

Course Information	
Course title	Numerical Methods for Engineering Science
Semester	114-2
Designated for	COLLEGE OF ENGINEERING GRADUATE INSTITUTE OF APPLIED MECHANICS
Instructor	CHOU, YI-JU
Curriculum Number	AM7008
Curriculum Identity Number	543EM1110
Class	
Credits	3.0
Full/Half Yr.	Half
Required/ Elective	Elective
Time	Tuesday 6,7,8(13:20~16:20)
Remarks	The upper limit of the number of students: 98.
Course introduction video	
Table of Core Capabilities and Curriculum Planning	Table of Core Capabilities and Curriculum Planning
Course Syllabus	
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Course Description	THIS IS THE FIRST COURSE IN NUMERICAL ANALYSIS FOR GRADUATE STUDENTS. THE MAIN OBJECTIVES OF THIS COURSE INCLUDE: (1) DEVELOPMENT AND APPLICATIONS OF NUMERICAL METHODS WHEN ANALYTICAL TECHNIQUES ARE NOT AVAILABLE; (2) DEVELOPMENT OF A CONCEPTUAL FRAMEWORK FOR ANALYSIS OF METHODS TO FIX THE PROBLEM; (3) DISCRETE CALCULUS AND APPROXIMATIONS; (4) TRADEOFFS BETWEEN ACCURACY AND COMPUTATIONAL COST;
Course Objective	1. INTERPOLATION (3 HRS) (1) LAGRANGE POLYNOMIALS (2) POLYNOMIAL INTERPOLATIONS; SPLINES

	2. NUMERICAL DIFFERENTIATION (4 HRS) (1) CONSTRUCTION OF FINITE DIFFERENCE SCHEME, ORDER OF ACCURACY (2) MODIFIED WAVENUMBER AS A MEASURE OF ACCURACY (3) PADE APPROXIMATION (4) MATRIX REPRESENTATION OF FINITE DIFFERENCE SCHEMES 3. NUMERICAL INTEGRATION (8 HRS) (1) TRAPEZOIDAL RULE; SIMPSON'S RULE; ERROR ANALYSIS AND MID-POINT RULE (2) ROMBERG INTEGRATION AND RICHARDSON'S EXTRAPOLATION (3) ADAPTIVE QUADRATURE; GAUSS QUADRATURE 4. NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS (10 HRS) (1) INITIAL VALUE PROBLEMS; NUMERICAL STABILITY ANALYSIS, MODEL EQUATION (2) ACCURACY; PHASE AND AMPLITUDE ERRORS (3) RUNGE-KUTTA TYPE FORMULAS, MULTI-STEP METHODS; IMPLICIT METHODS (4) SYSTEM OF DIFFERENTIAL EQUATIONS; STIFFNESS (5) LINEARIZATION FOR IMPLICIT SOLUTION OF NON-LINEAR DIFFERENTIAL EQUATIONS (6) BOUNDARY VALUE PROBLEMS, SHOOTING, DIRECT METHODS, NON-UNIFORM GRIDS, EIGENVALUE PROBLEMS 5. PARTIAL DIFFERENTIAL EQUATIONS (10 HRS) (1) FINITE-DIFFERENCE SOLUTION OF PARTIAL DIFFERENTIAL EQUATIONS (2) MODIFIED WAVENUMBER AND VON NEUMANN STABILITY ANALYSIS, MODIFIED EQUATIONS ANALYSIS (3) ALTERNATING DIRECTION IMPLICIT METHODS; NON-LINEAR EQUATIONS; ITERATIVE METHODS FOR ELLIPTIC PDE'S
Course Requirement	HOMEWORKS (60%); FINAL EXAM (%40)
Student Workload (Expected weekly study hours before and/or after class)	
Office Hours	
Designated reading	
References	PARVIZ MOIN "FUNDAMENTALS OF ENGINEERING NUMERICAL ANALYSIS", CAMBRIDGE UNIVERSITY PRESS MICHAEL T. HEATH "SCIENTIFIC COMPUTING: AN INTRODUCTORY SURVEY", MCGRAW HILL
Grading	1. NTU has not set an upper limit on the percentage of A+ grades.

2. NTU uses a letter grade system for assessment. The grade percentage ranges and the single-subject grade conversion table in the NATIONAL TAIWAN UNIVERSITY Regulations Governing Academic Grading are for reference only. Instructors may adjust the percentage ranges according to the grade definitions. For more information, see [the Assessment for Learning Section](#).

Progress		
Week	Date	Topic
No data		