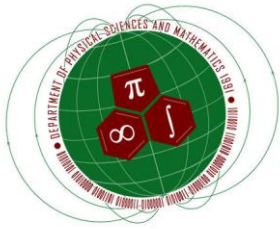


**DEPARTMENT OF PHYSICAL SCIENCES AND MATHEMATICS
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UNIVERSITY OF THE PHILIPPINES MANILA**



**Bachelor of Science in Computer Science
Course Description**

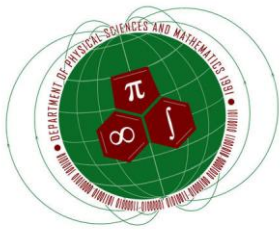
Course Code	Course Title	Course Description	Prerequisite	Credit
Chem 32	Chemistry of Biomolecules	Introduction to the basic principles of organic chemistry and biochemistry; genomics and bioinformatics results and methodologies		3 u. (2 u. lec. + 1 u. lab.)
CMSC 11	Introduction to Computer Science	Introduction to the major areas of computer science; software systems and methodology; computer theory, computer organization and architecture. Students learn to write programs using high-level block-structured programming language	None	3 u. (2 u. lec. + 1 u. lab.)
CMSC 21	Fundamentals of Programming	Expansion and development of material introduced in CMSC 11; processing of files and linked-lists; programming in the C language; recursion systematic program development; top-down design and program verification	CMSC 11	3 u. (2 u. lec. + 1 u. lab.)
CMSC 23	Object-Oriented Programming Paradigms	Object-oriented design, class hierarchy design for modeling, classes dynamic dispatch; subtyping and subtype polymorphism; behavioral replacement; object-oriented idioms for encapsulation; private fields; abstract base classes; using collection classes, iterators and other common library components	CMSC 21	3 u. (2 u. lec. + 1 u. lab.)
CMSC 55	Discrete Mathematical Structures in Computer Science	Principles of logic and set theory, combinatorics, discrete probability, recurrence relations, graph theory, algebraic systems and their applications in computer science	Math 17 CMSC 11 Philo I	4 u.
CMSC 121	Web Programming	Web programming languages; web platform constraints; Software-as-a-Service web applications	CMSC 23	3 u. (2 u. lec. + 1 u. lab.)
CMSC 122	Human Computer Interaction	Fundamental theoretical issues dealing with principles of human perception and visual representation; systematic approaches to the design and analysis of user interfaces	CMSC 121	3 u. (2 u. lec. + 1 u. lab.)
CMSC 123	Data Structures	Abstract data types and their implementations; lists, stacks, queues, trees, mappings, sets and graphs; searching and sorting techniques; dynamic storage managements	CMSC 21 CMSC 55	3 u. (2 u. lec. + 1 u. lab.)
CMSC 124	Design and Implementation of Programming Languages	Study of the fundamental concepts in the design and implementation of current high-level programming languages; syntax and translation; language definition structures; elementary and structured data types;	CMSC 23 CMSC 123	3 u. (2 u. lec. + 1 u. lab.)



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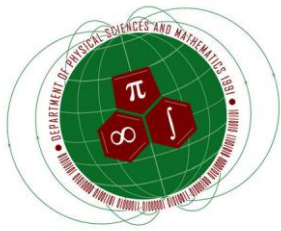
		abstraction mechanisms; sequence and data control; runtime considerations		
CMSC 125	Operating Systems	Processor management, memory management, file and disk management, resource management, networks and distributed systems	CMSC 123	3 u. (2 u. lec. + 1 u. lab.)
CMSC 127	Database Systems	Database concepts; relational algebra & calculus; query optimization; object-oriented databases. Database recovery & security. Survey of database management systems with emphasis on biomedical databases. Distributed databases. C/S systems.	CMSC 23	3 u. (2 u. lec. + 1 u. lab.)
CMSC 128.1	Software Engineering I	Application of sound engineering principles in software systems; Software Development Life Cycle (SDLC); Requirement analysis and specification, design, construction testing, deployment, operation and maintenance. Design patterns and frameworks in software development	CMSC 121 CMSC 127	3 u. (2 u. lec. + 1 u. lab)
CMSC 128.2	Software Engineering II	Basic rudiments of engineering methodologies applied to software development; Current techniques used in the IT industry in design and analysis of software systems	CMSC 128.1	3 u. (2 u. lec. + 1 u. lab.)
CMSC 130	Logic Design and Digital Computer Circuits	Data representation and computer arithmetic, logic functions and equations; description, analysis and design of combinatorial and sequential circuits; functional properties of digital integrated circuits	CMSC 55	3 u. (2 u. lec. + 1 u. lab.)
CMSC 135	Computer Organization and Architecture	Computer architecture design and concepts; design and utilization of high performance computing systems; instruction set architecture, performance evaluation, pipeline microprocessor, cache and memory, multiprocessor & parallel computing, interconnection network, and embedded systems.	CMSC 21 CMSC 130	3 u. (2 u. lec. + 1 u. lab.)
CMSC 138	Computer Networking	Network models and layers; terminal and file transfer protocols; message handling protocols; concurrency; network interconnection; distributed computation; overview of networking and communication software.	CMSC 125	3 u. (2 u. lec. + 1 u. lab.)
CMSC 141	Automata and Language Theory	Finite automata and regular languages. Pushdown automata and context-free languages; Turing machines and recursively enumerable sets; linear bounded automata and context-free languages; computability and the halting	CMSC 124	3 u.



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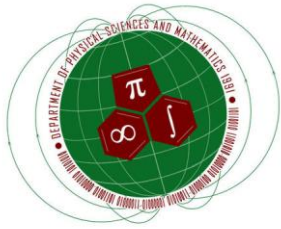
		problem; undecided problems; recursive functions and computational complexity		
CMSC 142	Design and Analysis of Algorithms	Algorithm design techniques; use of data structures, divide and conquer, dynamic programming, greedy techniques, local and global search; complexity analysis of algorithms; asymptotic analysis, worst case and average case, recurrences, lower bounds, NP-completeness	CMSC 123	3 u.
CMSC 143	Graph Algorithms	Algorithms for fundamental graph optimization problems, non-bipartite matching, planar separators and applications, shortest paths. Data structures including Fibonacci heaps, splay trees and dynamic trees. Tools from linear programming, matroid theory, minmax theorems, polytope theory and random sampling.	CMSC 123	3 u.
CMSC 150	Computer Security	Principles of computer systems and network security; various attacks and techniques and how to defend against them.	CMSC 121 CMSC 138	3 u. (2 u. lec. + 1 u. lab.)
CMSC 155	Compiler Design and Construction	Study of theoretical constructs underlying the design of compilers and means for the effective and efficient implementation. The course is centered around a substantial programming project; implementing a complete compiler for a simple high-level programming language	CMSC 124	3 u. (2 u. lec. + 1 u. lab.)
CMSC 161	Interactive Computer Graphics	Graphics systems software and hardware, 2D drawing algorithms, geometrical transformations, surface modeling, 3D viewing, visible surface determination algorithms, illumination and reflection models, shading models of polygons, color theory, ray tracing.	CMSC 123 Math 120 or COI	3 u. (2 u. lec. + 1 u. lab.)
CMSC 170	Introduction to Artificial Intelligence	Basic principles and applications of artificial intelligence; knowledge representation, natural language processing, pattern recognition and expert systems	CMSC 123	3 u.
CMSC 171	Computer Science Ethics	Principles of ethics and their application to computer science	Junior standing	1 u.
CMSC 172	Robot Modeling	Robotics manipulation and their characteristics; conversion from joint space to real world coordinates; inverse kinematics; workspace analysis; differential motions	CMSC 123	3 u.
CMSC 173	Machine Learning	Supervised and unsupervised learning algorithms; neural networks, support vector machines; ensemble of classifiers;	CMSC 176 Stat 121	3 u. (2 u. lec. + 1 u. lab.)



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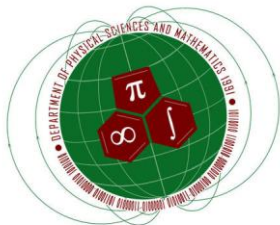
		introduction to deep learning; applications to health data		
CMSC 175	Information Technology Project Management	Project management knowledge areas and processes; application of project management in the IT industry; best practices in project management.	CMSC 128.2	3 u.
CMSC 176	Fundamentals of Data Science	Fundamental concepts of learning from data; methods and processes to extract knowledge from data in various forms; data curation and management	CMSC 127 Stat 121	3 u. (2 u. lec. + 1 u. lab.)
CMSC 177	Model Building and Assessment in Data Science	Methods of exploratory data analysis, statistical and algorithmic approaches in model building, selection and assessment	CMSC 176 Stat 122	3 u. (2 u. lec. + 1 u. lab.)
CMSC 178	Algorithm Design and Software Foundation in Data Science	Algorithmic problem solving skills, use of efficient strategies to formulate an algorithmic solution and implementation in a suitable high level language	CMSC 123 CMSC 176	3 u. (2 u. lec. + 1 u. lab.)
CMSC 180	Introduction to Parallel Computing	Parallel computational models, machine architectures, performance models, algorithms and programming	CMSC 135	3 u.
CMSC 181	IT Service Management	Exposure to activities performed by organization to plan, design, deliver, operate and control information technology services offered to customers	CMSC 128.1	3 u.
CMSC 190	Practicum		Junior standing	3 u.
CMSC 191	Special Topics	Lecture course in topics of current interest, such as data communication, parallel computation, artificial intelligence, neural networks. May be taken twice.	Senior standing	3 u.
CMSC 197	Undergraduate Seminar		Senior standing	1 u.
CMSC 198	Special Problem		CMSC 197 CMSC 199	3 u.
CMSC 199	Research Methods in Computer Science	Conceptual and methodological approaches in computer science research	Senior standing	3 u.
HI 191	Fundamentals of Health Informatics	Fundamental concepts of information technology applied to health care	Junior standing	3 u.
HI 192	Knowledge Representation and Health Decision Support	Biomedical decision making and its applications to computer based decision support tools. Bayesian statistics, belief networks and influence diagrams; Computational approaches to probabilistic and decision-theoretic inference	HI 191 Math 101	3 u.
HI 193.1	Representation and Algorithms for Computational Biochemistry	Basic algorithms in biochemistry; Computing with strings and network of genes, phylogenetic tree construction; Basic structural computations on proteins; Statistical analysis & graphical display of biochemical data	CMSC 124 Math 120 Chem 32	3 u.



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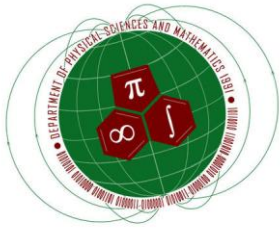
HI 193.2	Genetic Algorithms and Genetic Programming	Introduction to genetic algorithms and genetic programming; mathematical basis for genetic algorithms; implementation on parallel computers and field programmable gate arrays; applications to genomics and protein sequences	HI 193.1	3 u.
Math 83	Essentials of Analysis I	Functions and graphs, limits, continuity, derivatives; applications to simple differential equations, related rates, optimization problems, curve sketching, antidifferentiation and definite integrals		5 u. (4 u. lec. + 1 u. lab.)
Math 84	Essentials of Analysis II	Integration, conic sections and polar curves, two-dimensional and three-dimensional planes, calculus of vector-valued functions and multivariate analysis	Math 83	5 u. (4 u. lec. + 1 u. lab.)
Math 85	Essentials of Analysis III	Directional derivatives and gradients, extrema of functions in two variables, double and triple integrals in different coordinate systems, vector fields and applications, sequences and series, tests for convergence, power series and Taylor series	Math 84	3 u. (2 u. lec. + 1 u. lab.)
Math 101	Elementary Statistics	Presentation of data; frequency distributions; central tendencies; index numbers, dispersion; normal curve; Poisson curve, correlations; sampling distributions; elements of statistical inference	Math 11 or Math 17	3 u. (2 u. lec. + 1 u. lab.)
Math 120	Linear Algebra	Solution of system of linear equations by matrices; matrix operations and vector spaces; linear operators and linear transformations; determinants and eigenvalues	Math 75 or COI	3 u.
Math 121.1	Elementary Differential Equations I	Ordinary differential equations of order one; linear differential operators; Laplace transform; non-linear equations; series solutions about an ordinary point	Math 75	3 u.
Math 126	Real Analysis	Properties of real numbers; integrals of step functions; Lebesgue integral; convergence theorems; measurable functions; measurable sets; introduction to the Hahn-Banach theorem; Riesz representation theorem, fixed-point theorems	Math 121.1	3 u.
Math 162	Theory of Interest	Simple interest, compound interest, continuous interest, annuities; amortization schedules and sinking funds; bonds and other securities; special topics	Math 120	3 u.
Math 164	Life Contingencies	Mathematical theory of life contingencies involving single life functions; mortality; life annuities and insurances; reserves; the expense factor; population theory	CMSC 55 Math 101 Math 162	3 u.



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Math 165	Finite Differences	Linear operators of the finite calculus; polynomials interpolation in terms of advancing differences, divided differences, central differences; summation; approximate integration	Math 75	3 u.
Math 174	Numerical Analysis I	Polynomial approximation; Weierstrass approximation theorem, polynomial least squares approximation; interpolation, Lagrangian, equal interval, finite difference, Aitken, Gauss, Newton, Hermite interpolation; numerical differentiation and integration, numerical quadrature, Gaussian, Jacobi, Chebyshev, composite quadrature	CMSC 21 Math 121.1	3 u.
Math 180.1	Operations Research I	Review of classical optimization theory; introduction to linear programming; quadratic programming, non-linear programming; networks (Paths, PERT/CPM) and inventory problems	CMSC 55 Math 101 Math 120	3 u.
Math 180.2	Operations Research II	Review of probability theory; Stochastic models; Markov chains; introduction to queuing theory; introduction to simulation; games; replacement and reliability theory	Math 180.1	3 u.
Math 181	Linear and Integer Programming	Linear programming and integer programming with emphasis on formulation techniques and computer software usage for model validation and solutions	Math 180.1	3 u.
Physics 71	Elementary Physics I	Newtonian mechanics and fluid physics (primarily for students in the physical and engineering sciences)	Math 73	4 u.
Stat 121	Applied Probability Models	Introduction to applied probability distributions; discrete and continuous random variables; transformation of variables; joint, conditional, sums and ratios of random variable distributions, moment generating functions.	Math 74 Math 101	3 u. (2 u. lec. + 1 u. lab.)
Stat 122	Applied Statistical Inferential Models	Modern statistical conference; limiting theorems and distributions; empirical distribution functions, boot strap methods; MLF, sufficiency and exponential families, test hypothesis, likelihood ratios, UMP tests; application to health data	Stat 121	3 u. (2 u. lec. + 1 u. lab.)
Stat 130	Non-parametric Statistical Methods	Review of parametric statistical inferences; non-parametric statistical methods (goodness of fit tests; sign and signed rank tests; distribution tests; association tests; tests for independence; non-parametric correlation analysis; non-parametric analysis of variance)	Math 101	3 u. (2u. lec. + 1 u. lab.)
Stat 186	Time Series Analysis	Box-Jenkins methods; stationary, autocorrelation, moving averages, and	Math 120 Stat 122	3 u.



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		auto-aggressive processes; non-stationary time series; identification and estimation; forecasting		(2 u. lec. + 1 u. lab.)
Stat 187	Applied Bayesian Inference	Bayesian approach to hypothesis testing and numerical methods with emphasis on biomedical applications. Large sample Bayes inference from likelihoods, non-informative, conjugate priors; Bayesian approaches to linear and non-linear regression	Math 120 Stat 122	3 u. (2 u. lec. + 1 u. lab.)
Stat Comp 181.1	Linear Models in Statistical Computing I	Linear and non-linear regression algorithms: Gauss-Newton algorithms, derivative free methods, interactive reweighted least squares; General maximum likelihood algorithms: Newton-Raphson, Fisher-scoring conjugate gradient, quasi-Newton methods, EM algorithm. Logistic model. Application to health sciences	Math 120 Stat 122	3 u. (2 u. lec. + 1 u. lab.)
Stat Comp 181.2	Linear Models in Statistical Computing II	Principles of experimentation: Basic experimental models; Clinical trials; Applications to health sciences	Stat Comp 181.1	3 u. (2 u. lec. + 1 u. lab.)
Stat Comp 183	Multivariate Statistical Models	Methods of inference among several variables; Multivariate normal, Hotelling's T ² and Wishart distributions; MANOVA; Survey of various multivariate techniques; applications to health statistical data sets	Math 120 Stat 122	3 u. (2 u. lec. + 1 u. lab.)
Stat. Comp. 185	Stochastic Models	Fundamentals of stochastic processes and modeling; Markov chains and processes; Poisson, birth and death, multidimensional processes and epidemic processes; stochastic integrals and differential equations; application of stochastic processes in biomedical research using information technology	Math 120 Math 121.1 Stat 122	3 u. (2 u. lec. + 1 u. lab.)