University of Moratuwa, Faculty of Engineering, Department of Mathematics-20160202
BSc Engineering Honors Degree
Semester 3(14 batch): 2016/02/01-2016/05/27-15 weeks, Reading Week-2016/04/08-2016/04/24
BM(15)+EN(100)+ME(100)-Tue 13.15: 15.15-JG(215)

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Module Code	**MA2023**	**Title**	**Calculus**			
Credits	**02**	**Hours/ Week**	**Lectures**	**02**	**Pre-requisites**	MA1023
			Lab/Tutorials	**-**		

Learning Outcomes

At the end of this module the student should be able to

- Perform vector differentiation and integration and evaluate vector and scalar quantities in various engineering applications.
- Apply Divergence, Stokes' and Green's theorem in various situations.
- Apply Cauchy's integral formula to solve engineering problems.
- Perform contour integration techniques.
- Apply conformal mapping in physical system modeling.

Outline Syllabus

Vector Calculus

- Double integral, triple integral, vector functions;
- Introduction to vector calculus. Vector differentiation and differential operators.
- Space curves and line integral, surface integrals;
- Divergence theorem, Stokes' theorem and Green's theorem in a plane.
- Some basic applications.

Complex Variables

- Analytical function and Cauchy-Reimann equation.
- Cauchy's integral formula and applications.
- Taylor and Laurent's series.
- Contour integration.
- Introduction to conformal mapping.

Method of Assessment

End of semester examination: 2 hour closes book paper: 70%
Mid semester examination: 1 hour open book paper: 10%
In-class assessments: 12%
Take-home assessment: 8%

References

- Advanced Calculus, David V. Widder
- Calculus: Volume I & II, Tom M. Apostol
- Mathematical Analysis, Tom M. Apostol
- Advanced Engineering Mathematics, Michael D. Greenberg
- Complex Variables: Introduction and Applications- Cambridge Texts in Applied Mathematics, Mark J. Ablowitz and Athanassios S. Fokas .
- http://www.wolframalpha.com/
- http://mathworld.wolfram.com/
- General Theory of Relativity, S. P. Puri
- Gravity- an Introduction to Einstein's General Relativity, James B. Hartle

Detailed Syllabus (from last time)

1. Introduction.
    - Vectors.
    - Vector functions.
    - Vector differentiation.
2. Curves in Space.
3. Differential Operators
4. Multiple Integrals.
    - Double integral.
    - Triple integral.
    - Surface integral.
    - Volume integral.
    - Green's, Stokes' and Divergence theorem.
5. Complex Variables.
    - Analytical functions and Cauchy-Reimann equation.
    - Cauchy's integral formula and applications.
    - Taylor and Laurent's series.
    - Contour integration.
    - Introduction to conformal mapping.

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Vector Functions of One Variable, Differentiation, Length of a curve, Tangent Vector, Curvature, Normal Vector, Binormal Vector, Torsion, Frenet-Serret Formuls, Vector Functions of Several Variables, Grad Curl Divergence and Relations, Line Element, Line Integrals, Path Independence, Conservative and Irrotational Vector Fields, Exact Differentials, Scalar Potential, Surface Area, Surface Element, Surface Integrals, Curvilinear Coordinates, Green's Theorem, Stokes Theorem, Volume Element, Volume Integrals, Divergence Theorem, Solenoidal Vector Fields
Analytic Function, Cauchy Riemann Equations, Entire and Harmonic Functions, Simply Connected Doubly Connected and Multiply Connected Regions, Cauchy Integral Formula, Taylor Series, Laurent Series, Singular Points, Poles Essential and Removable Singularities, Residues, Cauchy Residue Theorem, Conformal Mapping