MAIRANG PRESBYTERIAN SCIENCE COLLEGE
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MAIRANG

DEPARTMENT OF MATHEMATICS

PSO-1	On the successful completion of the course, the graduates understands the concepts of calculus (Differential and integral, differential equations (ordinary and partial, algebra (abstract, linear) and analysis (real, complex and numerical) and mechanics.
PSO-2	Read, understand and construct correct mathematical proofs.
PSO-3	Develop power of reasoning, critical thinking, problem solving ability, developing new ideas, drawing logical conclusions and high level of numeracy.
PSO-4	Explains the importance of mathematics and its techniques to solve real life problems.
PSO-5	Able to communicate effectively both orally and in writing.
PSO-6	Develop skills in analyzing and interpreting data.
PSO-7	Graduates of mathematics programmes will be able to apply their knowledge in modern industry, teaching, and other fields such as MBA, MCA, Mathematical Computing and research.
PSO-8	Studying mathematics simply opens the doors to a wealth of opportunities.
PSO-9	Able to communicate mathematical thoughts and ideas clearly and concisely to others in the oral and written form.
PSO-10	Able to work on their own during preparation for competitive examinations.

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Department of Mathematics

Course Outcomes

Course	Outcomes
Calculus	To inculcate knowledge on the ability to find the effects of changing conditions on a system. Whereby both the branches viz, Differential and Integral calculus are studied.
Analytical Geometry	To inculcate knowledge on solving problems in analytic geometry and able to find appropriate solutions for given problems and knowledge of coordinates and space.
Vector calculus	To inculcate knowledge on differentiation and integration of vector fields and the knowledge of 3-dimensional space.
Statics	To inculcate knowledge on fixed particle properties and proofs.
Operations Research	To inculcate knowledge on maximize the profit and minimize the cost in every place.
Differential Equation	To inculcate knowledge on solving of first and second order differential equations that can be applied to other branches of mathematics.
Dynamics	To inculcate knowledge on moving particle, properties and proofs.
Real Analysis	To inculcate knowledge on real numbers and their properties & proofs.
Modern Algebra	To inculcate knowledge on algebraic equations and their relations with properties.
Number Theory	Define and interpret the concepts of divisibility, congruence, greatest common divisor, prime, and prime-factorization, also to formulate and prove conjectures about numeric patterns
GHS 11: ***Algebra-I, & Calculus - I***	**Algebra-I** Students will have • Brief review of basics in set theory relations; Functions and graphs. • Studies of different mappings, properties of m x n matrix • array of numbers (motivation through systems of linear equations) **Calculus-I** • Study the properties and examples of continuous functions defined on closed and bounded intervals intermediate value

	theorem, uniform continuity. • In dept studies of Properties, Problems, solution and applications of derivatives. Anti-derivative (integration). • Study the properties and examples of continuous functions defined on closed and bounded intervals intermediate value theorem, uniform continuity. • In depth studies of Properties, Problems, solution and applications of derivatives, Anti-derivative (Integration) • Use of $\in -\delta$ definition to find the limits and continuity of functions. • Study relationship between continuation and differentiation. • Able to understand the idea of limits of functions by L- hospitals rule and solve the indeterminate form of limits. • Understands basic definitions and terminology associated with ordinary differential equations. • Learn rules to find integrating factors. • Finding of solutions of linear differential equations.
GHS 21: ***Geometry & Vector Calculus***	**Geometry** Students will learn about properties of • Change of axes - invariants; pairs of straight lines; general equation of second degree; • General conics: equations of tangents, normal, pairs of tangents, chord of contact, chords, asymptotes. • About Polar equation, equation of a conic. • Separately study Parabola, ellipse, hyperbola; perpendicular distances. • Extension of knowledge to 3-Dimensional Geometry. Leaming of Equations of straight lines. • Sphere - plane section and its equation; Equation of a cone; equation of a cylinder and right circular cylinder. **Vector Calculus** • Study differentiation & partial differentiation of a vector sum. • Learn the concept of the dot product. • To study to find gradient, divergence and curl of functions
GHS 31: ***Statics& Calculus - II***	**Statics:** Students will attain knowledge of theory, problems and application • Composition and resolution of forces;

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	parallelogram of forces. • Coplanar forces: Triangle of forces, Lami's Theorem and its converse. • Parallel forces, Varignon's Theorem. Couples; • Resultant of a couple and a force. • Reduction of coplanar forces. **Calculus - II** Learn the proofs of general theorem and their geometrical consequences. • Learns the notation of concavity convexity asymptotes. • Are able to trace the curves in polar and rectangular coordinates. • Understands the concepts of limit and continuity of functions of several variables. • Are able to convert Cartesian to polar coordinates and vice versa. • Learn the proof and applications of Euler's theorem on homogeneous functions
GHS 41: ***Algebra II& Dynamics***	**Algebra II:** Students learn about • Binary operations as maps; groups: • nth roots of unity etc; laws of indices in both additive and multiplicative notation; right and left cancellation laws; Uniqueness of identity and inverse; abelian group; subgroups of cyclic groups Determination of all subgroups of Z; • Order of an element, cosets; Lagrange's theorem and its applications • Applications and problems Fermat's (little) theorem; Euler's generalizations. • Polynomials over Z / Q / R / C. • Application of Eisenstein's theorem; unique factorisation theorem. • roots of a polynomial; factor theorem; fundamental theorem of algebra (statement only); its failure. • the fundamental theorem of algebra; multiple roots, common roots, complex roots, surd roots. • Relation between roots and coefficients of a polynomial. • cubic and biquadratic equations; Descartes' rule of signs; Rolle's theorem; Cardan's method; De Moivre's theorem

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	Dynamics: Students will learn about • Friction. • Centre of gravity. • Rectilinear motion with variable Laws of forces; Motion under inverse square Law, velocity and acceleration, Amplitude, Time-period. • Collision of elastic bodies. • Projectiles. • Rectilinear motion. • Tangential and normal acceleration on smooth curves, radial & transversal acceleration, motion. • On a smooth plane curve such as vertical circles and cycloids. • Impulse and Impulsive force, conservation of linear momentum. • Work done by a force; work energy equation; potential function; conservative forces
H 51: ***Elementary Number Theory***	**Elementary Number Theory:** Students Learn the theory and problems relating to • Divisibility in the set of integers; basic properties; the division algorithm; gcd; elementary • Properties; the Euclidean algorithm; 1cm; primes (in the set of natural numbers); They will study fundamental theorem • Of arithmetic and its applications; Learning the vast knowledge about • The property of primes; Congruences in the set of integers modulo a positive integer and basic properties; complete residue system and reduced residue system; Introducing and solving problems on • Euler's Ø - function; Fermat's theorem; Euler's generalization of Fermat's theorem; applications, Wilson's theorem. They will study and learn about • Solution of congruences; Chinese remainder theorem), Greatest integer function, Arithmetic functions; multiplicative functions, functions such as $\emptyset(n), \mu(n), t(n), s(n), k(n)$.
H-52 ***Advance Calculus I***	Students learn about • Riemann integral, Darboux's theorem Learn the Conditions. • properties of integrable their continuity

	and differentiability; Understanding the • Mean value theorems for integrals. • Improper integrals; test for convergence when the integrand is nonnegative; absolute convergence; tests • for absolute and conditional convergence, beta and gamma functions; Abel's theorem, Dirichlet's theorem; • Frullani's integral. Have in depth knowledge about • Integrals as functions of parameters; continuity, differentiability and integrability function; learn the applications to evaluation of integrals, Improper integrals, continuity, differentiability and integrability of uniformly convergent improper integrals of continuous • Line integral in R2, Green's theorem in R2, Surface Integral and Stokes Theorem • Volume integral and Gauss's divergence theorem • Basic properties of Euclidean distance function in Rn, Bolzano Weierstrass theorem; Cantor intersection theorem, Lindel of covering theorem. • Compact sets; Heine-Borel theorem; lnterrmediate value theorem; uniform continuity; discontinuities of real valued functions; • Jacobian; change in the order of partial derivatives, statements of Young's Theorem. Schwarz's Theorem and their applications, differentiation of composite functions; chain rule.
H-53: ***Differential Equations***	In this course the students will learn about Linear Equation of second and third order with constant coefficients. • Linear differential equations of second order with variable coefficient. • Homogenous equations, exact equations, normal form. • Method of Variation of Parameters. • Simultaneous Equations. • Total differential equations $Pdx + Qdy + Rdz = 0$ Students will also learn and understand about the theories of • Partial Differential Equations • Formation of Equation

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	• Solutions of linear equations • Lagrange's Method • Nonlinear Partial differential equation • Integral Surfaces, Orthogonal surfaces • Charpit's Method.
H-54 ***Advance Dynamics***	In this course students will learn about • Central forces, Central orbits, Motion on a rough cycloid, Central Conic, Reciprocal polar coordinates, pedal equations, apse, perihelion and aphelion; Kepler's Law of Planetary motion. Also, students will understand the concepts of • Moments and products of inertia, Momental ellipsoid, equimomental system, D'Alembert's Principle, General equations of motion, motion relative to the Centre of inertia. • Motion about a fixed axis, moment of the effective forces about the axis of rotation, expression for kinetic energy, moment of momentum about a fixed axis. Compound pendulum, interchangeability of Centre of suspension and Centre of oscillation, Motion in two-dimension, friction, kinetic energy in two dimensions, moment of momentum in two dimensions.
H 62: ***Advanced Algebra***	In this course students will learn about the topics on • Normal Subgroup, Conditions for a subgroup to be normal, Centre for a group, Quotient Group, homomorphism, Kernel and Image, Isomorphism, automorphism, inner automorphisms, rings. • Subrings, ideals, finite number of elements in commutative ring, principal ideals, maximal ideals, quotient rings, kernels, isomorphisms, homomorphism, correspondence theorem, Ideals in Zp, divisibility in integral domains, units, associates, prime elements, irreducible element, gcd, Euclidean domain, PID, UFD. Students will also learn and have and in-

	depth knowledge on topics like • Vector Spaces, Subspace, Homomorphism, Isomorphism theorems, Direct Sum, Linear Dependence, Linear Independence, basis, dimension, vector space axioms, rank and nullity of a linear transformation, matrix representation of a linear transformation, characteristic roots, characteristic vectors, characteristic polynomial, Cayley-Hamilton's Theorem.
HOPT-2: Operations Research	In this course students will learn about • Convex sets • Mathematical Formulation of LPP • Graphical Solution of LPP • Simplex Method • Transportation Problem • Assignment Problem • Markov Analysis • Theory of Games

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