Integration: **CO7:** Numerical Solutions of Ordinary Differential Equations: **CO8:** Euler's Methods - Runge Kutta Methods.
7.	**BS:601/C**	**DSE - 1F/C Analytical Solid Geometry**	Students understand the beautiful interplay between algebra and geometry. **CO1:** Definition-The Sphere Through Four Given Points **CO2:** Equation of a Tangent Plane-Angle of Intersection of Two Spheres -. **CO3:** Definition-Condition that the General Equation of second degree Represents a Cone-Cone and a Plane through its Vertex **CO4**-Intersection of a Line with a Cone. **CO5:** The Right Circular Cone-The Cylinder-. **CO6:** The Right Circular Cylinder **CO7:** General Equation of the Second Degree-Intersection of Line with a Conicoid - Plane of contact-Enveloping Cone and Cylinder. **CO8:** Plane of contact-Enveloping Cone and Cylinder

8.	**BS:606**	**DSE-1F/B Vector Calculus**	Students realize the way vector calculus is used to addresses some of the problems of physics. **CO1:** Work done against a Force-Evaluation of Line Integrals **CO2:** Integrals Conservative Vector Fields-Surface Integrals **CO3:** Evaluation of Volume integrals Gradient, Divergence and Curl **CO4**: Partial differentiation and Taylor series **CO5:** Gradient of a scalar field-Gradients **CO6** Conservative fields **CO7:** Divergence of a vector field - Curl of a vector field Relation between curl and rotation- **CO8:** Relation between curl and rotation-
9.	**BS: 301**	**SEC – 1 Theory of Equations**	On completion of this course the students will be able to; **CO1:** By using the concepts the students are expected to solve Some of the polynomial equations. **CO2:** Graphic representation of a polynomial. **CO3:** Existence of a root in the general equation. **CO4:** Descartes' rule of signs for positive roots- Descartes' rule of signs for negative roots. **CO5:** Relations between the roots and coefficients **CO6:** The cube roots of unity Symmetric functions of the roots.
1(	**BS: 401**	**SEC-2 Transportation and Game theory**	On the completion of this course, the students will be able to; **CO1**: Students come to know about the applications of Operations Research. **CO2:** A Streamlined Simplex Method for the Transportation Problem. **CO3:** The Assignment Problem. **CO4:** The Formulation of Two-Person, Zero-Sum Games-Graphical Solution Procedure **CO5:** Solving by Linear Programming - Extensions.
1	**BS:40 1**	**SEC-2D Number Theory**	Student uses the knowledge acquired solving some divisor problems. **CO1**: The Goldbach conjecture - Basic properties of congruence **CO2:** Binary and Decimal Representation - of integers

			CO3: Number Theoretic Functions; The Sum and Number of divisors. **CO4:** Euler's generalization of Fermat's Theorem **CO5:** Euler's Phi function- Euler's theorem Some Properties
	BS:501	**SEC-3 Mathematical Modelling**	On the completion of this course, the students will be able to **CO1**: Student realizes some problems can be modelled by using Differential equations. **CO2:** Linear Models-Nonlinear Models-Modeling with Systems of First-Order DEs. **CO3:** Initial-Value Problems. **CO4:** Driven Motion-Series Circuit Analogue. **CO5:** Boundary-Value Problems.
12	**BS: 601**	**SEC-4 Game Theory**	On the completion of this course, the students will be able to; **CO1**: Come to know about nice applications of Operations Research **CO2** A Gentle Introduction - Definitions and Basic Properties - Isomorphism. **CO3:** Paths and Circuits. **CO4:** Eulerian Circuits - Hamiltonian Cycles. **CO5:** The Adjacency Matrix Shortest Path Algorithms.
13	**BS 502**	**GE-1 Lattice Theory**	Students apply their knowledge to solve some problems on switching circuits. **CO1:** Properties and Examples of Lattices. **CO2:** Minimal Forms of Boolean Polynomials. **CO3:** Applications of Lattices. **CO4:** Applications of Switching Circuits – **CO5:** More Applications of Boolean Algebras.
14	**BS 602**	**GE-2 Elements of Number Theory**	Students apply their knowledge problems on check digits, modular designs. **CO1:** Prime and Composite Numbers. **CO2:** Fermat Numbers- GCD. **CO3:** The Euclidean Algorithm. **CO4:** The Chinese Remainder Theorem **CO5:** General Linear Systems

DEPARTMENT OF PHYSICS

S.No.	Course Code	Course Title	Course Outcomes (CO)
1.	PS120	Paper I Mechanics and Ocillations	On completion of this course, the students will be able to: **CO1:** Develop understanding on the concept of scalar, vector fields, Gradient, Divergence and curl of vector fields. **CO2:** Able to apply the Gauss, stokes and Greens theorems in related problems. **CO3:** Identify and apply the laws of mechanics along with the necessary mathematics for solving numerically. **CO4:** Describe Newton's laws of motion and conservation principles. **CO5 :** Able to articulate and describe relative motion, Inertial and non-inertial reference frames. **CO4:** Understand the Mechanics of rigid bodies, concept of Gyroscope and establish the rotational Kinematic relations. **CO5:** Explain the Gravitational potentials and fields, central forces and Kepler's laws. **CO6:** Differentiate between Galilean and Lorentz transformations. **CO7:** Describe the Michelson-Morley Experiment, Postulates of special theory of relativity. **CO8:** Understand and derive the Kepler's laws. **CO9:** Understand physical characteristics of SHM and obtaining solution of the oscillator using differential equations and Lissajous figures **CO10:** Calculate logarithmic decrement, relaxation factor and quality factor of a harmonic oscillator.

2.	**PS220**	**Paper-II Thermal Physics**	On completion of this course, the students will be able to: **CO1:** Recall the laws of gasses and Kinetic theory of gasses. **CO2**: Analyse the different transport Phenomena **CO3:** Understand the thermodynamic laws and entropy **CO4:** Derive the equations of thermodynamic potentials and establishes the relation among them. **CO5**: Explain the Joule-Kelvin effect and methods of production of low temperature. **CO6:** Distinguish between adiabatic and Joule- Kelvin effect. **CO7:** Understand the Planks law, Wein's law and Reyleigh' Jeans Law and Stefans law and establishes relation among them. **CO8**: Describe the experimental setups of optical pyrometers. **CO9:** Understand the concepts of phase space, Ensembles and postulates of statistical mechanics. **CO10:** Differentiate among Maxwell's-Boltzmann, Bose-Einstein, Fermi-Dirac distribution laws
3.	**PS320**	**Paper – III Electromagnetic Theory**	At the end of the course the students will be able to **CO1:** Recall the concepts of basics laws of electro statics and Magneto statics. **CO2:** Derive the Gauss laws and applies the Gauss law in Physics problems. **CO3:** Able to apply the Ampere's law in Straight, circular and solenoidal currents. **CO4:** Understand the working principle of Ballistic Galvanometer. **CO5:** Explain the Faraday's, Lenz's laws and concept of self, mutual Inductions and continuity Equation. **CO6:** Derive the Maxwell's equations in Vacuum and dielectric medium. **CO7:** Draws the current and voltage response of charging and discharging of LR, CR, RC and LCR Circuit.

			CO8: Understand the concepts of passive, active elements, power series and network models. **CO9:** Explain the different network theorems and importance.
4.	**PS420**	**Paper – IV – Waves and Optics**	On the completion of this course, the students will be able to; **CO1:** Understand the fundamental of waves and transverse and longitudinal vibrations of bars **CO2:** Understand the properties and applications of light like reflection, refraction, interference, diffraction etc **CO3**: Apply the principles of wave motion and superposition to explain the Physics of polarization, interference and diffraction. **CO4:** Understand the applications of interference in design and working of interferometers. **CO5:** In the laboratory course, student will gain hands-on experience of using various optical instruments and making finer measurements of wavelength of light using Newton Rings experiment, Fresnel Biprism etc. Resolving power of optical equipment can be learnt firsthand. **CO6:** Distinguish between Fresnel and Fraunhofer diffraction. **CO7**:Explain the different methods of polarization. **CO8:**Describe the experimental setup and working principle of Babinet's compensator.
5.	**PS520**	**DSE-VA Modern Physics**	The students will be able to **CO1:** Recall the limitations of Bohr's atomic model and understand the Concepts of Atomic spectra, types of molecular spectra, Vector atom model Stern-Gerlach Experiment and quantum numbers associated with coupling schemes.

			CO2: Distinguish among Zeeman, Paschen-Back and stark effect and understand experimental arrangement of Raman Spectra and its applications. **CO3:** Understand the central concepts of quantum mechanics: wave functions, momentum and energy operator, the Schrodinger equation, time dependent and time independent cases, probability density and the normalization techniques, basic postulates of quantum mechanics. **CO4:** Understand the De-Broglie Hypothesis and Heisenberg Uncertainty Principle. **CO5:** Understanding the properties of nuclei like density, size, binding energy, nuclear forces and structure of atomic nucleus, liquid drop model and nuclear shell model and mass formula. **CO6:** Ability to calculate the decay rates and lifetime of radioactive decays like alpha, beta, gamma decay, Neutrinos and its properties and role in theory of beta decay. **CO7:** Explain different types of particle detectors. **CO8:** Differentiate between Crystalline and amorphous substances, structures and understand the concepts of lattice, unit cell, miller indices, and diffraction of X-rays by crystalline materials. **CO9**: Analyze the simple crystal structures. **CO10**: Explain the characteristics of crystals with different bondings**.**
6.	**PS 521**	**DSE-VB: Computational Physics**	On completion of this course, the students will be able to: **CO1:** Understand the different concepts of Programming in 'C'. **CO2:** Analyse the different numerical methods. **CO3:** Able to give numerical solutions of ordinary differential equations. **CO4:** Explain the different Algorithms and Monte Carlo simulations.

7.	**PS620**	**DSE-VIA Electronics**	After completion of the course, the students will be able to; **CO1:** Understand the energy bands in solids and type of diodes. **CO2:** Understand different types of transistors, amplifier and oscillators. **CO3:** Explain special devises i.e FET, UJT, SCR, etc… **CO4:** Applies the logic gates in simple electronic circuits. **CO5:** Understand the binary number system, hexa decimal and their conversion.
8.	**PS621**	**DSE-VIB Applied optics**	After the completion of this course, the learner will be able to: **CO1:** Classifies the different types of laser systems. **CO2:** Understand the basic principles and applications of holography. **CO3:** Explain the Fourier and non-linear optics **CO4:** Understand the different types of optical fibres and their structures.
9.	**PS321**	**SEC1: Experimental methods and error analysis**	On completion of this course, the students will be able to: **CO1:** Understand the different measurement methods, least count, accuracy and types of errors. **CO2:** Understand the errors of computation and minimising methods. **CO3:** Understand the mean, mode and standard deviation. **CO4:** Explain the Binomial, passion, normal distributions and chi square test.
10.	**PS421**	**SEC2: Digital Electronics**	After completion of the course, the students will be able to; **CO1:** Distinguish between intrinsic and extrinsic semi-conductors, P-type and N-type semiconductors. **CO2:** Able to apply rectifiers with and without filters in electronic circuits. **CO3:** Analyses different types amplifiers. **CO4:** Explain the construction and characteristics of photo diode, Photo transistors, LED, LCD, SCR and UJT. **CO5**: Understand the concept of feedback oscillators and digital systems.

Department of Chemistry

S.No.	Course Code	Course Title	Course Outcomes (CO)
1.	BS106	Paper I	On completion of this course, the students will be able to: CO1: Students will learn the basic knowledge of s.p groups of Periodic table CO2: Students will understand the general principles of Inorganic qualitative analysis CO3: Pupil will understand the Structural Theory in Organic Chemistry CO4: Pupil will understand Hydrocarbons reactivity and properties CO5: Student will be able to explore the Atomic structure and elementary quantum mechanics CO6: Student will be able to Gaseous and liquid state CO7: Students will learn Chemical Bonding, Molecular orbital theory CO8: Students will learn Evaluation of analytical data
2.	BS206	Paper-II	On completion of this course, the students will be able to: CO1: Students will explore the properties of p-block Elements, Interhalogens, Chemistry of Zero group elements, Chemistry of d-block elements CO2: Students will explore the physical and chemical properties of Aromatic Hydrocarbons CO3: Students will learn Dilute Solutions & Colligative Properties CO4: Students will explore the properties of Solutions CO5: Students will explore the properties of Solid-state Chemistry CO6: Students will learn the Theory of Quantitative Analysis
3.	BS 306	Paper – III	At the end of the course the students will be able to CO1: Students will learn the Theory of Quantitative Analysis Chemistry of f-block elements CO2: Students will learn the Theory of Quantitative Analysis Coordination Compounds chemistry

			CO3: Students will explore the properties of Metal carbonyls and Organometallic Chemistry CO4: Students will explore the physical and chemical properties of Carboxylic acids and derivatives and applications CO5: Student will learn interrelation of heat and work with chemical reactions or with physical changes of state in Thermodynamics CO6: Student will understand the Bioinorganic Chemistry
4.	BS 301	SEC –Safety rules in Chemistry laboratory and lab reagents	To improve the skills of students in the application of theory and practical knowledge. To fill the gap between theory and practical. To train the students in understanding laboratory safety rules and to improve the skills in preparation of laboratory reagents CO1: general rules for working safely in a chemical laboratory Recognize the Hazards CO2: Assess the Risks of the Hazards CO3: Minimize the Risks of the Hazards CO4: Preparation of Lab Reagents
5.	BS 301	SEC- Remedial methods for pollution, drinking water and soil fertility	On the completion of this course, the students will be able to; CO1: Acquire skills to help the individuals to identify and solve problems related to pollution CO2: Apply simple and useful methods of purification of water CO3: Educate people about adverse effects of cell phone radiation CO4: Identify the suitable soil for the growth of different crops
6.	BS 406	Paper – IV –	On the completion of this course, the students will be able to; CO1: Simple inorganic molecules and coordination complexes CO2: Carboxylic acids and derivatives, Synthesis based on Carbanions CO3: Electrochemistry & EMF CO4: Synthetic Strategies CO5: Asymmetric synthesis

7.	BS 401	SEC-3: Materials and their Applications	After completion of the course, the students will be able to; CO1: Identify different types materials and their applications CO2: Acquire the knowledge of different types of alloys and their applications CO3: Identify different types of glass and ceramics CO4: Know the Chemicals required for cement preparation and the process of preparation CO5: Identify different types of polymers and their applications
8.	BS 401	SEC-4: Chemistry of Cosmetics and Food Processing	On completion of this course, the students will be able to: CO1: Identify the chemicals involved in cosmetic preparation, food processing and preservation CO2: Acquire the knowledge of preparation of certain cosmetics CO3: Understand the food processing procedure and apply in their daily life CO4: Identify adulterants and educate the people around them CO5: Run their own small-scale Industry
9.	BS 502	GE1 – Pharmaceuticals	After completion of the course, the students will be able to; CO1: Student learns history of pharmacy, development of pharmacy profession and industry in India. CO2: Understands various routes of drug administration, concept of dosage forms, unit operations involved in preparation of these dosage forms. CO3: Describes alternative system of medicines CO4: Explain the factors which influence the design of pharmaceutical dosage forms. CO5: Summarize the factors influencing formulation of various dosage form like solution
10.		GE2 Materials and their Applications	After completion of the course, the students will be able to; CO1: Identify different types materials and their applications CO2: Acquire the knowledge of different types of alloys and their applications

			CO3: Identify different types of glass and ceramics CO4: Know the Chemicals required for cement preparation and the process of preparation CO5: Identify different types of polymers and their applications
11.	BS505	DSC:	After the completion of this course, the learner will be able to: CO1: Understand the theories of bonding, stabilities and applications coordination compounds CO2: Understand the structures of Boranes and Carboranes CO3: Gain knowledge of different types of spectroscopy and enable to analyse and interpret different spectral data CO4: Understanding reactions and reaction mechanism of nitrogen containing functional groups. CO5: Acquire the knowledge of reaction rates, rate laws, and applications of chemical kinetics in studying enzyme catalysis
12.	BS508A	DSE1A: Instrumental methods of Analysis	On completion of this course, the students will be able to: CO1: Gain the knowledge of principle and methods of solvent extractions CO2: Understand the classification of methods of chromatographic techniques, nature of adsorbents and solvent systems CO3: identify the usage of different spectroscopic methods to find the purity of compounds prepared CO4: Analyse the given compounds CO5: Acquires the knowledge of electro analytical methods
13.	BS508B	DSE1B: Industrial Chemistry and Catalysis	After completion of the course, the students will be able to; CO1: understand the Kinetics of heterogeneous catalysis CO2: Identify the different types synthetic and natural dyes and their applications CO3: Identifies different Metallurgical procedures CO4: Understand phase transfer catalysis and enzyme catalysis CO5: Explain Michaelis- Menten mechanism

14.	BS605	DSC:	On completion of this course, the students will be able to; CO1: To know the concepts of inorganic reaction mechanisms CO2: Know about biological significance of essential elements and toxicity of heavy metals CO3: To gain the knowledge of HSAB concept and stability of complexes CO4: To understand the principle of NMR spectroscopy and interpretation of spectrum CO5: Acquire the knowledge of mass spectrometry for the analysis of given sample CO6: Understand different types of carbohydrates and amino acids structures
15.	BS608A	DSE2A: Medicinal Chemistry	On the completion of the course the students will be able to CO1: acquire the basics of medicinal chemistry, biophysical properties CO2: To know the mechanism of action of drugs and ADME properties of drugs CO3: To gain the knowledge of molecular messengers, health promoting drugs and deficiency disorders CO4: Understands the Biophysical and chemical properties of enzymes, hormones, vitamins CO5: understand the Drug metabolism
16.	BS608B	DSE2B: Agricultural and Fuel Chemistry	On completion of this course the students will be able to: CO1: Know different types of Pesticides and their structures CO2: Identifies potential pesticidal plants of India and the role of Neem in plant protection CO3: Understand soil fertility and the need of fertilizers CO4: Understand the importance and need of Organic farming CO5: Acquire the knowledge of refining process of crude oil and fuel derived from Biomass

Vivekananda Government Degree College,
Vidyanagar, Hyderabad.

Department of Statistics

Introduction:

B.Sc. Statistics program consists of 132 credits spread over six semesters. Each credit has one hour of class room teaching per week. This program emphasizes both theory and applications of statistics and is structured to provide knowledge and skills in depth necessary for the employability of students in industry, other organizations, as well as in academics.

Course Objectives:

- To prepare graduates who are not only statistically sound but also capable of using their appropriate statistical skills in interdisciplinary areas such as finance, health, agriculture, government, business, industry, telecommunication, and bio-statistics. As a result, they can pursue their future career either in the core field or in the applied field of Statistics.
- To familiarize students with computational techniques and software used in the statistical arena.
- To provide a solid ground in the best practices of collating and disseminating information.
- To prepare students for undertaking further study.
- To teach students to construct practical statistical models for several processes in the real-world

Program Learning Outcomes in B.Sc. Statistics:

The student graduating with the Degree B.Sc. Statistics should be able to

1. Demonstrate the ability to use skills in Statistics and different practicing areas for formulating and tackling Statistics related problems and identifying and applying appropriate principles and methodologies to solve a wide range of problems associated with Statistics.

2. Acquire

(i) fundamental/systematic or coherent understanding of the academic field of Statistics and its different learning areas and applications.

(ii) Procedural knowledge that creates different types of professionals related to subject area of Statistics, including professionals engaged in government/public service and private sectors;

(iii) Skills in areas related to one's specialization area within the disciplinary/subject area of Statistics and emerging developments in the field of Statistics.

3. Recognize the importance of statistical modeling and computing, and the role of approximation and mathematical approaches to analyze the real problems using various statistical tools.

4. Plan and execute Statistical experiments or investigations, analyze and interpret data/information collected using appropriate methods, including the use of appropriate statistical software including programming languages, and report accurately the findings of the experiment/investigations.

5. Demonstrate relevant generic skills and global competencies such as

(i) Problem-solving Skills that are required to solve different types of Statistics related problems with well-defined solutions, and tackle open-ended problems that belong to the disciplinary-area boundaries;

(ii) Investigative Skills, including skills of independent thinking of Statistics-related issues and problems;

(iii) Communication Skills involving the ability to listen carefully, to read texts and reference material analytically and to present information in a concise manner to different groups/audiences of technical or popular nature;

(iv) Analytical Skills involving paying attention to detail and ability to construct logical arguments using correct technical language related to Statistics and ability to translate them with popular language when needed;

(v) ICT Skills;

(vi) Personal Skills such as the ability to work both independently and in a group.

6. Demonstrate professional behavior such as.

(i) Being objective, unbiased and truthful in all aspects of work and avoiding unethical, irrational behavior such as fabricating, falsifying or misrepresenting data or committing plagiarism;

(ii) The ability to identify the potential ethical issues in work-related situations

(iii) Appreciation of intellectual property, environmental and sustainability issues and

(iv) Promoting safe learning and working environment.

Course Outcomes:

On successful completion of 132 credit six-semester an under-graduate student will be able to

- Knowledge of Statistics and its scope and importance in various areas such as Medical, Engineering, Agricultural and Social Sciences etc.
- Ability to distinguish between random and non-random experiments.
- Basic knowledge of complete enumeration and sample, sampling frame, sampling distribution, sampling and non-sampling errors, principal steps in sample surveys, limitations of sampling etc.,
- Applications to real data by means of laboratory assignments.
- Real data implementation of various demographic concepts.
- The basic idea of various terminologies in epidemiology, clinical trial experiments involving different phases etc.,
- Various data management and data collection systems for a good clinical trial practice.
- Analyze, interpret and take appropriate decisions in solving real life problems using statistical tools.
- Various basic concepts related to computer architecture and its organization, various peripheral devices.
- Understand basic concepts and aspects related to research, data collection, analyses and interpretation.

S.No.	Course Code	Course Title	Course Outcomes
1	123 (Paper-I)	Descriptive Statistics and Probability	On completion of the course students will be able to : CO1: Knowledge of Statistics and its scope and importance in various areas such as Medical, Engineering, Agricultural and Social Sciences etc. CO2: Information about various Statistical organizations in India and their functions for societal developments, CO3: Knowledge of various types of data, their organization and evaluation of summary measures such as measures of central tendency and dispersion etc. CO4: Knowledge of other types of data reflecting quality characteristics including concepts of independence and association between two attributes, CO5: Insights into preliminary exploration of different types of data. CO6: Knowledge of correlation, regression analysis, regression diagnostics, partial and multiple correlations.
2	123 (PAPER-II)	Probability Distributions	On completion of the course students will be able to : CO1: Ability to distinguish between random and non-random experiments, CO2: Knowledge to conceptualize the probabilities of events including frequency and axiomatic approach. Simultaneously, they will learn the notion of conditional probability including the concept of Bayes' Theorem, CO3: Knowledge related to concept of discrete and continuous random

			variables and their probability distributions including expectation and moments, CO4: Knowledge of important discrete and continuous distributions such as Binomial, Poisson, Geometric, Negative Binomial and Hyper-geometric, normal, uniform, exponential, beta and gamma distributions,
3	123 (PAPER-III)	Statistical Methods and Theory of Estimation	On completion of the course students will be able to : CO1: Concept of law large numbers and their uses CO2: Concept of central limit theorem and its uses in statistics CO3: Concept of random sample from a distribution, sampling distribution of a statistic, standard error of important estimates such as mean and proportions, CO4: Knowledge about important inferential aspects such as point estimation, test of hypotheses and associated concepts, CO5: Knowledge about inferences from Binomial, Poisson and Normal distributions as illustrations, CO6: Knowledge about order statistics and associated distributions, CO7: Concept about non-parametric method and some important non-parametric tests.
4	Paper V	Sampling Techniques and Designs of Experiments	On completion of the course students will be able to : (CO1 Basic knowledge of complete enumeration and sample, sampling frame, sampling distribution, sampling and non-sampling errors, principal steps in sample surveys, limitations of sampling etc.,

			CO2 Introduced to various statistical sampling schemes such as simple, stratified and systematic sampling. CO3: An idea of conducting the sample surveys and selecting appropriate sampling techniques, CO4: Knowledge about comparing various sampling techniques. CO5: Carry out one way and two way Analysis of Variance, CO6: Understand the basic terms used in design of experiments, CO7: Use appropriate experimental designs to analyze the experimental data, CO8: Apply Multiple range tests, the multiple t–test, Student-Newman-Keuls test, Duncan's multiple range test, Tukey's test, CO9: Give statistical interpretation of the experimental results obtained.
4	Paper IV	Statistical inference	The students will acquire (CO1) Concept of law large numbers and their uses (CO2) Concept of central limit theorem and its uses in statistics (CO3) concept of random sample from a distribution, sampling distribution of a statistic, standard error of important estimates such as mean and proportions, (CO4) knowledge about important inferential aspects such as point estimation, test of hypotheses and associated concepts, (CO5) knowledge about inferences from Binomial, Poisson and Normal distributions as illustrations, (CO6) knowledge about order statistics and associated distributions,

			(CO7) concept about non-parametric method and some important non-parametric tests.
5	Paper V	Design of sampling, Time Series, Index numbers and Demand Analysis	On completion of the course students will be able to : CO1: Time series data, its applications to various fields and components of time series, CO2: Fitting and plotting of various growth curves such as modified exponential, Gompertz and logistic curve, CO3: Fitting of trend by Moving Average method, CO4: Measurement of Seasonal Indices by Ratio-to-Trend , Ratio-to-Moving Average and Link Relative methods, CO5: Calculation of variance of random component by variate component method, CO6: Applications to real data by means of laboratory assignments.
6	Paper VI	Statistical Quality control and Reliability	On completion of the course students will be able to : CO1: Modelling of individual and aggregate losses, CO2: Fitting of distributions to claims data, deductibles and retention limits, proportional and excess-of-loss reinsurance, (CO3: Risk models: models for individual claims and their sums, CO4: Finding distribution of aggregate claims, compound distributions and their applications, CO5: Applications of credibility theory, (CO6: Finding of survival function, curate future lifetime, force of mortality,

			CO7: Handling problems on joint life and last survivor status and multiple decrement model, CO8: Mean and variance of various continuous and discrete payments for assurance and annuity contracts, CO9: Calculation of various payments from life tables using principle of equivalence, net premiums, prospective and retrospective provisions/reserves, (j) real illustrations for the concepts mentioned above through laboratory assignments.
7	Paper VII	Design of Experiments, vital statistics and official statistics.	On completion of the course students will be able to : CO1: Income distributions and their fitting in real life situations, CO2: Commonly used measures of demography pertaining to its three basic aspects, viz. the fertility, mortality and migration, CO3: Various data collection methods enabling them to have a better insight in policy making, planning and systematic implementation, CO4: Construction and implication of life tables, CO5: Population growth curves, population estimates and projections, CO6: Real data implementation of various demographic concepts as outlined above through practical assignments.
8	Paper VIII	Operations Research	On completion of the course students will be able to: CO1: Know how to formulate a real life problem into mathematical problem.

			CO2:solve the mathematical linear problem by using graphical method ,simplex method ,Big M method and Two phase method CO3: Can formulate transportation problem and solve by North West corner method, Matrix minimum method and VAM method also MODI method. CO4:Can solve assignment problem using Hungarian method. CO5:Can solve Two machine and n jobs.

DEPARTMENT OF COMPUTERS

PROGRAMME	PROGRAMME OUTCOMES(PO)
B.Sc. (Physical sciences / life sciences)	**PO1:** Computational knowledge: Apply the knowledge of mathematics, science fundamentals and a technical specialization to the solution of complex mathematical problems. **PO2:** Problem analysis: Identify, formulate, reverse search literature, and analyze complex science problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and computer science. **PO3:** Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the programming practice. **PO4:** Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings. **PO5:** Communication: Communicate effectively on software development activities with the computer science community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PROGRAMME	PROGRAMME SPECIFIC OUTCOMES(PSO)
B. Sc (Computer Science)	**PSO1:** Students will acquire basics of C , C++ and ,Java Programming languages to develops Applications . **PSO2:** To understand the algorithms to maintain memory in an Organized way. Stacks, queues, lists, trees, graphs algorithms used in applications. **PSO3:** Students will analyse system, Relational database model, ER model and distributed databases to write good queries using a structured query language called SQL. **PSO4:** Students will gain skills of usage of Web Technologies to design Web pages. **PSO5:** Computer Networks are the basis of communication in IT . they are used in a huge variety of ways and can include many different types of networks.

B. Sc (Computer Applications)	**PSO1**: Students will acquire basics of C, C++ & JAVA Programming languages to develop Applications. **PSO2**: Students will analyse system, Relational database model, ER model and distributed databases to write good queries using a structured query language called SQL **PSO3:** To acquire the knowledge of multimedia systems.. **PSO4:** Students will gain skills of usage of Web Technologies to design Web pages.

PROGRAMME SPECIFIC OUTCOMES (PSO)

S. No.	Course Code	Course Title	Course Outcomes (CO)
1.	BS106	Paper-I Programming in C	CO1: To understand the fundamentals of computers and programming languages. CO2: Understanding concepts of algorithms, flow charts, pseudo code, data types and operators. CO3: Ability to work with arrays of complex objects. CO4: Understanding a concept of functional hierarchical code organization. CO5: Ability to work with pointers, structures and files. CO6: Ability to handle possible errors during program execution.
2.	BS206	Paper-II Programming in C++	CO1: Understand importance of object oriented programming and difference between structured oriented and object oriented programming features. CO2: Able to make use of objects and classes for developing programs CO3: Ability to implement constructors and array of objects. CO4: Design and implement C++ programs for complex problems, making good use of the inheritance and polymorphism. CO5: Ability to handle runtime errors by using exception handling techniques.
3.	BS306	Paper – III Data Structures using c++	CO1: To understand the algorithms to maintain memory in an organized way. CO2: Use the appropriate data structure in context of solution of given problem. CO3: Understanding concepts of stacks, queues and linked list to organize memory of applications. CO4: Select the appropriate searching or sorting algorithm based on the algorithm's behaviour. CO5: Ability to have knowledge of tree and graphs concepts.
4.	BS306	(LS) Paper – III Relational Database Management System	CO1: Identify the basic concepts and various data model used in database design ER modelling concepts and architecture use and design queries using SQL CO2: Recognize and identify the use of normalization and functional dependency, indexing and hashing technique used in database design. CO3: Apply and relate the concept of transaction, concurrency control and recovery in database. CO4: To understand recovery system and be familiar with introduction to web database and distribute databases.

5.	**BS406**	**Paper – IV – Database Management System**	**CO1:** Understand how data is stored and indexed in a DBMS. **CO2:** Identify the basic concepts and various data model used in database design ER modelling concepts and architecture use and design queries using SQL **CO3:** Recognize and identify the use of normalization and functional dependency, indexing and hashing technique used in database design. **CO4:** Apply and relate the concept of transaction, concurrency control and recovery in database. **CO5:** To understand recovery system and be familiar with introduction to web database and distribute databases.
6.	**BS406**	**Paper – IV Multimedia Systems**	**CO1**: Multimedia Systems is one of the earliest published journals in multimedia. It is a peer-reviewed. **CO2**: It is a peer-reviewed, international journal that publishes original research on multimedia. **CO3:** And multimedia systems, including theories, methods, tools, technologies, applications, and so on. **CO4:** To Design and develop various Multimedia Systems applicable in real time.
7.	**BS505**	**Paper – V Programming in JAVA**	**CO1:** To understand fundamentals of object-oriented programming in Java and to create Java application programs using OOP practices. **CO2**: To identify Java language components and how they work together in applications. **CO3:** To learn how to extend Java classes with inheritance and dynamic binding. **CO4:** To learn how to use exception handling in Java applications. **CO5:** To understand how to design GUI components with the Java Swing API. **CO6:** To understand how to design applications with threads in Java. **CO76**:Read and make elementary modifications to java programs that solves real world problems
8.	**BS605**	**Paper – VI Computer Networks**	**CO1**: Computer Networks are the basis of communication in IT. **CO2:** They are used in a huge variety of ways and can include many different types of network. **CO3:** Study the basic taxonomy and terminology of the computer networking and enumerate the layers of OSI model and TCP/IP model. **CO4:** Gain core knowledge of Network layer routing protocols and IP addressing. **CO5:** Study data link layer concepts, design issues, and protocols.
9.	**BS302**	**SEC-2: Python-I**	**CO1**: To understand Python is a useful scripting language for develop. **CO2:** Ability to write loops and decision statements in Python. **CO3:** Ability to implement functions and modules. **CO4:** Ability to handle runtime errors by using exception handling techniques in Python.

10.	**BS402**	**SEC-4: Python-II**	**CO1**: To understand Python is a useful scripting language for developers. **CO2:** Ability to implement stings, slicing, testing, searching and manipulating. **CO3:** Design and implement Python programs for complex problems, making good use of the inheritance and polymorphism. **CO4:** To understand how to design GUI, widgets, labels and buttons in Python programming.
11.	**BS502**	**SEC-3: Computer Organization**	**CO1:** To understand the structure, function and characteristics of computer systems **CO2:** To understand the design of the various functional units and components of computers. **CO3:** To identify the elements of modern instructions sets and their impact on processor design. **CO4:**To explore the memory organization
12.	**BS602**	**SEC-4: Information Security**	**CO1:** Analyze and resolve security issues in networks and computer systems to secure an IT infrastructure. **CO2**: To Implement Design, develop, test and evaluate secure software. **CO3:** Develop policies and procedures to manage enterprise security risks. **CO4:** Evaluate and communicate the human role in security systems with an emphasis on ethics, social engineering vulnerabilities and training. **CO5:** Interpret and forensically investigate security incidents.
13.	**BS506**	**DSE 1E: Operating Systems**	**CO1:** Identify the different types of operating systems and their responsibilities. **CO2:** Understanding issues in different file systems and describes the access methods for files and solve problems of disk scheduling. **CO3:** Solve the memory management problems with techniques like paging and segmentation and also use page replacement algorithms. **CO4:** Explain the concurrency conditions and critical section problem and apply the solutions to process synchronization problems. **CO5:** Define deadlock and implement methods for its avoidance, detection and identify goals of protection.
14.	**BS606**	**DSE 2F: Web Technologies**	**CO1**: Understand the principles of creating an effective web page including an in depth consideration of information architecture. **CO2:** Develop web based application using suitable client side and server side web technologies **CO3**: Develop solution to complex problems using appropriate method, technologies, frameworks, web services and content management. **CO4**:Become familiar with graphic design principles that relate to web design and learn how to implement theories into practice **CO5**: Develop skills in analyzing the usability of a website. **CO6**: Learn techniques of responsive web design, including media queries **CO7**:Develop skills in digital imaging (adobe photo shop)