Study Plan

Mathematics Department

2013 - 1434H

King Saud University
College of Science
Academic Affairs Vice Dean
Study Plans

Mathematical Study Plan

1st Semester				
Course Code	**Course Title**	**Pre-Req.**	**Co-Req.**	**Credits (Lect. - Exre. – Pract.)**
CI 140	Learning, Thinking and Research Skills	-	-	3 (3+0+0)
CHS 150	Health and Fitness	-	-	1 (1+0+0)
ENG 140	English Language (1) **(E)**	-	-	8 (8+0+0)
MATH 140	Introduction to Mathematics **(E)**	-	-	2(1+1+0)
Total of Credit Hours				**14**

2nd Semester				
Course Code	**Course Title**	**Pre-Req.**	**Co-Req.**	**Credits (Lect. - Exre. – Pract.)**
CT 140	Computer Skills **(E)**	-	-	3 (0+0+3)
MC 140	Communication Skills	-	-	2 (2+0+0)
ENG 150	English Language (2) **(E)**	ENG 140	-	8 (8+0+0)
MATH 150	Differential Calculus **(E)**	MATH 140	-	3(2+1+0)
ENT 101	Entrepreunership	-	-	1(1+0+0)
Total of Credit Hours				**17**

3rd Semester				
Course Code	**Course Title**	**Pre-Req.**	**Co-Req.**	**Credits (Lect. - Exre. – Pract.)**
CSC 111	Computer programming (1)	CT 140	-	4(3+2+1)
STAT 100	Introduction to Statistics	MATH 150	-	3(2+1+0)
MATH 111	Integral Calculus **(E)**		-	4(3+1+0)
MATH 131	Foundations of Mathematic		-	4(3+1+0)
Elective University requirement course			-	2 (2+0+0)
Total of Credit Hours				**17**

4th Semester				
Course Code	**Course Title**	**Pre-Req.**	**Co-Req.**	**Credits (Lect. - Exre. – Pract.)**
STAT 105	Statistical Methods **(E)**	-	-	4(3+1+0)
PHYS 101	General Physics (1)	-	-	4(3+0+1)
MATH 201	Differential and Integral Calculus (E)	MATH 111	-	4(3+1+0)
MATH 202	Vector Calculus (E)		MATH 201	4(3+1+0)
MATH 246	Linear Algebra	MATH 131	-	4(3+1+0)
Total of Credit Hours				**20**

5th Semester				
Course Code	**Course Title**	**Pre-Req.**	**Co-Req.**	**Credits (Lect. - Exre. – Pract.)**
MATH 225	Introduction to Differential Equations **(E)**	MATH 201	-	4(3+1+0)
MATH 243	Number Theory	MATH 131	-	4(3+1+0)
MATH 352	Numerical Analysis (1)	MATH 246	-	4(3+1+0)
MATH 382	Real Analysis (1) **(E)**	MATH 201	-	4(3+1+0)
Elective University requirement course			-	2 (2+0+0)
Total of Credit Hours				**18**

6th Semester				
Course Code	**Course Title**	**Pre-Req.**	**Co-Req.**	**Credits (Lect. - Exre. – Pract.)**
MATH 316	Mathematical Methods **(E)**	MATH 202 + MATH 225	-	4(3+1+0)
MATH 343	Group Theory	MATH243+ MATH 246	-	4(3+1+0)
MATH 373	Introduction to Topology **(E)**	MATH 382	-	4(3+1+0)
Elective University requirement course			-	2 (2+0+0)
Elective Course			-	4
Total of Credit Hours				**18**

7th Semester				
Course Code	**Course Title**	**Pre-Req.**	**Co-Req.**	**Credits (Lect. - Exre. – Pract.)**
MATH 425	Partial Differential Equations **(E)**	MATH 316	-	4(3+1+0)
MATH 431	Combinatorics and Graph Theory (1)	MATH 246	-	4(3+1+0)
MATH 441	Rings and Fields	MATH 343	-	4(3+1+0)
MATH 481	Real Analysis (2) **(E)**	MATH 382	-	4(3+1+0)
Total of Credit Hours				**16**

8th Semester				
Course Code	**Course Title**	**Pre-Req.**	**Co-Req.**	**Credits (Lect. - Exre. – Pract.)**
MATH 473	Introduction to Differential Geometry **(E)**	MATH 202 + MATH 246	-	4(3+1+0)
MATH 487	Complex Analysis **(E)**	MATH 382	-	4(3+1+0)
MATH 499	Research Project	Completion of 100 credit	-	3(0+0+3)
Elective University requirement course			-	2 (2+0+0)
Elective Course			-	3
Total of Credit Hours				**16**

(Lect - Exer – Pract) = (Lecture – Exercise – Practical)

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List of the Elective Courses of the University Requirements
(Student elects 8 credit hours)

Course Code	Course Title	Pre-requisite	Credits (Lect. – Exer. - Pract.)
IC 100	Studies in the Biography of the Prophet	-	2 (2+0+0)
IC 101	Introduction of Islamic Culture	-	2 (2+0+0)
IC 102	Islam and Building up the Society	-	2 (2+0+0)
IC 103	Economic System in Islam	-	2 (2+0+0)
IC 104	Political system in Islam	-	3 (2+0+1)
IC 105	Human Rights	-	3 (2+0+1)
IC 106	Islamic Jurisprudence	-	2 (2+0+0)
IC 107	Ethics of Occupation	-	2 (2+0+0)
IC 108	Contemporary Issues	-	2 (2+0+0)
IC 109	Woman and Her Developmental Role	-	2 (2+0+0)

List of the Elective Courses ***(Student elects 7 credit hours)***

Course Code	Course Title	Pre-requisite	Credits (Lect - Exer- Pract)
MATH 379	Foundations of Euclidean and Non-Euclidean Geometry	MATH 202 + MATH 246	4 (3+1+0)
MATH 391	History of Mathematics	MATH 243	2 (2+0+0)
MATH 426	Modeling in Mathematical Biology **(E)**	MATH 225	3 (3+0+0)
MATH 433	Combinatorics and Graph Theory (2)	MATH 431	4 (3+1+0)
MATH 436	Mathematical Logic **(E)**	MATH 131	4 (3+1+0)
MATH 442	Applications of Algebra	MATH 441	4 (3+1+0)
MATH 453	Numerical Analysis (2) **(E)**	MATH 352	4 (3+1+0)
MATH 456	Introduction to Mathematical Programming	MATH 246	3 (2+1+0)
MATH 466	Dynamical Systems and Chaos **(E)**	MATH 316	4 (3+1+0)
MATH 482	Multivariable Calculus **(E)**	MATH 246 + MATH 481	3 (2+1+0)
STAT 215	Probability (1)	STAT 100 + MATH 111	4 (3+1+0)
PHYS 102	General Physics (2)	-	4 (3+0+1)
ECON 101	Principles of Microeconomics	-	3
ECON 102	Principles of Macroeconomics	ECON 101	3
CSC 113	Computer Programming (2)	CSC 111	4 (3+0+1)

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List of service courses to Other Specialization and colleges.

Course Code	Course Title	Pre-requisite	Credits (Lect. – Exer.- Pract.)	Specialization / College of
MATH 104	General mathematics (2)	MATH 150	3 (3+0+0)	Agriculture – Architecture and Planning
MATH 106	Integral Calculus		3 (3+0+0)	Engineering – Computer Sciences
MATH 107	Vectors and matrices		3 (3+0+0)	Engineering
MATH 111	Integral Calculus		4 (3+1+0)	STAT - OPER - PHYS - CHEM - GPH
MATH 151	Discrete Math		3 (3+0+0)	Computer Sciences
MATH 200	Integral and Differential Calculus	MATH 111	3 (3+0+0)	GPH - Computer Sciences
MATH 203	Integral and Differential Calculus	MATH 106 + MATH 107	3 (3+0+0)	Engineering
MATH 204	Differential Equations	MATH 200 ***OR*** MATH 201 ***OR*** MATH 203	3 (3+0+0)	GPH – Engineering - Computer Sciences
MATH 207	Advanced Integral and Differential Calculus	MATH 111	3 (2+1+0)	OPER + STAT
MATH 209	Differential Equations		4 (3+1+0)	PHYS
MATH 244	Linear Algebra	MATH 102 ***OR*** MATH 106 ***OR*** MATH 107	3 (3+0+0)	OPER - STAT - Engineering - Computer Sciences
MATH 254	Numerical Methods	(MATH 107 ***OR*** MATH 202 ***OR*** MATH 244) + (CSC 101 ***OR*** CSC 206 ***OR*** CSC 207)	3 (3+0+0)	Engineering

Short Courses Description

I- Compulsory courses *from* the Department [credit hours (Lect. – Exer. – Pract).]

MATH 140 : Introduction to Mathematics (E) 2(2+0+0)

Linear equations and applications, linear inequalities, absolute value in equations and inequalities, complex numbers, quadratic equations and applications, functions, odd and even functions, operations on functions, inverse functions, exponential and logarithmic functions, trigonometric functions, conic sections, systems of equations and inequalities, matrices, matrix operations.

MATH 150 : Differential Calculus (E) 3(3+0+0)

The concept of limit, computation of limits, continuity and its consequences, limits involving infinity, formal definition of limit, the concept of derivative, computation of derivatives (power rule, higher order derivatives, acceleration), the product and quotient rules, the chain rule, derivatives of exponential and logarithmic functions, implicit differentiation and inverse

trigonometric functions, the mean value theorem, indeterminate forms and L'Hopital's rule, maximum and minimum values, increasing and decreasing functions, concavity and the second derivative test, optimization, related rates.

MATH 111 : Integral Calculus (E)	**4(3+1+0)**

Definition of definite integral and its properties, the anti-derivative, indefinite integral and the fundamental theorem of calculus. Change of variables. Integrals of natural and general exponential functions. Integrals of natural and general logarithmic functions. Derivatives and integrals of hyperbolic and inverse-hyperbolic functions. Techniques of integration: by parts, trigonometric substitutions, completing the square, integrals of rational functions, miscellaneous substitutions. Indeterminate forms, improper Integrals. Applications of integration: area, solids of revolution, arc length and surface of revolution, linear Motion, work, momentum and center of mass. Numerical integration. Polar coordinates, relation between polar and Cartesian coordinates, graphs of polar curves, area in polar coordinates. Parametric equations.

MATH 131 : Foundations of Mathematics	**4(3+1+0)**

Introduction to logic, methods of proof, mathematical induction. Sets, operations on sets, Cartesian product, binary relations, partition of a set, equivalence relation, equivalence classes, mappings, equivalence of sets, finite sets, countable sets, cardinal numbers. Binary operations, morphisms. Definition and examples of groups, definition and examples of rings and fields.

MATH 201 : Differential and Integral Calculus (E)	**4(3+1+0)**

Cartesian, cylindrical and spherical coordinate systems. Functions of two and three variables, limits and continuity, partial derivatives, the chain rule, extrema of functions of two variables, Lagrange multipliers. Double integrals, moments and center of mass, double integrals in polar coordinates, triple integrals, applications of triple integrals, triple integrals in cylindrical and spherical coordinates, surface area. Sequences, infinite series, convergence tests, representation of functions by power series, Taylor and Maclaurin series, the binomial series.

MATH 202 : Vector Calculus (E)	**4(3+1+0)**

Vectors in two and three dimensions, scalar and vector products, equations of lines and planes in 3-dimensional space. Surfaces of revolution and their equations in cylindrical and spherical coordinates. Vector-valued functions of a real variable, curves in space, curvature. Rates of change in tangent and normal directions, directional derivatives. Gradient of a function, equations of normal and tangent space to a surface at a point. Vector fields, divergence, curl of a vector, line and surface integrals. Green's theorem, Gauss' divergence theorem, Stockes' theorem.

MATH 225 : Introduction to Differential Equations (E)	**4(3+1+0)**

Classification of Differential equations and their origins. Methods of solution of first order differential equations, orthogonal trajectories. Linear equations with constant coefficients and variable coefficients. Linear systems of equations, power series solutions of linear differential equation of the second order with polynomial coefficients, Laplace transform and the convolution. Fourier's series.

MATH 243 : Number Theory	**4(3+1+0)**

First and second principles of mathematical induction. Well-ordering principle. Divisibility, Euclidean algorithm. Prime numbers and their properties. Linear Diophantine equations. Congruences and their properties, linear congruences. The Chinese remainder theorem. Fermat's little theorem. Euler's theorem. Wilson's theorem. Arithmetic functions. Pythagorean triples. Some cases of Fermat's last theorem.

MATH 246: Linear Algebra	4(3+1+0)
Matrices and their operations, types of matrices. Elementary transformations. Determinants, elementary properties. Inverse of a matrix. Vector spaces, linear independence, finite dimensional spaces, linear subspaces. Inner product spaces. Linear transformations, kernel and image of a linear transformation. Eigenvalues and eigenvectors of a matrix and of a linear operator.	

MATH 316 : Mathematical Methods (E)	4(3+1+0)
Inner product space, sequences of functions and their modes of convergence. Sturm-Liouville problem (ordinary and singular), self-adjoint differential operator. Fourier series, convergence in L^2, pointwise convergence. Orthogonal polynomials (Legendre, Hermite, Laguerre) and their properties, expansions of functions. Bessel functions, properties, orthogonality . Fourier transform, Fourier integral, applications.	

MATH 343 : Group Theory	4(3+1+0)
Definitions and examples, subgroups, Lagrange's theorem, normal subgroups, Factor groups, homomorphisms, isomorphism theorems, automorphisms, Cayley's theorem and its generalization. Simple groups, permutation groups. Class equation. Group action on a set. p-groups, Cauchy's theorem, Sylow theorems. External and internal direct products of groups. Burnside's theorem. Dihedral groups. Quaternions. Groups of automorphisms of cyclic groups.	

MATH 352 : Numerical Analysis (1)	4(3+1+0)
Numerical methods for nonlinear equations. Error and convergence, analysis. Direct & iterative methods for linear systems. Error analysis & iterative methods convergence. Interpolation & approximation, error analysis. Numerical differentiation & numerical integration & their error analysis.	

MATH 373 : Introduction to Topology (E)	4(3+1+0)
Topological spaces, examples, closure of a set, derived set, subspace topology. Bases, finite product topology, subbases. Metric spaces, examples, metrizability, $\mathbb{R}^n$ as a metrizable space. Continuous functions, characterization of continuous functions on topological and metric spaces, homeomorphisms, examples, topological property. Compact spaces, compactness in $\mathbb{R}^n$, limit point and sequentially compact spaces.	

MATH 382 : Real Analysis (1) (E)	4(3+1+0)
Basic properties of the field of real numbers, completeness axiom, countable sets. Sequences and their convergence, monotone sequence, Bolzano-Weierstrass theorem, Cauchy criterion. Basic topological properties of the real numbers. Limit of a function, continuous functions and properties of continuity, uniform continuity, compact sets. The derivative of a function, mean value theorem, L'Hospital rule, Taylor theorem.	

MATH 425 : Partial Differential Equations (E)	4(3+1+0)
Classification and formation of PDE. First order equation, solution of the quasi-linear equation by Lagrange Method, Cauchy problem. Second order linear equation, classification, solution by factorization of operator and by separation of variables, Cauchy problem. Laplace's equation, harmonic functions; Dirichlet, Neumann, and Mixed conditions; examples in Cartesian, polar, cylindrical, and spherical coordinates. Wave equation in one and two dimensions, solution by Fourier series. Heat equation in bounded and unbounded one-dimensional domain, solution by Fourier series and transform.	

MATH 431 : Combinatorics and Graph Theory (1)	4(3+1+0)
Basic counting principles. The inclusion-exclusion principle. The pigeonhole principle. Ordinary generating functions. Exponential generating functions. Homogeneous recurrence relations. Non-homogeneous recurrence relations. Basic concepts in graph theory. Eulerian graphs. Hamiltonian graphs. Trees. Planar graphs. Coloring. Chromatic polynomials.	

MATH 441 : Rings and Fields	4(3+1+0)
Rings, group of units and group of automorphisms of a ring. Ideals and factor rings Principal ring. Prime and maximal ideals. Field of quotients of an integral domain. Characteristic of a ring. Direct sum of rings. Modules. Euclidean rings. Ring of polynomials. Roots of polynomials over a field. Field extensions. Finite and simple extensions of fields. Algebraic closure of a field. Splitting fields. Finite fields.	

MATH 473 : Introduction to Differential Geometry (E)	4(3+1+0)
Theory of curves in space. Regular curves. Arc length and reparameterization, natural parameterization, Serret-Frenet apparatus, existence and uniqueness theorem for space curves, Bertrand curves. Involutes and evolutes. Local theory of surfaces: simple surfaces, coordinate transformations, tangent vectors and tangent spaces. First and second fundamental forms. Normal and geodesic curvatures, Weingarten map; principal, Gaussian and mean curvatures. Geodesics, equations of Gauss and Codazzi-Mainardi.	

MATH 481 : Real Analysis (2) (E)	4(3+1+0)
Riemann Integration: the definition, Darboux theorem, Riemann sums, the fundamental theorem. Sequences and series of functions: uniform convergence for the sequences and series of functions, power series. Lebesgue measure: Borel $\sigma-$algebra, outer measure, Lebesgue measurable sets, properties of Lebesgue measure. Lebesgue integral: simple functions, measurable functions, definition of Lebesgue integral. Monotone convergence theorem, bounded convergence theorem, the relation between Lebesgue and Riemann integrals.	

MATH 487 : Complex Analysis (E)	4(3+1+0)
Complex numbers, Cartesian and polar representation of complex numbers, powers and roots of complex numbers. Limits and continuity of a complex functions. Analytic functions, Cauchy-Riemann equations, harmonic functions. Exponential, trigonometric, hyperbolic and logarithmic functions. Complex integration, contour integrals, Cauchy's theorem, Cauchy's formula. Bounds on analytic functions. Series representation of analytic functions, Taylor and Laurent series, power series. Zeros and singularities. Residue theory. Applications to real and improper integrals.	

MATH 499 : Research Project	3(0+0+3)
The student should prepare a research project under the supervision of a faculty member. The followed procedure consists of three main steps: 1- Choosing the subject matter of the project. 2- Locating relevant references and studying them. 3- Writing up the research project and presenting it.	

II- Compulsory courses *from outside* the Department [credit hours (Lect. – Exer. – Pract.)]

PHYS 101 : General Physics 1	**4(3+0+1)**
Reflection and refraction of light, lenses, optical instruments, wave theory of light. Interference, and diffraction of light. Electrostatics, electric current, DC circuits, electrical instruments, electromagnetism and AC circuits. Introduction to quantum theory, atomic spectra, X-rays. Properties of nuclei, radioactivity, decay of alpha, beta and gamma, nuclear fission and nuclear power.	

STAT 100: Introduction to Statistics	**3(2+1+0)**
Descriptive statistics - Measures of central tendency - Measures of dispersion - Basic probability concepts - Conditional probability, Expectation - Variance - Bayes law - Random variables - Probability distribution - Binomial distribution - Poisson distribution - Hyper geometric distribution - Normal distribution – Applications by Excel	

STAT 105: Statistical Methods	**4(3+1+0)**
Some Statistical distributions - Sampling distributions - Central limit theorem - Chebychev's inequality - Interval estimation - Testing hypotheses (two populations case) - Introduction to experimental designs (CRD and RBD)- Analysis of variance (one and two ways) - Regression analysis (simple) - Correlation (Pearson and Spearman) - Chi square test and its applications - Some nonparametric tests.	

CSC 111: Computer programming (1)	**4(3+0+1)**
Some Statistical distributions - Sampling distributions - Central limit theorem - Chebychev's inequality - Interval estimation - Testing hypotheses (two populations case) - Introduction to experimental designs (CRD and RBD)- Analysis of variance (one and two ways) - Regression analysis (simple) - Correlation (Pearson and Spearman) - Chi square test and its applications - Some nonparametric tests.	

III- Elective courses *from* the Department [credit hours (Lect. – Exer. – Pract.)]

MATH 379 : Foundations of Euclidean and Non-Euclidean Geometry	**4(3+1+0)**
Mathematics in Babylonia and Egypt. The Greek mathematics. History of mathematics in India and China. Mathematics in the Islamic age. Development of mathematics in Europe from the seventeenth century up to now.	

MATH 391 : History of Mathematics	**2(2+0+0)**
Mathematics in Babylonia and Egypt. The Greek mathematics. History of mathematics in India and China. Mathematics in the Islamic age. Development of mathematics in Europe from the seventeenth century up to now.	

MATH 426 : Modeling in Mathematical Biology (E)	**3(3+0+0)**
Introduction to compartments models: definition of model, goal of model. Examples: Foxes and rabbits model, brief introduction to glucose insulin model. Phase-plane analysis: linear system. Population dynamics: Verhulst model, a predator-prey model, reaction kinetic. A basic epidemic model (SIR). Nonlinear systems and linearization. Qualitative analysis of the general population interaction model. Qualitative analysis of the epidemic model. The Spruce Budworm model. SI model with treatment and Hopf bifurcation. A cell population model. Parameter estimation. Project.	

MATH 433 : Combinatorics and Graph Theory (2)	4(3+1+0)
Partitions of sets. Stirling numbers. Partitions of integers. Ferrers diagrams. Euler's identity. Ordered sets. Dilworth's theorem. Linear extensions. Combinatorial designs. Block designs. Latin squares. Connectivity of graphs. Blocks. Edge connectivity. Matching. Hall's theorem. Directed graphs. Tournaments. Networks. Connectivity and networks.	

MATH 436 : Mathematical Logic (E)	4(3+1+0)
Propositional calculus. The deduction theorem for propositional calculus. Completeness and consistency of propositional calculus. Predicate calculus. First-order theorems. Consistency of first-order predicate calculus. Completeness theorem for predicate logic.	

MATH 442 : Applications of Algebra	4(3+1+0)
Classical cipher systems. Steam ciphers. Introduction to cryptanalysis. Exponential ciphers and public keys. Introduction to codes. Linear codes. Perfect codes. Cyclic codes.	

MATH 453 : Numerical Analysis (2) (E)	4(3+1+0)
Numerical methods for solving nonlinear systems: fixed point iteration, Newton and quasi-Newton methods. Numerical methods for solving initial value problems in ODE: finite difference, multistep and predictor corrector methods; derivation of some methods, error analysis, stability and convergence. Rung-Kutta methods. Numerical methods for solving boundary value problems in ODE: finite difference methods for linear and nonlinear problems, error analysis and convergence. Collocation method. Applications (applicable problems solved by the computer).	

MATH 456 : Introduction to Mathematical Programming	3(2+1+0)
Modeling of real life optimization problems. Convex sets & polyhedra approach and geometrical approach. Exchange method & the structure of matrices. Simplex method & variants (2 phase; revised, degeneracy Blands rule etc.). Duality theory and applications. Transportation Problem. Networks & flow problems.	

MATH 466 : Dynamical Systems and Chaos (E)	4(3+1+0)
Dynamical systems, regular and irregular behavior of nonlinear dynamical systems, existence and uniqueness theorems; linear ODEs with constant and periodic coefficients, Floquet theory; linearization and stability analysis. Nonlinear oscillations and the method of averaging; perturbation methods; bifurcation theory and normal forms; phase plane analysis for autonomous systems. Hamiltonian dynamics, chaotic systems. Chaotic motion, Lyapunov exponents functions, Poincare maps, horseshoe maps and the Melnikov method.	

MATH 482 : Multivariable Calculus (E)	4(3+1+0)
Norms, inner product on general vector spaces, linear transformation and their properties. Basic concepts of topology in the Euclidian space, Continuous functions on the Euclidian space and their properties. Differentiability in $\mathbb{R}^n$ and its properties, chain rule and other rules, higher order derivatives and Taylor's theorem. Maxima and minima, quadratic forms, Lagrange multiplier method. Inverse and implicit function theorems in higher dimension. Integration of function of n variables. Fubini theorem and change of variable formula.	

IV- Elective courses from *Outside* the Department [credit hours (Lect. – Exer. – Pract.)]

PHYS 102 : General physics (2) (E)	**4(3+0+1)**
Vectors, Motion in straight line, Newton's Laws of motion, work, energy and momentum, simple harmonic motion, elasticity, mechanics of non-viscous fluids, flow of viscous fluids, surface tension, temperature, quantity of heat, work and heat.	

STAT 215 : Probability (1) (E)	**4(3+1+0)**
Random variables - Probability distributions (Discrete and continuous) - Famous discrete and continuous probability distributions – Random vectors - Expectation and variation - Discrete bivariate probability distributions - Marginal and conditional probability distributions - Independence, correlation and covariance - Moments and moment generating function - Distributions of Function of one and two random variables.	

V- Service Courses to Other Specializations and Colleges [credit hours (Lect. – Exer. – Pract.)]

MATH 106 : Integral Calculus	**3(3+0+0)**
Definition of definite integral and its properties, the anti-derivative, indefinite integral and the fundamental theorem of calculus. Change of variables. Integrals of natural and general exponential functions. Integrals of natural and general logarithmic functions. Derivatives and integrals of hyperbolic and inverse-hyperbolic functions. Techniques of integration: by parts, trigonometric substitutions, completing the square, integrals of rational functions, miscellaneous substitutions. Indeterminate forms, improper Integrals. Applications of integration: area, solids of revolution, arc length and surface of revolution, linear Motion, work, momentum and center of mass. Numerical integration. Polar coordinates, relation between polar and Cartesian coordinates, graphs of polar curves, area in polar coordinates. Parametric equations.	

MATH 111 :	**4(3+1+0)**
Definition of definite integral and its properties, the anti-derivative, indefinite integral and the fundamental theorem of calculus. Change of variables. Integrals of natural and general exponential functions. Integrals of natural and general logarithmic functions. Derivatives and integrals of hyperbolic and inverse-hyperbolic functions. Techniques of integration: by parts, trigonometric substitutions, completing the square, integrals of rational functions, miscellaneous substitutions. Indeterminate forms, improper Integrals. Applications of integration: area, solids of revolution, arc length and surface of revolution, linear Motion, work, momentum and center of mass. Numerical integration. Polar coordinates, relation between polar and Cartesian coordinates, graphs of polar curves, area in polar coordinates. Parametric equations.	

MATH 200 : Differential and Integral Calculus	**3(3+0+0)**
Cartesian, cylindrical and spherical coordinate systems. Functions of two and three variables, limits and continuity, partial derivatives, the chain rule, extrema of functions of two variables, Lagrange multipliers. Double integrals, moments and center of mass, double integrals in polar coordinates, triple integrals, applications of triple integrals, triple integrals in cylindrical and spherical coordinates, surface area. Sequences, infinite series, convergence tests, representation of functions by power series, Taylor and Maclaurin series, the binomial series.	

MATH 204 : Differential Equations	**3(3+0+0)**
Classification of Differential equations and their origins. Methods of solution of first order differential equations, orthogonal trajectories. Linear equations with constant coefficients and	

variable coefficients. Linear systems of equations, power series solutions of linear differential equation of the second order with polynomial coefficients, Laplace transform and the convolution. Fourier's series.

MATH 207 : Advanced Differential and Integral Calculus	**3(2+1+0)**

Cartesian coordinates - functions of two or several variables - limits and continuity - partial derivatives - chain rule - maxima and minima for functions of two and several variables - Lagrange multipliers - double integrals and their applications - triple integrals and their applications - sequences - infinite series - geometric series - convergence tests - alternative series - absolute convergence - conditional convergence - functions representation by power series - Taylor' series - Maclaurin' series - Binomial series - first order differential equations.

MATH 209 : Differential Equations	**4(3+1+0)**

- Sequences limit, infinite series, geometric series, tests for convergence (integral, comparison and ratio tests…etc) alternating series, absolute convergence.

-Series of functions: Pointwise convergence, Taylor and Maclaurin Series. Fourier series, Fourier integral.

-Differential Equations: First Order Differential equations, definitions. Separable Equations. Linear Equations, Method of integrating Factor. Homogenous First Order Equations. Bernoulli Equations, Modeling Physical Problems with differential equations.

MATH 244 : Linear Algebra	**3(3+0+0)**

Matrices and their operations - types of matrices. Elementary transformations. Determinants - elementary properties. Inverse of a matrix. Linear systems of equations. Vector spaces - linear independence - finite dimensional spaces - linear subspaces. Inner product spaces. Linear transformations - kernel and image of a liner transformation. Eigen values and Eigen vectors of a matrix and of a linear operator.

MATH 254 : Numerical Methods	**3(3+0+0)**

Methods of numerical solve nonlinear equations, calculation errors associated rates and methods repetitive, methods of direct and iterative solve systems Almhadlat linear calculation errors related to these methods, Interpolation using polynomial formula error accompanying this Interpolation, differentiation and numerical integration including errors related to it, Entrance Solutionsnumerical ordinary differential equations.

Important Note: The student must review the department concerned for decisions that taught outside the college (Compulsory and Elective).