University of Macau

Undergraduate Civil Engineering, Computer Science, Electrical and Computer Engineering, Electromechanical Engineering Programs

Coordinating Unit:	Department of Mathematics, Faculty of Science and Technology		
Supporting Unit(s):	Nil		
Course Code:	MATB220	Year of Study:	2
Course Title:	Engineering Mathematics II		
Compulsory/Elective:	Compulsory		
Course Prerequisites:	MATB120 Calculus II and MATB210 Engineering Mathematics I		
Prerequisite Knowledge:	The fundamental theories of calculus, e.g., limits, continuity, derivatives, partial derivatives, integrals, series.		
Duration:	One semester	Credit Units:	3
Class/Laboratory Schedule:	Three hours of lecture and one hour of tutorial per week.		
Laboratory/Software Usage:	Nil		
Course Description:	This course aims at preparing students to study their advanced engineering courses. Topics include linear algebra, ordinary differential equations, Laplace transformation, Fourier series & integrals, and partial differential equations.		
Course Objectives:	1. To introduce the basic knowledge in engineering mathematics. 2. To prepare students for the advanced courses in engineering.		
Learning Outcomes (LOs):	Upon completion of this course, students are expected to: 1. be able to solve the linear systems and eigenvalue problems; [PO: a] 2. be able to solve the ordinary differential equations; [PO: a] 3. be able to compute Laplace transforms and employ it for solving the initial value problems; [PO: a] 4. be able to calculate Fourier series, and understand the Fourier integrals and transforms; [PO: a] 5. understand and be able to solve the partial differential equations by separation variable methods. [PO: a]		
Texts & References: (* *recommended textbook*(*s*))	1. *Advanced Engineering Mathematics (9^{th} ed.), E. Kreysizig, John Wiley & Sons, 2006.* 2. Advanced Engineering Mathematics (5^{th} ed.), Peter V. O' Neil, Thomson Leaning, 2003.		
Student Assessment:	• Assignments: 10% • Quizzes & Midterm examination: 50% • Final examination: 40%		
Learning Outcome Assessment:	• assignments, quizzes, midterm and final examinations		

Pedagogical Methods:	☑ Lecture	☐ Service learning
	☐ Guest speakers	☐ Internship
	☐ Case study	☐ Field study
	☐ Role playing	☐ Company visits
	☐ Student presentation	☐ e-learning
	☐ Project	☐ Independent study
	☐ Simulation game	☐ Others: _____
	☑ Exercises and problems	

Major Assessment Methods: For each Major Assessment Method below, please indicate the specific pedagogical methods involved (by putting a ✓ in the relevant box(es) on the right-hand side).	Case Study	Role Playing	Student Presentation	Individual project/paper	Group project/paper	Simulation Game	Exercises & problems	Service learning	Internship	Field Study	Company visits	Written examination	Oral examination	Others (please specify)
Class Participation/ Discussion (0%)														
Assignments (20%)							✓							
Quizzes (5%)												✓		
Midterm Exam (35%)												✓		
Final Exam (40%)												✓		
Others *(please specify)*														
Course Web: (if any)														

Course Content: (topic outline)

Week no.	Topics	Assignment no.	LO no.
1,2	**Linear algebra: matrices, vectors, determinants, and linear systems** Addition, scalar multiplication of matrices and vectors, matrix multiplication, linear systems, Gauss elimination, linear independence, rank of a matrix, Cramer's rule, inverse of a matrix, vector spaces.	1,2	1
3	**Linear Algebra: matrix eigenvalue problems** Eigenvalues, eigenvectors, orthogonal matrices, quadratic forms.	3	1
4,5	**First order ordinary differential equations** Basic concepts of first order ODEs, separable equations, exact equations with integrating factors, first order linear ODEs	4,5	2
6,7	**Higher order linear ODEs** Homogeneous linear equations with constant coefficients, Euler-Cauchy equations, Wronskian, nonhomogeneous linear equations, methods of undetermined coefficients	6,7	2
8-9	**Laplace transforms** Laplace transforms, inverse Laplace transforms, shifting theorem, transformation of derivatives & integrals, solving ODEs by Laplace transforms, convolution, integral equations	8,9	3
10	**Midterm examination**		
11-13	**Fourier series, integrals, and transforms** Fourier series, half range expansions, Fourier series in complex form, Fourier integrals, Fourier transforms	10,11	4
14	**Partial differential equations** Basic concepts, D'Alembert's solution of the wave equation, solution by separating variables.	12	5
TBA	**Final Examination**		

TBA: To be arranged by the Registry

Contribution to Program Outcomes:	

Program Outcomes	Contribution to POs# 5 ----------> 1 Significant Least				
	5	4	3	2	1
(a) apply knowledge of mathematics, science, and engineering	✓				
(b) design and conduct experiments, and analyze data					
(c) design components, systems or processes in presence of constraints					
(d) Function in a multi-disciplinary team					
(e) Engineering problem solving					
(f) Understand professional and ethical responsibility					
(g) Communicate effectively					
(h) Understand the impact of engineering solutions to the society					
(i) Recognize the need and have the ability for lifelong learning					
(j) Have knowledge of contemporary issues					
(k) Apply the skills, techniques, modern engineering tools					
(l) Use the computer/IT tools relevant to the discipline					

 # Note 5: Significant contribution; 4: Supporting contribution; 3: Moderate contribution; 2: Marginal support; 1: Least support

Course Instructor(s):	Dr. Haiwei Sun