MATH 2011 Introduction to Multivariable Calculus

Course Outline – Spring Term 2016/2017

1. Instructor: (L1 & L2) Professor *Tiezheng QIAN*

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Office: Room 3424 (near Lifts 17/18)

Course webpage: http://www.math.ust.hk/~maqian/ma2011_1617S.html

2. Lecture/Tutorial Hours and Venues:

Class	Class Title	Enrolled	Days & Times	Room	Class Dates
MATH 2011-L1 (3120)	Intro to Multivar Calculu (Lecture)	132	TuTh 10:30AM - 11:50AM	Lecture Theater D (216)	Feb 1, 2017-May 9, 2017
MATH 2011-L2 (3122)	Intro to Multivar Calculu (Lecture)	129	TuTh 12:00PM - 1:20PM	Lecture Theater J (300)	Feb 1, 2017-May 9, 2017
MATH 2011-T1A (3124)	Intro to Multivar Calculu (Tutorial)	43	Mo 4:30PM - 5:20PM	G009B, CYT Bldg (70)	Feb 1, 2017-May 9, 2017
MATH 2011-T1B (3126)	Intro to Multivar Calculu (Tutorial)	30	We 12:00PM - 12:50PM	Rm 4582, Lift 27-28 (66)	Feb 1, 2017-May 9, 2017
MATH 2011-T1C (3127)	Intro to Multivar Calculu (Tutorial)	35	Fr 3:00PM - 3:50PM	Rm 4503, Lift 25-26 (64)	Feb 1, 2017-May 9, 2017
MATH 2011-T1D (3128)	Intro to Multivar Calculu (Tutorial)	24	Mo 9:30AM - 10:20AM	G009A, CYT Bldg (80)	Feb 1, 2017-May 9, 2017
MATH 2011-T2A (3129)	Intro to Multivar Calculu (Tutorial)	28	Fr 3:00PM - 3:50PM	Rm 6602, Lift 31-32 (60)	Feb 1, 2017-May 9, 2017
MATH 2011-T2B (3130)	Intro to Multivar Calculu (Tutorial)	32	Fr 6:00PM - 6:50PM	Rm 2463, Lift 25-26 (42)	Feb 1, 2017-May 9, 2017
MATH 2011-T2C (3131)	Intro to Multivar Calculu (Tutorial)	34	Mo 6:00PM - 6:50PM	Rm 2504, Lift 25-26 (84)	Feb 1, 2017-May 9, 2017
MATH 2011-T2D (3132)	Intro to Multivar Calculu (Tutorial)	35	Fr 2:00PM - 2:50PM	Rm 6591, Lift 31-32 (60)	Feb 1, 2017-May 9, 2017

3. COURSE DESCRIPTION

Credits: 3

Parametric and Polar Curves, Vectors and Vector-Valued Functions, Functions of Several Variables, Multiple Integration, Vector Calculus.

Exclusion: MATH 2010, MATH 2021, MATH 2023

Pre-requisite: A passing grade in AL Pure Mathematics / AL Applied Mathematics; OR MATH 1014; OR MATH 1018; OR MATH 1020; OR MATH 1024 (*for appropriate knowledge in one-variable calculus*)

4. INTENDED LEARNING OUTCOMES (ILOs)

Upon successful completion of this course, students should be able to

1	Understand the basic *concepts* and know the basic *techniques* of differential and integral calculus of functions of several variables;
2	Apply the theory to calculate the gradients, directional derivatives, arc length of curves, area of surfaces, and volume of solids;
3	Solve problems involving maxima and minima, line integral and surface integral, and vector calculus;
4	Develop mathematical maturity to undertake higher level studies in mathematics and related fields.

5. ASSESSMENT SCHEME

10% Homework: WeBWorK. Course ILOs: 1, 2, 3, 4

30% Midterm Exam: March 25, 2017 (Saturday). Course ILOs: 1, 2, 3, 4

60% Final Exam. Course ILOs: 1, 2, 3, 4

Final exam is comprehensive, i.e., all the materials taught in the whole semester will be tested, including those already tested in the midterm exam. But **focus** will be on those topics not covered in the midterm.

Closed-book exams: No notes and no calculators. More information will be given prior to the exams. No make-up exams.

6. Student Learning Resources

Textbook: Calculus – James Stewart. BROOKS/COLE

Reference: *Calculus for Scientists and Engineers: Early Transcendentals* – Briggs, Cochran and Gillett. Pearson New International Edition.

7. Teaching and learning Activities

Scheduled activities: 4 hours (Lecture for 3 hours & Tutorial for 1 hour) per week

8. TEACHING SCHEDULE (25 Classes)

Topic 1. **Parametric and Polar Curves: Class 1 – 3**

1. Parametric equations
2. Polar coordinates
3. Calculus in polar coordinates

Topic 2. **Vectors and Vector-Valued Functions: Class 4 – 10**

1. Vectors in the plane
2. Vectors in three dimensions

3. Dot products
4. Cross products
5. Lines and curves in space
6. Calculus of vector-valued functions
7. Motion in space
8. Length of curves
9. Curvature and normal vectors

Topic 3. **Functions of Several Variables: Class 11 – 17**

1. Planes and surfaces
2. Graphs and level curves
3. Limits and continuity
4. Partial derivatives
5. The chain rule
6. Directional derivatives and the gradient
7. Tangent planes and linear approximation
8. Maximum/minimum problems

Topic 4. **Multiple Integration: Class 18 – 21**

1. Double integrals over rectangular regions
2. Double integrals over general regions
3. Double integrals in polar coordinates
4. Triple integrals

Topic 5. **Vector Calculus: Class 22 – 25**

1. Vector fields
2. Line integrals
3. Conservative vector fields
4. Green’s Theorem