

Module (Course Syllabus) Catalogue 2025-2026

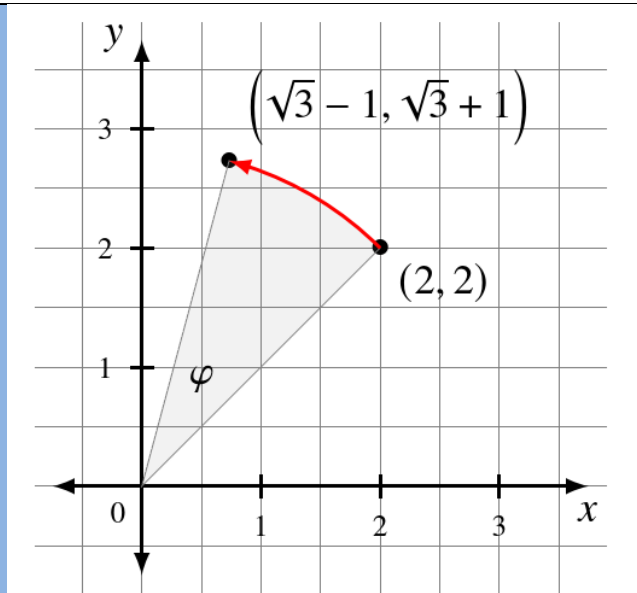
College/ Institute	Erbil Polytechnic University	
Department	Information System Engineering Techniques	
Module Name	Engineering Analysis	
Module Code	ENA6044	
Degree	Technical Diploma <input type="checkbox"/> Bachelor <input checked="" type="checkbox"/> High Diploma <input type="checkbox"/> Master <input type="checkbox"/> PhD <input type="checkbox"/>	
Semester	6 th	
Qualification	PhD	
Scientific Title	Asst. Prof.	
ECTS (Credits)	3	
Module type	Prerequisite <input type="checkbox"/> Core <input checked="" type="checkbox"/> Assist. <input type="checkbox"/>	
Weekly hours		
Weekly hours (Theory)	(3) hr Class	(126) Total hrs Workload
Weekly hours (Tutorial)	(2) hr Class (To be removed)	(36) Total hrs Workload
Number of Weeks	14	
Lecturer (Theory)	Ismael Abdulrahman	
E-Mail & Mobile NO.	ismael.abdulrahman@epu.edu.iq	
Lecturer (Practical)		
E-Mail & Mobile NO.		
Websites		

Course Book

Course Description	<p>This course covers several topics in engineering analysis, including complex number systems, transformation methods, and numerical analysis techniques for solving engineering problems. Topics include: (1) a review of the complex number system, Euler's formula, phase rotation, roots of unity (e.g., used in quantum computing), and Taylor series (e.g., used in scientific calculators); (2) Fourier series, Fourier transforms, and the Fast Fourier Transform (FFT) (e.g., used in communication engineering, signal analysis, and image processing); (3) the Laplace transform and its applications in dynamic systems, control systems, and systems of differential equations; and (4) several important approaches for solving systems of equations numerically, including the Newton-Raphson method, the secant method, and Gaussian and Jacobian methods.</p> <p>This course is often referred to as "Advanced Engineering Mathematics." You may need to review fundamental calculus concepts, particularly differentiation and integration techniques. Many professional engineering software packages and commercial tools use algorithms based on the principles covered in this course.</p>
Course objectives	<p>This course is advanced engineering mathematics. All the departments in engineering colleges study this course as a mandatory course and complementary of Calculus I and II studied earlier. The course is required by the syndicate of engineers. At the end of this course, the student learns to solve many problems in engineering using mathematical approaches. The objective is to provide and teach the students engineering tools to analyze systems mathematically and programmatically using computers. From this course, the student learns how the scientific calculator works and how to build algorithms in order to solve systems of equations that represent models of any problem in engineering.</p>
Student's obligation	<ul style="list-style-type: none">• Attendance• Quizzes / homework / simulation / seminars/reports/ projects• Exams• Homework assignments will be a mix of paperwork and electronic copies. Written homework should be finished individually, discussions with peers or instructor are allowed,

	but copying or any other type of cheating is strictly prohibited and will be reported to the department. You will be given one week to finish the written homework. Some of the machine problems are designed for teamwork and due day may vary. Any late submission will not be considered or incur a penalty for that assignment.				
Required Learning Materials					
Evaluation	Task	Weight (Marks)	Due Week	Relevant Learning Outcome	
	Paper Review				
	Assignments	Homework	10		
		Class Activity	2		
		Report	8		
		Seminar			
		Essay			
		Project	8		
	Quiz	8			
	Lab.	0			
	Midterm Exam	24			
	Final Exam	40			
	Total	100			
Specific learning outcome:	<p>Upon completion of this course, participants will have gained detailed knowledge in the following main areas:</p> <ol style="list-style-type: none"> 1. Mathematical Foundations & Review <ul style="list-style-type: none"> • Understanding the Complex Number System, including Euler's formula, phase rotation, and roots of unity (essential for quantum computing and signal processing). • Understanding Taylor Series approximations and their role in scientific calculations. 2. Transformation Methods <ul style="list-style-type: none"> • Knowledge of Fourier Analysis, including Fourier Series, Fourier Transforms, and the Fast Fourier Transform (FFT) for signal and image processing. • Knowledge of Laplace Transforms and their application in analyzing dynamic systems, control systems, and differential equations. 				

	<p>3. Numerical Analysis Techniques</p> <ul style="list-style-type: none"> Understanding algorithms for solving systems of equations numerically. Specific methods include Bisection, Newton-Raphson, Secant, Gaussian, and Jacobian methods for solving linear and non-linear engineering problems. <p>4. Simulation & Practice</p> <ul style="list-style-type: none"> Practical skills in applying these algorithms using MATLAB, Simulink, and other programming platforms to solve real-world engineering challenges. 	
Course References:	<ul style="list-style-type: none"> Erwin Kreyzig, Advanced Engineering mathematics, 10th ed. Columbus, Ohio. Glyn James, Advanced Modern Engineering Mathematics, 4th ed. Prentice Hall, 2011. 	
Course topics (Theory)	Week	Learning Outcome
<ul style="list-style-type: none"> Complex Number System, Euler's formula, phase rotation, roots of unity. Fourier Series, Fourier Transform, Laplace Transform, Z-Transform. Numerical Analysis (Newton Raphson method, fixed-point method, Gaussian method, Secant method, and other techniques). System analysis (solution of systems). 		
Practical Topics	Week	Learning Outcome
No practical hours. Only projects.		
<p>19. Examinations (samples of questions)</p> <p>Q: Use complex number to rotate the coordinate shown below by the angle $\varphi = \frac{\pi}{6}$.</p>		

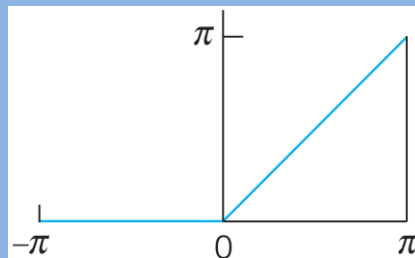


Q: Solve $(y'' - y = t)$ using Laplace transform.

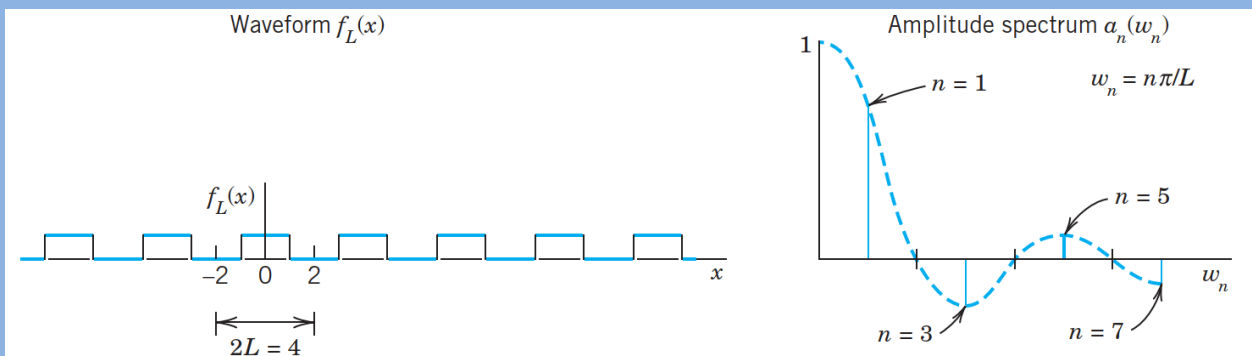
Q: Solve the following inverse Laplace transform problem:

$$\mathcal{L}^{-1}\left(\frac{3s - 134}{s^2 + 4s + 404}\right)$$

Q: Find the Fourier series of the given periodic function shown below. Show the details of your work.



Q: Use Fourier series to compute the components a_0 , a_n , and b_n for the function below.



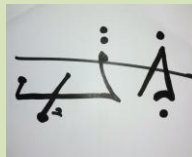
Q: Compute 4 iterations of Newton's method to approximate the square root of 2. Use $x_0 = 1$ as the initial guess. Show the error at each iteration ($\epsilon_i = |x_{i+1} - x_i|$) and its ratio ($\frac{\epsilon_{i+1}}{\epsilon_i}$). Put your steps in a table. Repeat the same procedure for $x_0 = -1$. Comment on both results.

Extra notes:

This course is a mandatory course required by the Syndicate of Engineers for all engineering departments in the country and the region.

External Evaluator

I confirm that the syllabus given the attached course book is sufficient and covers the required areas needed for the students.



Assist. Lect. Najat Yohana Danha