



**SHRI GOVINDRAOMUNGHATE COLLEGE ARTS AND SCIENCE COLLEGE  
KURKHEDA**

Dist- Gadchiroli-441209

**PROGRAMME: B. SC.**

**Programme Outcomes (POs) of B.Sc**

- P01. Disciplinary knowledge:** Students will possess a breadth and depth of disciplinary knowledge in the field of Science.
- P02. Scientific Judgment, Critical Thinking & Research:** Students will be able to analyze information objectively and make a reasoned judgment by observation, understanding and evaluation of sources, such as data, facts and link research findings to innovation and entrepreneurship.
- P03. Problem solving & Analytical Skills:** Students will be able to think logically, analyze situations and solve problems skillfully.
- P04. Environment and sustainability:** Ability to understand the issues related to environmental contexts and sustainable development
- P05. Effective Communication:** Students will be able to present ideas clearly and confidently with skills to convey with others. They will be able to evaluate primary literature, in oral and written form during seminar delivery and subsequently articulate the information.
- P06. Digital Literacy:** Acquire ability to use ICT, demonstrate ability to access, evaluate, and use a variety of relevant information sources; and use appropriate software for analysis of data.
- P07. Leadership & Team work:** Ability to work as a leader as well as in a team for group projects, field work and group activities and participate actively, in a healthy spirit
- P08. Ethical & Moral values:** Students will bear the core characters of honesty, integrity and commitment and imbibe qualities of empathy for fellow human beings.
- P09. Effective Citizenship and Social Interaction:** Students will develop tolerance and harmony towards cultural, regional, linguistic, communal, socioeconomic and other diversities and respect for national symbols of pride
- P010. Technological Upliftment:** Students will learn how to handle equipment and machines used for practical purpose in this programme. This is useful for them to choose their future education and area of expertise as a career.

## **PROGRAMME SPECIFIC OUTCOMES (PSOs)**

### **B.Sc: Physics, Chemistry, Mathematics (P.C.M) OUTCOMES**

By the end of this programme, the students will be able to:

**PSO 1:** Understand the theoretical concepts of physical and chemical properties of materials and the role of mathematics in dealing with them in a quantitative way.

**PSO 2:** Analyse the concepts of mathematics, physics and chemistry and understand the relation among them like physical chemistry, mathematical modelling of physics and chemistry problems.

Skills needed to handle instruments and adopt lab procedures to study physical chemical properties of materials.

**PSO 3:** Mathematical, numerical techniques required to model them.

**PSO 4:** Ability to interlink the skills and knowledge in mathematics, physics and chemistry and develop an aptitude to address the problems in biophysics, stock market analysis.

### **B.Sc: Physics, Computer Science, Mathematics, (P.Cs.M) OUTCOMES**

By the end of this programme, the students will be able to:

**PSO 1:** Understand the concepts of vector spaces, group theory, quantum mechanics, optical, thermal, electrical, mechanical properties of a materials, probability, algorithm design, data base

**PSO 2:** Analyze the concepts of mathematics, physics and computers science able to relate them in numerical programming of models of physical systems.

**PSO 3:** Acquire the skills to study the properties of materials, implementation of numerical algorithms by using various

**PSO 4:** Ability to interlink the skills developed and acquires an aptitude to address the problems in simulations of material properties, web and mobile app development.

### **B.Sc., Electronics, Computer Science, Mathematics (E.Cs.M.) OUTCOMES**

By the end of this programme, the students will be able to:

**PSO 1:** Understand the concepts of basic electronic components, networks, communication systems, microprocessors and microcontrollers, algorithms, C language, Arduino programming, Networking, cloud and Big Data.

**PSO 2:** Analyse the concepts of mathematics, Electronics and computer Networks and able to use them in solving real world problems.

**PSO 3:** Acquire the skills to use various electronic microcontroller, Arduino, Raspberry PI and simulators.

**PSO 4:** Ability to interlink the skills developed and gets an aptitude to address the problems in smart home design, smart vehicles, smart sensors in various fields.

### **B.Sc., Physics, Electronics, Mathematics (P.E.M.) OUTCOMES**

By the end of this programme, the students will be able to:

**POS 1:** Understand the basic concepts of electronics components, network theorem, digital electronics, solid state semiconductor devices, amplifier theory, Analog and Digital circuits, basic circuits, design using circuit maker software and their application

**POS 2:** Analyze different parameters of various circuits

**POS 3:** Understand the use of electronics in the field of computer science.

**POS 4:** Perform and testing of different electronics components and circuits.

**POS 5:** Analyze the I/P, O/P V-I characteristics of the circuits.

**POS 6:** Understand the application of Electronics in domestic appliances

**POS 7:** Analyze the relationship between analogue and digital circuits.

**POS 8:** Repair small household electrical and electronics appliances

## **COURSE OUTCOME (COs) FOR SUBJECT: MATHEMATICS**

### **SEMESTER I**

<b>Course Code</b>	<b>Course Title</b>	<b>Course Outcomes</b>
<b>USMT-01</b>	<b>Differential and Integral Calculus</b>	<b>Aim: To make the students understand the basic concepts of differential and Integral calculus for one variable.</b>  After completing of the course, the students will be able to-

		<p>CO1: Application of limit and continuity to solve various problems by using <math>\varepsilon</math> and <math>\delta</math> Definition</p> <p>CO2: Understand Successive differentiation and solve problems by using Leibniz theorem.</p> <p>CO3: Apply Mean Value theorem(MVT), Rolle's Theorem and Cauchy's Mean Value theorem(CMVT)</p> <p>CO4: Solve Problems on Taylors Series and Maclaurin's Series of <math>\sin x</math>, <math>\cos x</math>, <math>e^x</math>, <math>\log 1+x</math>, <math>(1+x)^m</math></p> <p>CO5: study the Gamma function and Beta function and their properties and solve the problem.</p> <p>CO6: Derive relation between Beta and Gamma functions.</p> <p>CO7: Understand Indeterminate forms and Apply L'Hospital rule to solve the problems of indeterminate forms.</p> <p>CO8: Double integration and Transformation of Double integral Cartesian form to polar form understand and solve the various problems.</p> <p>CO9: Apply change variable method to find the value of double integral.</p>
<p><b>USMT-02</b></p>	<p><b>Differential Calculus and Trigonometry</b></p>	<p><b>Aim: Students should understand the concept Differential Calculus for two variable and Trigonometry.</b></p> <p>After completing the course, the students will be able to-</p> <p>CO1: Understand the Limit and Continuity for function of two variables.</p> <p>CO2: Apply the various methods to solve the differential equations for two variables.</p> <p>CO3: Understand Maxima and Minima of function of two variables.</p> <p>CO4: Understand and solve the Lagrange's Multiplier method.</p> <p>CO5: Concept of sub tangent and subnormal and applications.</p> <p>CO6: Find angle of intersection of two curves.</p>

		<p>CO7: Study circle, radius and centre of curvature. .</p> <p>CO8: To enable students to learn and to apply the De Moivre's theorem and its applications.</p> <p>CO9: Understand and Expand <math>\cos n\theta</math>, <math>\sin n\theta</math> and <math>\tan n\theta</math> in terms of <math>\theta</math>.</p> <p>CO10: Define the hyperbolic functions and their inverse hyperbolic functions.</p>
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## SEMESTER II

Course Code	Course Title	Course Outcomes
USMT-03	<b>Ordinary Differential Equations and Difference Equations</b>	<p><b>Aim: To make the students understand the basic concepts Ordinary Differential Equations and Difference Equations.</b></p> <p>After completing the course, the students will be able to-</p> <p>CO1: Understand type of Differential Equation and order and degree of Differential Equations.</p> <p>CO2: Find the solution of differential equations of the first order and first degree by variables separable, Homogeneous and Non-Homogeneous methods.</p> <p>CO3: Understand Linear differential equations and solve problems on Bernoulli's equations. Solve practical problems using the methods.</p> <p>CO4: Find a solution of differential equations of the first order and of a degree higher than the first by using methods of solvable for p, x and y.</p> <p>CO5: Compute complementary function and particular integral of differential equations.</p> <p>CO6: Compute all the solutions of second and higher order linear differential equations with constant coefficients, linear equations with variable coefficients.</p> <p>CO7: Solve simultaneous linear equations with constant coefficients and total differential equations</p> <p>CO8: Understand to Formulate Difference equation and solve problems.</p>

<b>USMT-04</b>	<b>Partial Differential Equation</b>	<p><b>Aim : To make the students understand the basic concepts of Partial Differential Equation.</b></p> <p>After completing the course, the students will be able to-</p> <p>CO1: Study the concept of Formation of partial differential equations</p> <p>CO2: Student will understand the Solve linear partial differential equation of first order.</p> <p>CO3: Illustrate Lagrange's linear differential equations.</p> <p>CO4: Solve the solution of First order partial differential equations for some standard types.</p> <p>CO5: Study the Homogeneous partial differential equations and its applications.</p> <p>CO6: Solve problems by using Jacobbi's method.</p> <p>CO7: Understand and solve the Non-Homogeneous differential equations.</p>
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### SEMESTER III

<b>Course Code</b>	<b>Course Title</b>	<b>Course Outcomes</b>
<b>USMT-05</b>	<b>Real Analysis</b>	<p><b>Aim: To make the students to understand the basic concepts of Real Analysis</b></p> <p>After completing the course, the students will be able to-</p> <p>CO1: Understand and Define different types of real sequence, bounded sequence, Cauchy Sequence.</p> <p>CO2: Study and Discuss the behavior of the geometric sequence.</p> <p>CO3: Understand and Verify the given sequence in convergent and divergent by using behavior of Monotonic sequence.</p> <p>CO4: Study the Cauchy's theorems on limits.</p> <p>CO5: The students should have solved the examples for convergence, divergence and oscillating series.</p>

		<p>CO6: Discuss the behavior of the geometric series.</p> <p>CO7: Student will understand the concept of Metric, Neighbourhood, closed sets, open sets, bounded sets, limit points, interior point.</p> <p>CO8: Study the Riemann integral, criterion for Riemann integrability and properties.</p> <p>CO9: Understand and Determine fundamental theorem on calculus and MVT of integral Calculus.</p>
<b>USMT-06</b>	<b>Set Theory and Laplace Transform</b>	<p><b>Aim: To make the students to understand the basic concepts of Set Theory and Laplace Transform.</b></p> <p>After completing the course, the students will be able to-</p> <p>CO1: To study the set theory.</p> <p>CO2: Understand the Countable and uncountable sets and solved the problems.</p> <p>CO3: To understand basic concepts of fuzzy sets, <math>\alpha</math>-cuts, fuzzy complements and Discuss types of operations on fuzzy sets, t-norms, fuzzy arithmetic.</p> <p>CO4: Determine the extension principle of fuzzy sets, fuzzy numbers.</p> <p>CO5: Discuss the Relations of fuzzy, binary fuzzy, fuzzy equivalence.</p> <p>CO6: Study the some applications of fuzzy sets.</p> <p>CO7: Understand Laplace transform and Inverse Laplace transform and their Formulae.</p> <p>CO8: Study the application of Laplace transform to solve differential equations.</p> <p>CO9: Use inverse Laplace transform to return familiar functions.</p> <p>CO10: Use the application of Laplace transform to solve ODE and PDE.</p>

## SEMESTER IV

Course Code	Course Title	Course Outcomes
USMT-07	Algebra	<p><b>Aim: To make the students to understand the basic concepts Group theory and Ring theory.</b></p> <p>After completing the course, the students will be able to-</p> <p>CO1: Study the basic definitions of Group ,subgroup, center, Normalizer of a subgroup.</p> <p>CO2: Understand and solved the cycles and transpositions of a given permutations.</p> <p>CO3: Study the Lagrange's theorem.</p> <p>CO4: Study the some group like cyclic groups, normal subgroups, quotient groups and index of a subgroup.</p> <p>CO5: Define homomorphism, kernel of a homomorphism, isomorphism.</p> <p>CO6: State and Prove the Cayley's theorem, the fundamental theorem of homomorphism for groups.</p> <p>CO7: Study the definitions of rings, zero divisors of a ring, integral domain , field and prove theorem.</p>
USMT-08	Elementary Number Theory	<p><b>Aim: To make the students to understand the Number Theory.</b></p> <p>After completing the course, the students will be able to-</p> <p>CO1: Study the Divisibility, Division and Euclidean Algorithm.</p> <p>CO2: Understand and Solve the problems of GCD and LCM.</p> <p>CO3: Describe the properties of prime numbers.</p> <p>CO4: Study the congruence's and their properties of congruence's.</p> <p>CO5: Solve the system of linear congruence's.</p> <p>CO6: Understand and Solve Diophantine equations.</p> <p>CO7: Study the statements of Chinese Remainder Theorem, Fermat's and Wilson's theorem and Goldbach</p>



		<p>Conjuncture.</p> <p>CO8: Describe Arithmetic function, Euler's theorem, Mobius <math>\mu</math> function, <math>\tau</math> and <math>\sigma</math> function</p> <p>CO9: Discuss the Pythagorean triplets.</p>
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## SEMESTER V

Course Code	Course Title	Course Outcomes
DSE -I	Linear Algebra	<p><b>Aim: To make the students to understand the basic concepts Vector Space, Linear transformations, Dual Space, Inner product space in linear Algebra.</b></p> <p>After completing the course, the students will be able to-</p> <p>CO1: Study to Define Vector Space, Quotient space Direct sum, linear span and linear independence, basis and inner product.</p> <p>CO2: Discuss the linear transformations, rank, range Kernel (Null) and nullity.</p> <p>CO3: Study the Rank Nullity Theorem and Rank Nullity of Matrix, Isomorphism.</p> <p>CO4: Discuss the Dual Space, Bi dual space and natural Isomorphism</p> <p>CO5: Find the characteristic equation, eigen values and eigen vectors of a matrix.</p> <p>CO6: Define the orthogonal vectors, orthogonal compliment, Orthogonal set.</p> <p>CO7: Understand to prove Schwartz inequality and process of Gram-Schmidt orthogonalisation.</p>
DSE-IV	Special Relativity - I	<p><b>Aim: To make the students to understand the basic concepts Relativity.</b></p> <p>After completing the course, the students will be able to-</p>

		<p>CO1: Discuss the Newtonian mechanics, Inertial system , Galilean transformation, Newtonian relativity.</p> <p>CO2: Derived the Conservation laws in Newtonian mechanics , Maxwell’s electromagnetic theory , Michelson – Morley experiment, Lorentz Fitzgerald contraction hypothesis</p> <p>CO3: Study the character of space and time.</p> <p>CO4: Discuss the special theory of relativity of Einstein’s and postulates.</p> <p>CO5: Study the Lorentz transformation Geometrical interpretation and their Group properties.</p> <p>CO6: Understand the Length contraction, Time dilation.</p> <p>CO7: Study the Relativistic Kinematics- Composition of parallel velocities, addition law for velocity.</p> <p>CO8: Study the transformation equation for components of velocity and components of acceleration of a particle.</p> <p>CO9: : Understand the Geometrical representation of space time</p> <p>CO10: Define the Time like, Light like, and Space like intervals, Proper time, world line of a particle.</p> <p>CO11: Study the Four dimensional, Four vectors and Four tensors in Minkowskin space time.</p>
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### SEMESTER VI

Course Code	Course Title	Course Outcomes
DSE –VI	Complex Analysis and Vector Calculus	<p><b>Aim: To make the students to understand the basic concepts Complex Analysis and Vector Calculus.</b></p> <p>After completing the course, the students will be able to-</p> <p>CO1: Compute sums, products, quotients, conjugate, modulus, and argument of complex numbers</p> <p>CO2: Explain how calculate exponentials and integral powers of complex numbers.</p>

		<p>CO3: Understand the significance of differentiability for complex functions and be familiar with the Cauchy-Riemann equations.</p> <p>CO4: Study to determine whether a given function is analytic.</p> <p>CO5: Understand the Bilinear transformation, cross ratio, fixed point .</p> <p>CO6: Write the bilinear transformation which maps real line to real line, unit circle to unit circle, real line to unit circle.</p> <p>CO7: Use Cauchy's integral theorem and formula to compute line integrals.</p> <p>CO8: Represent functions as Taylor, power and Laurent series.</p> <p>CO9: Study the singularities and poles and solve the problem.</p> <p>CO10: Solve the residues and evaluate complex integrals, real integrals using the residue theorem.</p> <p>CO11: Discuss the Vector Differentiation.</p> <p>CO12: Find and interpret the gradient curl, divergence for a function at a given point.</p> <p>CO13: Discuss and solve the problems of line, surface and volume integrals.</p> <p>CO14: Evaluate integrals by using Green's Theorem, Stokes theorem, Gauss's Theorem.</p>
<p><b>DSE –VIII</b></p>	<p><b>Special Relativity - II</b></p>	<p><b>Aim: To make the students to understand the basic concepts of Tensor Analysis, Christoffels, Relativistic Mechanics and Electromagnetism</b></p> <p>After completing the course, the students will be able to-</p> <p>CO1: Study the tensor Coordinate transformations.</p> <p>CO2: Understand and discuss the some tensor :- Covariant tensor, Contravariant tensor mixed tensor, symmetric tensor, skew symmetric tensors.</p> <p>CO3: Study the Fundamental operations on tensors.</p>

		<p>CO4: Understand the metric tensor, conjugate metric tensor.</p> <p>CO5: Study the Christoffels symbols and their Transformation.</p> <p>CO4: Understand and solve the problems of covariant and Absolute derivative.</p> <p>CO5: Study the Curvature tensor, Ricci tensor, Einstein tensor and solve the problems.</p> <p>CO6: Discuss the mass with velocity Equivalence and the transformation equation.</p> <p>CO7: Discuss and Understand the momentum and energy for four vectors.</p> <p>CO8: Study the Relativistic force, Relativistic Lagrangian Relativistic Hamiltonian and Relativistic equation of motion of particle.</p> <p>CO9: Understand the Maxwell's equation in vacuum.</p> <p>CO10: Study the Transformation equations for density of electric charge and current and electromagnetic four potential vectors.</p> <p>CO11: Discuss the propagation of electric field and magnetic field.</p> <p>CO12: Study the Lagrangian for a charged particle in an electromagnetic field.</p> <p>CO13: Discuss the electromagnetic field tensor Maxwell's equation in tensor form.</p>
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### Skill Enhancement Courses (SEC)

<b>SEMESTER V</b>		
<b>Course Code</b>	<b>Course Title</b>	<b>Course Outcomes</b>
<b>SEC - I</b>	<b>Probability</b>	<b>AIM: The aim of this course is to enable the students to Understand and apply the concepts of probability axioms and rules.</b>

		<p>After completing the course, the students will be able to-</p> <p>CO1: Learn the use of Sample Space, Events, and types of events, probability, conditional probability and properties.</p> <p>CO2: Learn the Addition, multiplicative theorem and define the probability mass function.</p> <p>CO3: Understand and solve example of the probability distribution, cumulative distribution function of a discrete random variable.</p> <p>CO4: Define the probability density function and distribution function of a continuous random variable and solve examples.</p>
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<b>SEMESTER VI</b>		
<b>Course Code</b>	<b>Course Title</b>	<b>Course Outcomes</b>
<b>SEC -III</b>	<b>Graph Theory</b>	<p><b>AIM: The aim of this course is to enable the students to Understand and apply the concepts of Graph theory.</b></p> <p>After completing the course, the students will be able to-</p> <p>CO1: Learn the basic Concepts of Graph Theory.</p> <p>CO2: Learn the types of graphs for examples Undirected, Directed graphs, simple graphs, multi graphs, sub graphs, isomorphic graphs and weighted graphs.</p> <p>CO3: Student learn and use the in-out degree, path, circuit and algorithm in the Graphs.</p>