Department of Mathematics, Faculty of Applied Science

King Mongkut's University of Technology North Bangkok (KMUTNB)

Course Syllabus: 040283211 Engineering Mathematics III

Semester 1, Academic Year 2024

Course Title: 040283211 Engineering Mathematics III **Credits:** 3(3-0-6)

Prerequisite: 040283112 Engineering Mathematics II

Course Learning Outcomes:

By the end of this module learners must be able to:

1. Understand the concepts and fundamental theorems of vector calculus and applications to sciences and engineering situations.
2. Use elementary row operation to obtain solutions of system of linear equations.
3. Find eigenvalues and eigenvectors of a given matrix.
4. Classify a given differential equation as ordinary or partial differential equation, and determine its order and whether it is linear.
5. Solve first-order linear ordinary differential equations.
6. Compute real valued linearly dependent solutions to homogenous ordinary differential equations with constant coefficients, and apply variation of parameters and method of undetermined coefficients to find a particular solution.
7. Formulate and solve appropriate applied problems involving exponential growth/decay and Newton's law of cooling and series circuits as first order differential equations and solve applied problems from electrical and mechanical engineering as second order differential equations.
8. Apply the obtained knowledge to study further in the area of interesting for each student.

Course Description:

Vector-valued function; space curve; derivative and integral of vector-valued function; gradient, curl and divergence; line integral; surface integral; ordinary differential equation; first-order differential equation; higher-order differential equation; applications of ordinary differential equations; system of linear equations and elementary row operation; eigenvalue and eigenvector.

Reading List

Core reading book:

The main parts of the course are contained in

Dennis G. Zill and Warren S. Wright (2018) ***Advanced Engineering Mathematics, 6th ed.*** USA.: Jones and Bartlett Learning. (TA330 Z5 2018)

Supplementary reading and study material:

1. Erwin Kreyszig (2011) ***Advanced Engineering Mathematics, 9th ed.***, N.J.: John Wiley & Sons. (QA401 K7 2011)
2. Glyn James (2015) ***Modern Engineering Mathematics, 4th ed.***, UK: Pearson. (TA330 M6 2015) – E-Book*
3. Dennis G. Zill, Warren S. Wright and Michael R. Cullen (2013) ***Differential Equations with Boundary Value Problems, 8th ed.***, Boston: Brooks/Cole Pub. Company. (QA371 Z5 2013)
4. **Howard Anton, Irl Bivens and Stephen Davis (2013)** ***Calculus: Early Transcendentals,*** **Singapore: John Willey & Sons.** (QA303.2 A5 2013)
5. James Stewart (2016) ***Calculus: Early Transcendentals (Metric Version)***, USA: Cengage Learning. (QA303.2 S7 2016)
6. Joel Hass, Christopher Heil and Maurice D. Weir (2003) ***Thomas' Calculus: Early Transcendentals***, New York: Pearson. (QA303.2 H3t 2019)

Note: Students can use other textbooks which include calculus topics as similar to the topics in the teaching outline for each week.

Required Prerequisite Knowledge / Skills:

1. Calculus (from the courses Engineering Mathematics I and II): limit and continuity, differentiation, integration and their applications.
2. Basic knowledge of vector algebra and its applications.

Lecturers:

No.	Lecturer's Name	Section	Study Time	Lecture Room	Office Hours
1	Dr. Uchupol Ruangsri (URS) uchupol.r@sci.kmutnb.ac.th	1	W 09.00-12.00	81-521	T 09.00 – 12.00 W 13.00 – 16.00
2	Assoc Prof. Dr. Sekson Sirisubtawee (SKS)* sekson.s@sci.kmutnb.ac.th	2	F 13.00-16.00	81-623	M 13.00 – 16.00 H 09.00 – 12.00

*Course coordinator

Assessments:

Midterm examination (week 1 - week 8)	40 %
Final examination (week 9 - week 15)	40 %
Assignments (4 times)	10 %
Quiz, class attention and participation	10 %

Teaching / Learning Activities:

Week No.	*Learning Topics*	*Topics in the Core Reading Book*	*Supplementary Activities*
1	Vector Calculus (Chapter 9)	9.1 Vector Functions 9.2 Motion on a Curve 9.3 Curvature and Components of Acceleration	Review the topics : week no.1-3
2	Vector Calculus (Cont.) : Differentiation	9.5 Directional Derivative 9.7 Curl and Divergence	Review Topics: 9.4 Partial Derivatives 9.6 Tangent Planes and Normal Lines 9.10 Double Integrals
3	Vector Calculus (Cont.)	9.8 Line Integral 9.9 Independence of the Path 9.12 Green's Theorem	Start Preparation for the Midterm Exam.
4	Vector Calculus (Cont.) : Integration of vector fields	9.13 Surface Integral	Self-Study Topics: 9.15 Triple Integrals Preparation for the Midterm Exam.
5	Vector Calculus (Cont.)	9.14 Stokes' Theorem 9.16 Divergence Theorem	

Week No.	*Learning Topics*	*Topics in the Core Reading Book*	*Supplementary Activities*
6	System of Linear Algebraic Equations	8.2 System of Linear Algebraic Equations	
7	Rank of a Matrix	8.3 Rank of a Matrix	Preparation for the Midterm Exam.
8	The Eigenvalue Problem	8.8 The Eigenvalue Problem	Review the topics for the Midterm Examination.
		Midterm Examination	
9	Introduction to Differential Equations (Chapter 1)	1.1 Definition and Terminology 1.2 Initial-Value Problems	Required Prerequisite Knowledge: A Preview of Calculus Self-Study Topics: 1.3 Differential Equations as Mathematical Models
10	First-Order Differential Equations (Chapter 2)	2.2 Separable Equations 2.3 Linear Equations 2.4 Exact Equations (Including Integrating Factors)	
11	First-Order Differential Equations (Cont.)	2.5 Solutions by Substitutions: - Homogeneous Equations - Bernoulli's Equations - Reduction to Separation of Variables	Self-Study Topics: 2.6 A Numerical Method Review topics in week 9-11
12	Mathematical Modelling with First-Order Differential Equations	2.7 Linear Models 2.8 Nonlinear Models	
13	Higher-Order Differential Equations (Chapter 3)	3.1 Theory of Linear Equations 3.3 Homogeneous Linear Equations with Constant Coefficients	Self-Study Topics: 3.2 Reduction of Order Preparation for the Final Exam.
14	Higher-Order Differential Equations: Particular solutions	3.4 Undetermined Coefficients 3.5 Variation of Parameters	Self-Study Topics: 3.6 Cauchy-Euler Equations 3.7 Nonlinear Equations Preparation for the Midterm Exam

Week No.	*Learning Topics*	*Topics in the Core Reading Book*	*Supplementary Activities*
15	Higher-Order Differential Equations: Particular solutions (Cont.)	3.8 Linear Models: Initial-Value Problems 3.9 Linear Models: Boundary-Value Problems	Review the topics for the Midterm Examination.
Final Examination			