Shanghai Jiao Tong University

MA261 Mathematics IB

Instructor Information:	Youzhou Zhou Home Institution: Xi'an Jiaotong-Liverpool University Email: youzhou.zhou@xjtlu.edu.cn Office Hours: Determined by Instructor		
Term:	December 16, 2019 - January 7, 2020	Credits:	4 units
Class Hours:	Monday through Friday, 160 mins per teaching day		
Discussion Sessions:	2 hours each week, conducted by teaching assistant(s)		
Total Contact Hours:	64 contact hours (1 contact hour = 45 mins, 2880 mins in total)		
Required Texts (with ISBN):	Textbook1: Poole, D., Linear Algebra: a Modern Introduction 4th edition (Cengage Learning) Textbook2: Stewart, J., Calculus 8th edition (metric version) (Cengage Learning)		
Prerequisite:	Mathematics IA		

Course Description:

Mathematics IB contains linear algebra and calculus.

Linear algebra consists of linear transformations (kernel and range, matrix of linear transformation, one-to-one and onto linear transformations, rank nullify theorem), vector spaces with scalar products (scalar product, length, orthogonal basis, Gram-Schmidt process, projections of a vector onto a vector subspace), diagonalization of real symmetric matrices (eigenvalues, eigenvectors), applications.

Calculus consists of limits (existence of limits, limit laws, squeeze theorem, L'Hospital's rule), continuity (intermediate value theorem), improper integrals (brief review of integration by parts, substitution rule, partial fraction), differential equations (separable equations, first order and second order linear differential equations with constant coefficients), applications of derivatives (maximum and minimum, concavity, mean value theorems, other applications), series (convergence, geometric series, p-series, power series, Taylor and Maclaurin series).

Multivariable Calculus (equations of lines and planes, partial derivatives, gradient, directional derivatives, tangent plane, maximum, minimum, etc).

Learning Outcomes:

1. Students will understand and master important theory on linear algebra, one variable calculus and multivariable calculus;
2. Students will be well trained to have stronger ability in mathematical analysis;
3. Students will be able to apply what they have learned to solve many limit problems, integrals, to determine the convergence of series, to find the maximum and minimum of functions with single and multiple variables, etc.;
4. Students will be ready to study higher level mathematics courses such as real analysis and complex analysis;
5. They will have a solid mathematical background to study other natural sciences.

Grading Policy

Participation	must
Quizzes and Homework	30%
Midterm Exam	30%
Final Exam	40%

Grading Scale is as follows

Number grade	Letter grade	GPA
90-100	A	4
85-89	A-	3.7
80-84	B+	3.3
75-79	B	3
70-74	B-	2.7
67-69	C+	2.3
65-66	C	2
62-64	C-	1.7
60-61	D	1
≤59	F (Failure)	0

Class Schedule

Date	Lecture	Textbook
Day 1	Algebra-The Vector Space R^n: Linear Independence, Spanning Sets, Basis, Dimension, Row Space, Column Space, Null Space, Rank Nullity Theorem	Textbook1
Day 2	Algebra-Linear Transformations: Kernel, Range, One-To-One, Onto, Matrix of Linear Transformation, Rank Nullity Theorem.	Textbook1
Day 3	Algebra-Scalar Spaces: Scalar Product, Length, Orthogonal Basis, Projections, Gram-Schmidt Process.	Textbook1
Day 4	Algebra-Orthogonal Diagonalization of Real Symmetric Matrices, Eigenvalues, Eigenvectors, Orthonormal Matrices, Quadratic Forms	Textbook1
Day 5	Calculus-Limits: Existence of Limits, Limit Laws, Limits at Infinity, Squeeze Theorem, L'Hospital's Theorem	Textbook1
Day 6	Calculus-Limits and Continuity: L'Hospital's Rule, Intermediate Value Theorem, Newton's Method	Textbook2
Day 7	Calculus-Derivatives: Definitions, Product Rule, Quotient Rule, Chain Rule, Implicit Differentiation, Derivatives of Trigonometric and Inverse Trigonometric Functions	Textbook2
Day 8	**Midterm Exam**	
Day 9	Calculus-Applications of Derivatives: Maximum, Minimum, Concavity, First and Second Derivative Tests	Textbook2
Day 10	Calculus-Rolle's Theorem, Mean Value Theorem, Applications. Improper Integrals: Brief Review of Integration by Parts, Substitution Rule, Partial Fractions.	Textbook2
Day 11	Calculus-Separable Differential Equations, First and Second Order Linear Differential Equations with Constant Coefficients	Textbook2
Day 12	Calculus-Convergence of Series,Geometric Series, p-Series, Power Series, Taylor Series, Maclaurin Series, Interval and Radius of Convergence of Power Series.	Textbook2
Day 13	Calculus-Multiple Variable Calculus: Equations of Lines and Planes, Functions of Multiple Variable, Limits and Continuity. Partial Derivatives, Derivatives of Higher Order.	Textbook2
Day 14	Calculus-Chain Rules, Directional Derivatives, Gradient. Tangent Planes, Maximum and Minimum. Second Derivative Test for Functions of Two variables.	Textbook2
Day 15	**Final Exam**	