Barrackpore Rastraguru Surendranath College

Teaching Plan

2022-23

Department of Mathematics
(General)

NAME OF THE PROGRAMME

B.SC. (General) IN MATHEMATICS

PROGRAMME OUTCOME

A student with B.Sc. (general) in Mathematics, will be able to:

- Pursue higher studies in different branches of Mathematics, along with related areas like Computer Science and Statistics;
- Develop a strong sense of logical reasoning;
- Model and solve real life problems using the subject knowledge;
- Present Mathematics clearly and precisely by making vague ideas precise by formulating them in the language of Mathematics.
- Join teaching profession in primary and secondary schools.
- Be employable for Government jobs, jobs in banking, insurance and investment sectors, data analyst jobs and jobs in various other public and private enterprises.

Notes:
You can merge cells in between and add students' seminars and class tests / internal assessment.
For incorporating PO / CO at UG level, you may refer to your WBSU CBCS syllabus.
If not there you can refer to the UGC model syllabus
https://www.ugc.ac.in/ugc_notices.aspx?id=MTA3Nw==

	Semester	**I**	
Course Title	**DifferentialCalculus**		
Course Code	**MTMGCOR01T**	**Credit**	**6**
Course Outcome	On completion of the course, a student will be able to : • Explain the relationship between the derivative of a function as a function and the notion of the derivative as the slope of the tangent line to a function at a point. • Compare and contrast the ideas of continuity and differentiability. • To inculcate to solve algebraic equations and inequalities involving the sequence root and modulus function • To able to calculate limits in inderminate forms by a repeated use of L' Hospital rule. • To know the claim rule and use it to find derivatives of composite functions. • To find maxima and minima, critical points and inflection points of functions and to determine the concarity of curves. • To able to evaluate integrals of rational functions by partial fractions.		

Scheme of Instruction					
Total Duration	6 Months	**Class/Week**	6	**Hours/week**	6
Instruction Mode	**Lecture**				

Scheme of Examination					
Maximum Score	75	**Internal**	25	**End Semester**	50

Course Mapping

Units	Course Content	Lecture Hour (Cumulative)
July	LimitandContinuity(εandδdefinition),Typesofdiscontinuities,Differentiabilityoffunctions,Successive differentiation. **Assignments & Internal Assessment.**	24
Aug.	Leibnitz's theorem, Partial differentiation, Euler's theorem on homogeneousfunctions. **Assignments & Internal Assessment.**	24
Sep.	Tangentsandnormals,Curvature,Asymptotes,Singularpoints,Tracingofcurves.Parametricrepresentation of curves and tracing of parametric curves. **Assignments & Internal Assessment.**	24
Oct.	Polar coordinates and tracing of curves in polarcoordinates. **Assignments & Internal Assessment.**	24
Nov.	Rolle'stheorem,MeanValuetheorems,Taylor'stheoremwithLagrange'sandCauchy'sformsofremainder. **Assignments & Internal Assessment.**	24
Dec.	Taylor's series, Maclaurin's series of sinx, cosx, e^x, log(l+x), $(l+x)^n$, Maxima and Minima,Indeterminate forms. **Assignments & Internal Assessment.**	24

		Semester	**II**		
Course Title	**DifferentialEquation**				
Course Code	**MTMGCOR02T**	**Credit**	**6**		
Course Outcome	On completion of the course, a student will be able to : • The main aim of the course is to introduce the students to the technique of solving various problems of engineering and science Distinguish between linear, nonlinear, partial and ordinary differential equations. • Solve basic application problems described by second order linear differential equations with constant coefficients. • Find power series solutions about ordinary points and singular points.				
Scheme of Instruction					
Total Duration	6 Months	**Class/Week**	6	**Hours/week**	6
Instruction Mode	**Lecture**				
Scheme of Examination					
Maximum Score	75	**Internal**	25	**End Semester**	50
Course Mapping					

Units	**Course Content**	**Lecture Hour (Cumulative)**

Jan.	First order exact differential equations. Integrating factors, rules to find an integrating factor. First orderhigher degree equationssolvable for x,y, p. **Assignments & Internal Assessment.**	24
Feb	Methods for solving higher-order differential equations.Basictheoryof linear differentialequations, Wronskian, and its properties. Solvingadifferential equation byreducingits order. **Assignments & Internal Assessment.**	24
March	Linear homogenous equations with constant coefficients, Linear non-homogenous equations, The methodofvariationofparameters, TheCauchy-Eulerequation,Simultaneousdifferentialequations,Totaldifferentialequations. **Assignments & Internal Assessment.**	24
April	Order and degree of partial differential equations, Concept of linear and non-linear partial differentialequations, Formation of first order partial differential equations. **Assignments & Internal Assessment.**	24
May	Linearpartialdifferentialequation offirstorder,Lagrange's method, Charpit's method. **Assignments & Internal Assessment.**	24
June	Classification of second order partial differential equations into elliptic, parabolic and hyperbolic throughillustrationsonly. **Assignments & Internal Assessment.**	24

	Semester	**III**	
Course Title	**RealAnalysis**		
Course Code	**MTMGCOR03T**	**Credit**	**6**
Course Outcome	On completion of the course, a student will be able to: • Describe the basic difference between the rational and real numbers. • Give the definition of concepts related to metric spaces such as continuity , compactness, convergent etc.		

	• Give the essence of the proof of Bolzano-weistrass theorem the contraction theorem as well as existence of convergent subsequence using equi-continuity. • Evaluate the limits of wide class of real sequences. • Determine whether or not real series are convergent by comparision with standard series or using the ratio test. • Understand and perform simple proofs. Students will be able to demonstrate basic knowledge of key topics in classical real analysis. • The course pervious the basic for further studies with in function analysis, topology & function Theory.

Scheme of Instruction					
Total Duration	6 months	**Class/Week**	6	**Hours/week**	6
Instruction Mode	**Lecture**				

Scheme of Examination					
Maximum Score	75	**Internal**	25	**End Semester**	50

Course Mapping

Units	Course Content	Lecture Hour (Cumulative)
July	Finite and infinite sets, examples of countable and uncountable sets. Real line, bounded sets, suprema andinfima, completeness property of R,Archimedean property of R, intervals. Concept of cluster points andstatementofBolzano-Weierstrass theorem. **Assignments & Internal Assessment.**	24
Aug.	Real Sequence, Bounded sequence, Cauchy convergence criterion for sequences. Cauchy's theorem onlimits, order preservation and squeeze theorem, monotone sequences and their convergence (monotoneconvergencetheorem	24

	without proof). **Assignments & Internal Assessment.**	
Sep.	Infinite series. Cauchy convergence criterion for series, positive term series, geometric series, comparisontest, convergence of p-series, **Assignments & Internal Assessment.**	24
Oct.	Root test, Ratio test, alternating series, Leibnitz's test(Tests of Convergencewithoutproof). Definition andexamples of absolute andconditionalconvergence. **Assignments & Internal Assessment.**	24
Nov.	Sequences and series of functions, Pointwise and uniform convergence. M_n-test, M-test, Statements of theresults about uniform convergence and integrability and differentiability of functions. **Assignments & Internal Assessment.**	24
Dec.	Power series andradiusof convergence. **Assignments & Internal Assessment.**	24

	Semester	**IV**	
Course Title	**Algebra**		
Course Code	**MTMGCOR04T**	**Credit**	**144**
Course Outcome	On completion of the course, a student will be able to : • Understand the combination of two important aspects of modern mathematics via Linear Algebra and classical Algebra. • Linear Algebra emphasizes the concept of vector spaces and linear transformations which are essential in simplifying various scientific problems. • It aims at inculcating problem solving skills within students to enable them compute large linear systems. • These tools are employed successfully in different branches of		

	engineering and physics (such as electromagnetic fields, fluid flow and gravitational fields).				
Scheme of Instruction					
Total Duration	6 months	**Class/ Week**	6	**Hours/week**	6
Instruction Mode	**Lecture**				
Scheme of Examination					
Maximum Score	75	**Internal**	25	**End Semester**	50

Course Mapping

Units	Course Content	Lecture Hour (Cumulative)
Jan.	Equivalencerelationsandpartitions,Functions,Compositionoffunctions,Invertiblefunctions,Onetoonecorrespondence and cardinality of a set. Definition and examples of groups, examples of abelian and non-abelian groups. **Assignments & Internal Assessment.**	24
Feb.	The group $Z_n$of integers under addition modulo n and the group U(n) of units undermultiplication modulo n. Cyclic groups from number systems, complex roots of unity, circle group, thegeneral lineargroup $GL_n(n,R)$, groups of symmetries of (i) an isosceles triangle, (ii) an equilateraltriangle,(iii)arectangle,and(iv)asquare,the permutationgroupSym(n),Group ofquaternions.	24

	Assignments & Internal Assessment.	
March	Subgroups, cyclic subgroups, the concept of a subgroup generated by a subset and thecommutatorsubgroup of group, examples of subgroups including the center of a group. **Assignments & Internal Assessment.**	24
April	Cosets, Index of subgroup,Lagrange'stheorem,orderofanelement,Normalsubgroups:theirdefinition,examples,andcharacterizations,Quotient groups. **Assignments & Internal Assessment.**	24
May	Definition and examples of rings, examples of commutative and non-commutative rings: rings fromnumber systems, Z_n the ring of integers modulo n, ring of real quaternions, rings of matrices. **Assignments & Internal Assessment.**	24
June	Polynomialrings, and rings of continuous functions. Subrings and ideals, Integral domains and fields, examples offields:Z_p, Q, R, andC. Field ofrational functions. **Assignments & Internal Assessment.**	24

	Semester	**V**	
Course Title	**Matrices**		
Course Code	**MTMGDSE01T**	**Credit**	**6**
Course Outcome	On completion of the course, a student will be able to : Describe systems of linear or differential equations, as well as representing a linear application.		
Scheme of Instruction			

Total Duration	6 months	**Class/Week**	6	**Hours/week**	6
Instruction Mode	**Lecture**				
Scheme of Examination					
Maximum Score	75	**Internal**	25	**End Semester**	50

Course Mapping

Units	Course Content	Lecture Hour (Cumulative)
July	R, R_2, R_3 as vector spaces over R. Standard basis for each of them. Concept of Linear Independence andexamplesof different bases.Subspaces of R_2, R_3. **Assignments & Internal Assessment.**	24
Aug.	Translation, Dilation, Rotation, Reflection in a point, line and plane. Matrix form of basic geometrictransformations.Interpretation of eigen values and eigen vectors for such transformations and eigenspacesas invariant subspaces. **Assignments & Internal Assessment.**	24
Sep.	Types of matrices. Rank of a matrix. Invariance of rank under elementary transformations. Reduction tonormalform. **Assignments & Internal Assessment.**	24
Oct.	Solutionsoflinear homogeneousandnon homogeneous Equationswithnumberofequationsand unknownsupto four.	24

	Assignments & Internal Assessment.	
Nov.	Matrices in diagonal form. Reduction to diagonal form upto matrices of order 3. Computation of matrixinverses using elementary row operations. Rank of matrix. **Assignments & Internal Assessment.**	24
Dec.	Solutions of a system of linear equations usingmatrices. Illustrative examples of above concepts from Geometry, Physics, Chemistry, Combinatorics andStatistics. **Assignments & Internal Assessment.**	24

Semester	**V**		
Course Title	**Mechanics**		
Course Code	**MTMGDSE02T**	**Credit**	**6**
Course Outcome	On completion of the course, a student will be able to • describe necessary conditions for the equilibrium of particles acted upon by various forces and learn the principle of virtual work for a system of coplanar forces acting on a rigid body; • determine the centre of gravity of some materialistic systems and discuss the equilibrium of a uniform cable hanging freely under its own weight; • solve problems about the kinematics and kinetics of the rectilinear and planar motions of a particle including the constrained oscillatory motions of particles; learn that a particle moving under a central force describes a plane curve and know the Kepler's laws of the planetary motions.		
Scheme of Instruction			

Total Duration	6 months	**Class/Week**	6	**Hours/week**	6
Instruction Mode	**Lecture**				
Scheme of Examination					
Maximum Score	75	**Internal**	25	**End Semester**	50

Course Mapping

Units	Course Content	Lecture Hour (Cumulative)
July	Conditions of equilibrium of a particle and of coplanar forces acting on a rigid Body. **Assignments & Internal Assessment.**	24
Aug.	Laws of friction,Problems of equilibrium under forces including friction. **Assignments & Internal Assessment.**	24
Sep.	Centre of gravity, Work and potential energy **Assignments & Internal Assessment.**	24
Oct.	Velocity and acceleration of a particle along a curve: radial and transverse components (plane curve). **Assignments & Internal Assessment.**	24
Nov.	Velocity and acceleration of a particle along a curve: radial and transverse components (plane curve). **Assignments & Internal Assessment.**	24
Dec.	Velocity and acceleration of a particle along a curve: radial and transverse components (plane curve). **Assignments & Internal Assessment.**	24

		Semester	**VI**		
Course Title	**NumericalMethods**				
Course Code	**MTMGDSE03T**	**Credit**	**144**		
Course Outcome	On completion of the course, a student will be able to: • Solve an algebraic or transcendental equation using an appropriate numerical method . • Approximate a function using an appropriate numerical method. • Solve a differential equation using an approximate numerical method. • Evaluate a derivative at a value using an appropriate numerical method. • Solve a linear system of equations using an appropriate numerical method. • Perform an error analysis for a given numerical method. • Prove results for numerical root finding methods. • Calculate a definite integral using an appropriate numerical method. • Code a numerical method in a modern computer language.				
Scheme of Instruction					
Total Duration	6 months	**Class/Week**	6	**Hours/week**	6
Instruction Mode	**Lecture**				
Scheme of Examination					

Semester	**VI**

Maximum Score	75	**Internal**	25	**End Semester**	50

Course Mapping

Units	Course Content	Lecture Hour (Cumulative)
Jan.	Algorithms,Convergence,Bisectionmethod,Falsepositionmethod,Fixed pointiterationmethod. **Assignments & Internal Assessment.**	24
Feb.	Newton's method, Secant method, LU decomposition, Gauss-Jacobi, Gauss-Siedel and SOR iterativemethods. **Assignments & Internal Assessment.**	24
March	LagrangeandNewtoninterpolation:linearandhigherorder,finitedifferenceoperators. **Assignments & Internal Assessment.**	24
April	Numericaldifferentiation: forward difference, backward difference and central Difference. **Assignments & Internal Assessment.**	24
May	Integration: trapezoidalrule,Simpson's rule, Euler's methodfor solvingordinarydifferentialequations. **Assignments & Internal Assessment.**	24
June	**Assignments & Internal Assessment.**	24

Course Title	**LinearProgramming**				
Course Code	**MTMGDSE04T**		**Credit**		**6**
Course Outcome	On completion of the course, a student will be able to • analyse and solve linear programming models of real life situations; • provide graphical solutions of linear programming problems with two variables, and illustrate the concept of convex set and extreme points; • apply the simplex method to solve LPP's; • describe the relationships between the primal and dual problems; describe the applications of transportation, assignment and two-person zero-sum game problems.				
Scheme of Instruction					
Total Duration	6 months	**Class/Week**	6	**Hours/week**	6
Instruction Mode	**Lecture**				
Scheme of Examination					
Maximum Score	75	**Internal**	25	**End Semester**	50

Course Mapping

Units	Course Content	Lecture Hour (Cumulative)
Jan.	Linear Programming Problems, Graphical Approach for solving some Linear	24

	Programs. **Assignments & Internal Assessment.**	
Feb.	Convex Sets,Supporting and Separating Hyperplanes. Theory of simplex method **Assignments & Internal Assessment.**	24
March	Optimality and unboundedness, thesimplexalgorithm,simplexmethodintableauformat,introductiontoartificialvariables **Assignments & Internal Assessment.**	24
April	Two-phasemethod,Big-M method and theircomparison. **Assignments & Internal Assessment.**	24
May	Duality, formulation of the dual problem, primal- dual relationships, economic interpretation of the dual, **Assignments & Internal Assessment.**	24
June	Sensitivityanalysis **Assignments & Internal Assessment.**	24