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SACRED HEART COLLEGE (AUTONOMOUS)

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A Don Bosco Institution of Higher Education, Founded in 1951 * Affiliated to Thiruvalluvar University, Vellore * Autonomous since 1987

Accredited by NAAC (4th Cycle – under RAF) with CGPA of 3.31 / 4 at 'A+' Grade

Name of the Programme: MSc. Mathematics

S No	Title of the Paper	Course Code	Course Objectives	Course Outcomes	Relevance
1	ABSTRACT ALGEBRA	M745	<ul style="list-style-type: none">To study the transformations, Extension Fields and algebraic extensions, Finite Fields and Sylow's theorems, Finite Simple groups, Symmetry groups and Cayley digraphs of groups and Galois Theory in Vector Space	<ul style="list-style-type: none">prove theorems applying algebraic ways of thinking.connect groups with graphs and understanding about Hamiltonian graphs.compose clear and accurate proofs using the concepts of Galois Theory.bringout insight into Abstract Algebra with focus on axiomatic theories.demonstrate knowledge and understanding of fundamental concepts including extension fields, Algebraic extension, Finite fields, Class equations and Sylow's theorem.	Global
2	REAL ANALYSIS	M746	<ul style="list-style-type: none">To study the real number system, Functions of Bounded Variation and Rectifiable, Riemann–Stieltjes integral, Lebesgue Integral and Square Space	<ul style="list-style-type: none">analyze and evaluate functions of bounded variation and Rectifiable Curves.describe the concept of Riemann–Stieltjes integral and its properties.demonstrate the concept of step function, upper function, Lebesgue function and their integrals.	Global

				<ul style="list-style-type: none"> • construct various mathematical proofs using the properties of Lebesgue integrals and establish the Levi monotone convergence theorem. • formulate the concept and properties of inner products, norms and measurable functions. 	
3	ORDINARY DIFFERENTIAL EQUATIONS	M747	<ul style="list-style-type: none"> • To study the Differential equation of higher order, to find the power series solution of special type of Differential equations, to solve the system of linear Differential equations, to study existence and uniqueness of the solutions, boundary value problems. 	<ul style="list-style-type: none"> • establish the qualitative behavior of solutions of systems of differential equations. • recognize the physical phenomena modeled by differential equations and dynamical systems. • analyze solutions using appropriate methods and give examples. • formulate Green's function for boundary value problems. • Understand and use various theoretical ideas and results that underlie the mathematics in this course. 	Global
4	MATHEMATICAL STATISTICS	M748	<ul style="list-style-type: none"> • To study and apply sampling theory, significance tests, estimation, testing of hypothesis and design of experiments 	<ul style="list-style-type: none"> • understand Sampling and Sampling distributions. • illustrate the methods of finding Estimators • determine Parametric point and Interval Estimation. • perform hypothesis testing , justify hypothesis testing to Sampling problems and to determine confidence Intervals. • define the basic terms used in design of experiments and use appropriate experimental designs to analyze the experimental data. 	Global

5	DIFFERENTIAL GEOMETRY	M749A	<ul style="list-style-type: none"> This course introduces space curves and their intrinsic properties of a surface and geodesics. Further the non – intrinsic properties of surfaces are explored 	<ul style="list-style-type: none"> explain space curves, Curves between surfaces, metrics on a surface, fundamental form of a surface and Geodesics. evaluate these concepts with related examples. compose problems on geodesics recognize applicability of developables construct and analyze the problems on curvature and minimal surfaces 	Global
6	SKILL ENHANCEMENT COURSE I – ALGEBRA	M749B	<ul style="list-style-type: none"> To develop broad and balanced knowledge and understanding of definitions, concepts, theorems and principles. To enhance the ability of learners to apply the knowledge and skills acquired by them during the programme to solve specific theoretical and applied problem in Mathematics. To empower students to crack competitive examinations such as NET, SET and TRB and to complement the theoretical content of the subject with exercise problems. 	<ul style="list-style-type: none"> disseminate new and innovative knowledge that will make them fit for any competitions in job opportunities. apply new tangents or to exercise their knowledge and skill in other disciplines. develop, prioritize, demonstrate display, and disseminate newer versions and to interpret in novel ways. bringout the flair for new and continuous learning process. build the dexterity. 	Global
7	CODING THEORY	M749C	<ul style="list-style-type: none"> To provide students with elementary knowledge of theory of error correcting codes and readable introduction to mathematical aspect of coding 	<ul style="list-style-type: none"> describe and justify the concept of linear codes and error correcting codes. perform encoding and decoding using linear codes. construct and decode BCH code. summarize different types of codes. solve linear coding theory problems 	Global

8	ADVANCED LINEAR ALGEBRA	M848	<ul style="list-style-type: none"> To give the students a thorough knowledge of the various aspects of Linear Algebra. To train the students in problem-solving as a preparatory for competitive exam 	<ul style="list-style-type: none"> understand linear transformations and represent in matrix form. compute minimal polynomial and characteristic polynomial of linear transformation. find applicability of the inner product spaces. outline and formulate the theory of the course to solve variety of problems at an appropriate level of difficulty examine bi-linear and Jordan canonical forms. 	Global
9	PARTIAL DIFFERENTIAL EQUATIONS	M849	<ul style="list-style-type: none"> To develop skills in solving partial differential equations. 	<ul style="list-style-type: none"> recognize the major classification of PDEs and the qualitative differences between the classes of equations. demonstrate modeling assumptions and derivations that lead to PDEs. becrtically competent in solving linear PDEs using classical solution methods. Use knowledge of partial differential equations for modelling the general structure of solutions and using analytic methods for solutions. investigate and solve boundary values problems and point out its significance 	Global
10	ADVANCED GRAPH THEORY	M850	<ul style="list-style-type: none"> To understand the concept of graphs, sub graphs, trees, connectivity, Euler tour, Hamilton cycle, matching, colouring of graphs, independent set, cliques, vertex colouring and planar graphs. 	<ul style="list-style-type: none"> understand basic concepts in Graph theory apply the understanding and use it to model real life situations. apply the concepts of connectivity, Euler and Hamilton cycles in the real life situations. identify and develop the applications of planarity and colourability. create graph models in network and computing 	Global

11	CLASSICAL DYNAMICS	M851	<ul style="list-style-type: none"> To study mechanical systems under generalized coordinate, virtual work, energy and momentum, also to study the mechanics developed by Newton, Lagrange, Hamilton and Jacobi. 	<ul style="list-style-type: none"> demonstrate the knowledge of core principles in mechanics interpret and consider complex problems of classical dynamics in a systematic way apply the variation principle for real physical situations explore different applications of these concepts in the mechanical and electromagnetic fields. describe and apply the concept of Angular momentum, Kinetic energy and Moment of inertia of a particle. 	Global
12	MATHEMATICAL MODELS IN BIOLOGY	M852A	<ul style="list-style-type: none"> This Course aims to explore the potential of Mathematical Modeling among the Students and in emphasizing the role of Mathematical Models in Biology and Medicine. 	<ul style="list-style-type: none"> describe standard modeling procedures, which involve observations of a natural system, the development of a numeric and or/analytical model. analyze the model through analytical and graphical solutions and/or statistical analysis. distinguish between two species and multi species models. formulate stochastic and deterministic models. construct and evaluate concrete examples in pharmacokinetics 	Global
13	SKILL ENHANCEMENT COURSE II – LINEAR ALGEBRA	M852B	<ul style="list-style-type: none"> To develop broad and balanced knowledge and understanding of definitions, concepts, theorems and principles. To enhance the ability of learners to apply the knowledge and skills acquired by them during the programme to solve specific theoretical and applied problem in Mathematics. 	<ul style="list-style-type: none"> disseminate new and innovative knowledge that will make them fit for any competitions in job opportunities. analyze new tangents or to exercise their knowledge and skill in their own disciplines. develop, give examples, demonstrate display, and disseminate newer versions and to interpret in novel ways. 	Global

			<ul style="list-style-type: none"> To empower students to crack competitive examinations such as NET, SET and TRB and to complement the theoretical content of the subject with exercise problems 	<ul style="list-style-type: none"> bring out the flair for new and continuous learning process. build the dexterity. 	
14	NUMERICAL ANALYSIS	M852C	<ul style="list-style-type: none"> To provide the student an understanding of the basic principles of numerical methods and to apply them in solving algebraic equations and ordinary differential equations numerically; To introduce various difference operators to enable the students to apply them in interpolation and numerical differentiation and integration. 	<ul style="list-style-type: none"> Understand the need for numerical methods in real life situations. Apply the methods to solve problems and find the size errors in each method. critically analyse the accuracy of each method in solving algebraic, transcendental system of equations. identify and implement numerical methods in various physical problems and find its efficacy in real life. develop and demonstrate the theoretical and practical aspects of numerical methods. 	Global
15	CERTIFICATE COURSE - R LANGUAGE FOR STATISTICS	M847X	<ul style="list-style-type: none"> To introduce to the students the novel applications of R language and to give them a hands on experience of working with data 	<ul style="list-style-type: none"> explain practical implications of expectation and variance and how they predict the shapes of distribution and density (mass) functions of a random variable demonstrate capability to write programming codes for plotting different distributions. evaluate the independence of attributes and design of experiments. describe and apply probability distribution function and different types of distributive functions through R Language. know and understand about Tests of Hypothesis through R. 	Global

16	SELF-STUDY PAPER – FORMAL LANGUAGES AND AUTOMATA	M845X	<ul style="list-style-type: none"> To obtain knowledge about finite automata, regular expressions and regular grammars, properties of context free languages 	<ul style="list-style-type: none"> understand basic concepts in Lattices , formal language and automata theory demonstrate abstract models of computing, including deterministic (DFA), non-deterministic (NFA), Push Down Automata(PDA) relate practical problems to languages and automata design grammars and recognizers for different formal languages Identify and formalate the structure of a given formal language using regular expressions and context - free grammars 	Global
17	ADVANCED BUSINESS STATISTICS FOR MANAGEMENT		<ul style="list-style-type: none"> To impart the knowledge to analyze the data using statistical techniques, such as hypothesis testing and regression estimation 	<ul style="list-style-type: none"> describe the concept of a random variable and its probability distributions. compute and interpret the correlation and regression analysis. analyze probability distribution (discrete and continuous) to a variety of problems in various diversified fields. draft various methods for testing of hypothesis. develop strategies using mathematical methods to solve real world problems 	Global
18	ADVANCED BUSINESS STATISTICS (FOR M.COM)	MBA134T	<ul style="list-style-type: none"> To apply statistical techniques for interpreting and drawing conclusion for business problems. 	<p>This course will enable the students to:</p> <ul style="list-style-type: none"> understand the concept of a random variable and its probability distributions. compute and interpret partial and multiple correlation. apply probability distribution (discrete and continuous) to a variety of problems in various diversified fields. discuss the different methods of testing of hypothesis 	Global

19	MATHEMATICAL FOUNDATIONS (FOR M.SC. COMPUTER SCIENCE)	MCS150T	<ul style="list-style-type: none"> To impart the knowledge of the concepts needed to test the logic of program, understanding in Identifying structures, properties of languages and Optimization method. 	<p>This course will enable the students to:</p> <ul style="list-style-type: none"> understand the concept of testing the mathematical logic. construct FA, DFA and NFA. have an in-depth study of Transportation and Assignment problems. understand PERT-CPM technique for project management and to construct network diagram. Time schedule Resource levelling with probability and cost consideration. discuss the various methods for testing of hypothesis. explore the knowledge of graph theoretical concepts. 	Global
20	QUANTITATIVE TECHNIQUES FOR BUSINESS DECISIONS (FOR M.COM)		<ul style="list-style-type: none"> To apply OR techniques for interpreting and drawing conclusion for business problems. 	<p>This course will enable the students to:</p> <ul style="list-style-type: none"> develop and solve LPP models using graphical and simplex method. have an in-depth study of Transportation and Assignment problems. understand the meaning of inventory control as well as various forms and functional role of inventory. understand and use PERT-CPM technique for project management and to construct network diagram. Time schedule Resource levelling with probability and cost consideration 	Global
21	OPTIMIZATION TECHNIQUES (FOR MCA)	MCA240T	<ul style="list-style-type: none"> To obtain knowledge on linear programming problems, transportation problems, assignment problems, inventory models, queuing models, project management and Game theory problems 	<ul style="list-style-type: none"> develop LPP models and find solutions using graphical and simplex method. understand the meaning of inventory control as well as various forms and functional role of inventory. identify and examine situations that generate queueing problems and to analyze 	Global

				<p>a variety of performance measure of a queueing systems.</p> <ul style="list-style-type: none"> • employ and evaluate PERT-CPM technique for project management and to construct network diagram. Time schedule Resource levelling with probability and cost consideration. • outline the principles of two person zero sum games and to apply graphical method and use linear programming approach to compute the value of the game. 	
22	APPLIED OPERATIONS RESEARCH FOR MANAGEMENT (FOR MBA	MBA235T	<ul style="list-style-type: none"> • To impart the knowledge of quantitative methods used in linear programming problems, transportation problems, assignment problems, project management, game theory problems, replacement and maintenance 	<ul style="list-style-type: none"> • develop LPP models and find solutions using graphical and simplex method. • understand the meaning of inventory control as well as various forms and functional role of inventory. • identify problems on Transportation and Assignment problems.. • employ and evaluate PERT-CPM technique for project management and to construct network diagram. Time schedule Resource levelling with probability and cost consideration. • outline the meaning of decision theory and the principles of two person zero sum games and to apply graphical method and use linear programming approach to compute the value of the game. 	Global
23	MATHEMATICAL FOUNDATIONS (TO M.SC. SOFTWARE TECHNOLOGY)	MCS150T	<ul style="list-style-type: none"> • To impart the knowledge of the concepts needed to test the logic of program, understanding in Identifying structures, properties of languages and Optimization method. 	<p>This course will enable the students to:</p> <ul style="list-style-type: none"> • understand the concept of logic and propositional calculus and study basic logical operations. • construct FA, DFA and NFA. • have an in-depth study of Transportation and Assignment problems. 	Global

				<ul style="list-style-type: none"> • understand PERT-CPM technique for project management and to construct network diagram. Time schedule Resource levelling with probability and cost consideration. • discuss the various methods for testing of hypothesis. • explore the knowledge of graph theoretical concepts. 	
24	MATHEMATICAL ANALYSIS	M953	<ul style="list-style-type: none"> • To study and analyze the real number system, Fourier series, Fourier Integral, multivariable calculus, Cauchy Theorem and Residue Calculus 	<ul style="list-style-type: none"> • understand and describe the basic concepts of Fourier series and Fourier integrals with respect to orthogonal system. • analyze the representation and convergence problems of Fourier series. • analyze and evaluate the differences between transforms of various functions • formulate and evaluate complex contour integrals directly and by the fundamental theorem. • apply the Cauchy integral theorem in its various versions to compute contour integration. 	Global
25	TOPOLOGY	M954	<ul style="list-style-type: none"> • To develop student's topological and proof writing skills which are essential in the study of advanced mathematics, understand the concepts of topological spaces, analyze and synthesize proofs, understanding the concepts of connectedness and compactness 	<ul style="list-style-type: none"> • define and illustrate the concept of topological spaces and the basic definitions of open sets, neighbourhood, interior, exterior, closure and their axioms for defining topological space. • Understand continuity, compactness, connectedness, homeomorphism and topological properties. • analyze and apply the topological concepts in Functional Analysis. • Ability to determine that a given point in a topological space is either a limit point or not for a given subset of a topological space. 	Global

				<ul style="list-style-type: none"> develop qualitative tools to characterize connectedness, compactness, second countable, Hausdorff and develop tools to identify when two are equivalent (homeomorphic). 	
26	FLUID DYNAMICS	M956	<ul style="list-style-type: none"> This course aims to provide basic knowledge in kinematics of fluids in motion, equations of motion of a fluid, three dimensional flows and viscous flows. 	<ul style="list-style-type: none"> Bring out the basic knowledge in Kinematics of fluids in motion. understand the meaning of two dimensional and three dimensional flow and related problems. analyze simple fluid flow problems (flow between parallel plates, flow through pipe etc.) with Navier-Stoke's equation of motion. construct and evaluate problems based on two and three dimensional flow. interpret the real life application of the concepts. 	Global
27	NONLINEAR DYNAMICAL SYSTEMS	M957A	<ul style="list-style-type: none"> To learn and apply phase plane analysis and stability techniques to problems in Science and technology. 	<ul style="list-style-type: none"> understand phase plane analysis and stability techniques to evaluate problems in Science and technology. describe these concepts with examples. propose and solve interesting examples of Dynamical Systems establish stability results point out the importance of modelling physical systems 	Global
28	SKILL ENHANCEMENT COURSE III – REAL ANALYSIS	M957B	<ul style="list-style-type: none"> Empowering students to crack competitive examinations such as NET, SET and TRB. To complement the theoretical content of the subject with exercise problems. 	<ul style="list-style-type: none"> apply the theoretical knowledge in solving problems. attempt competitive examinations such as NET, SET and TRB. Extend their knowledge of Lebesgue theory of integration by selecting and applying its tools for further research in this and other related areas 	Global

				<ul style="list-style-type: none"> Recognize the need of concept of measure from a practical view point. Understand the nature of abstract mathematics and explore the concepts in further details. 	
29	MATHEMATICAL PHYSICS	M957C	<ul style="list-style-type: none"> This course intends to introduce applications of various mathematical techniques to problems of Theoretical Physics. Examples could be chosen from all 4 traditional divisions of Modern Fundamental Theoretical Physics – Classical Mechanics, Electrodynamics, Quantum Mechanics and Statistical Physics. 	<ul style="list-style-type: none"> describe and employ the concepts of Gradient, Divergence, Curl and their typical applications in Physics. prioritize special functions like Gamma function, Beta function, Dirac function, Delta function, Bessel function and their relations. Illustrate Lagrangian and Hamiltonian approaches in classical mechanics. adapt to tensors in physics. evaluate special type of matrices that are relevant in Physics. 	Global
30	CERTIFICATE PROGRAMME – LATEX FOR MATHEMATICS	M951X	<ul style="list-style-type: none"> To train students in the preparation of projects and dissertations using LaTeX 	<ul style="list-style-type: none"> define preamble for preparation of documents with paragraphs and sections understand basic typesetting mathematical expressions and numbered equations explain and demonstrate different packages and construct tables and insert figures in the document. find and resolve errors that occurs. compile the source file to get expected output form as required. 	Global
31	CERTIFICATE COURSE – MATHEMATICS FOR COMPETITIVE	M952X	<ul style="list-style-type: none"> To prepare the students for competitive examinations 	<ul style="list-style-type: none"> make critique of quantitative information using proportional reasoning Interpret and compare weighted averages, indices, ranking. identify uses and misuses of percentages related to a proper understanding of the bases. 	Global

	EXAMINATIONS – I (IDC)			<ul style="list-style-type: none"> examining and estimating percentages as rates per 100 solve for an unknown quantity in proportional situation 	
32	COMPLEX FUNCTION THEORY	M1049	<ul style="list-style-type: none"> To study the Maximum Principle, Schwarz Lemma, Evaluation of Certain Integrals, Analytic Continuation, Representation of Meromorphic and Entire Functions and Mapping Theorems. 	<ul style="list-style-type: none"> develop the maximum assistance in mastering the fundamental concepts and techniques of Complex Function Theory. establish Maximum principle, Schwarz lemma and Liouville's theorem. evaluate different Types of Integral. examine interesting results concerning certain mapping problems between domains. understand and analyze the concept of Analytic Continuation. 	Global
33	FUNCTIONAL ANALYSIS	M1050	<ul style="list-style-type: none"> To provide students with a strong foundation in functional analysis, focusing on spaces, operators and fundamental theorems. To develop student's skills and confidence in mathematical analysis and proof techniques. 	<ul style="list-style-type: none"> understand the Banach spaces and Transformations on Banach Spaces. prove Hahn Banach theorem and open mapping theorem. describe operators and fundamental theorems. validate orthogonal and orthonormal sets. Analyze and establish the regular and singular elements. 	Global
34	DIFFERENCE EQUATIONS	M1051	<ul style="list-style-type: none"> To introduce the process of discretization, discrete version of Differential Equations, oscillation and the asymptotic behaviour of solutions of certain class of difference equations. Solving difference equations using z-transforms is stressed 	<ul style="list-style-type: none"> define the basic concepts of difference equations. calculate solutions of linear difference equations. solve difference equations using z-transforms. explain the oscillatory behaviour of difference equations. 	Global

				<ul style="list-style-type: none"> analyze and evaluate the asymptotic behaviour of solutions of certain class of difference equations. 	
35	STOCHASTIC PROCESSES	M1052A	<ul style="list-style-type: none"> To introduce to the students the basic ideas of Stochastic processes, Markov chains, Markov process and Renewal process and to motivate research in these areas 	<ul style="list-style-type: none"> demonstrate the basic concepts of Stochastic process, Markov chains. identify the type of the distribution apply the concepts in practical problems compose and evaluate simple Markovian Queueing models. analyze and evaluate renewal equations 	Global
36	SKILL ENHANCEMENT COURSE IV– COMPLEX ANALYSIS	M1052B	<ul style="list-style-type: none"> Empowering students to crack competitive examinations such as NET, SET and TRB. To complement the theoretical content of the subject with exercise problems 	<ul style="list-style-type: none"> analyze and solve problems on Analytic functions, Power Series and Complex Integration. Illustrate Conformal Mappings, Mobius Transformation and solve related problems. identify Singularities and derive Laurent's series formulate Residue Theorem in Contour Integration. analyze and evaluate problems based on Rouche's Theorem 	Global
37	THEORY OF TRANSFORMS	M1052C	<ul style="list-style-type: none"> To impart the basic knowledge of principles of Fourier series and Z-Transforms; To give different techniques to solve integral problems using Transforms 	<ul style="list-style-type: none"> summarize knowledge of various mathematical concepts and techniques required for successful application of mathematics in physics and related sciences examine application of Z-transform. solve differential & integral equations with initial conditions using Laplace transform. analyze and evaluate the Fourier transform of a continuous function and be familiar with its basic properties. validate solution of integral equation and their application. 	Global

38	CERTIFICATE COURSE – MATHEMATICS FOR COMPETITIVE EXAMINATIONS – II (IDC)	M1048X	<ul style="list-style-type: none"> Quantitative Aptitude Tests evaluate numerical ability and problem solving skills of candidates. This test forms the major part of a number of important entrance exams for different fields. CAT, MAT, XAT, and GMAT and many other significant exams have Quantitative Aptitude as a major section. Many companies use it in their selection procedure. Topics that may be included in different exams are: 	<ul style="list-style-type: none"> make critique of quantitative information using proportional reasoning interpret and compare the statements for verification of truth. identify suitable methods for providing analytical reasoning. examining and estimating simple and compound interest solve problems and provide suitable graphical representation. 	Global
39	STATISTICAL AND NUMERICAL METHODS (FOR MCA)		<ul style="list-style-type: none"> This course aims at providing the necessary basic concepts of a few statistical and numerical methods and give procedures for solving numerically different kinds of problems occurring in engineering and technology 	<ul style="list-style-type: none"> analyze various methods for testing of hypothesis. understand numerical methods for finding the solution of some problems upto a desired degree of accuracy. identify the numerical problems to be more competitive in computation. employ numerical methods for approximation. evaluate and formulate solutions of equations and eigen value problems. 	Global
40	QUANTITATIVE APTITUDE TECHNIQUES (FOR MCA)		<ul style="list-style-type: none"> To obtain aptitude skills and to solve quantitative problems. 	<ul style="list-style-type: none"> make critique of quantitative information using proportional reasoning interpret and compare weighted averages, indices, ranking. define interests and calculate simple and compound interest. examining and estimating percentages as rates per 100 solve for an unknown quantity in proportional situation 	Global