1- Course Specification of Advanced Engineering Mathematics
Course Code (ME501)

• General Information About the Course:

1.	**Course Title:**	Advanced Engineering Mathematics			
2.	**Course Code and Number:**	ME501			
3.	**Credit Hours:**	**Credit Hours**			**Total**
		Lecture	Practical	Seminar/Tutorial	
		3	--	--	**3**
4.	**Study Level and Semester:**	1st Level / 1st Semester			
5.	**Pre-requisites (if any):**	**ME502**			
6.	**Co-requisites (if any):**	**None**			
7.	**Program (s) in which the course is offered:**	MSc. In Mechanical Engineering Program			
8.	**Language of teaching the course:**	English			
9.	**Study System:**	Courses & Thesis			
10.	**Prepared By:**	Dr. Adnan Al-Salihi			
11.	**Reviewed by:**	Dr. ……			
12.	**Date of Approval:**				

• Course Description:

The objective of this course is to study in-depth and applications of the advance mathematics that will be used for solving mathematical problems that arise in science and engineering. Topics include: Fourier Analysis, Orthogonal Functions and Partial Differential Equations (PDE) with application on Heat, Wave and Laplace equations, Complex Numbers and Functions, Complex Integration, Power Series, Taylor Series, Laurant Series and Residue Integration, Special Linear Fractional Transformations, Complex Analysis to Potential Theory. introduction to numerical analysis include approximations of functions, systems of ordinary differential equations, eigenvalue/eigenvector problems, optimization, partial differential equations.

• Course Intended Learning Outcomes (CILOs):

Upon successful completion of **Advanced Solid Mechanics and Engineering Materials Course**, the graduates will be able to:

a1. **Demonstrate an advanced concepts and knowledge of** Partial differential equations, integral transforms, complex Integration, and Residue Integration, as well as to complex Analysis to Potential Theory.

a2. Introduce the concepts and mathematical methods to understand and analyze mechanical engineering fields.

a3. Select appropriate mathematical methods for solve a engineering problems governing by partial differential equations, as well as analyze, interpret the results and predict behavior.

b1. Construct the mathematical models through differential equations and associated analytical and numerical methods to solve various computational problems related to mechanical and interpret the results.

b2 Develop fundamental skills to complex variable analysis and apply it in solving differential equations through Laplace transform.

c1. Apply the different mathematical tasks for mechanical problems as well as analyze, interpret and predict behavior.

c2. Use Laplace and Fourier transforms, complex analysis, numerical methods and modern. computational tools to analysis a given solid mechanics problem.

d1. Effectively manage tasks, time, and resources.

d2. Communicate and work effectively in group and individually.

• Alignment of Course Intended Learning Outcomes (CILOs) to Program Intended Learning Outcomes (PILOs)

CILOs		PILOs
• **Knowledge and Understanding:** Upon successful completion of **Advanced Solid Mechanics and Engineering Materials Course**, the graduates will be able to:		• **Knowledge and Understanding:** Upon successful completion of the **MSc. In Mechanical Engineering Program**, the graduates will be able to:
a1.	**Demonstrate an advanced concepts and knowledge of** Partial differential equations, integral transforms, complex Integration, and Residue Integration, as well as to complex Analysis to Potential Theory.	**A1.** Acquire advanced concepts and knowledge of mathematics, scientific, mechanical engineering and associated technologies as well as across the boundaries of interdisciplinary disciplines.
		A2. Identify and critically evaluate contemporary engineering technologies, current developments and emerging trends within the mechanical engineering contexts.
a2.	**Introduce** the concepts and mathematical methods to understand and analyze mechanical engineering fields.	**A3.** Provide a holistic description of principles, concepts, approaches, techniques and analysis tools to design and development of existing and novel mechanical systems, while taking a sustainable and environmentally-friendly approach.
a3.	**Select** appropriate mathematical methods for solve a engineering problems governing by partial differential equations, as well as analyze, interpret the results and predict behavior.	
• **Cognitive/ Intellectual Skills:** Upon successful completion of the **Advanced Solid Mechanics and Engineering Materials Course,** the graduates will be able to:		• **Cognitive/ Intellectual Skills:** Upon successful completion of the **MSc. In Mechanical Engineering Program,** the graduates will be able to:
		B1. Identify and apply specialized knowledge and skills to solve problems that are critical to future growth of industry and business.
b1.	**Construct** the mathematical models through differential equations and associated analytical and numerical	**B2.** Creatively thinking and apply analysis tools to formulate and solve complex engineering problems in the mechanical engineering context using modern techniques

	methods to solve various computational problems related to mechanical and interpret the results.	and tools.
b2.	**Develop** fundamental skills to complex variable analysis and apply it in solving differential equations through Laplace transform.	**B3.** Design and optimize mechanical components, systems and process to meet desired needs within realistic constraints.
b4.		**B4.** Analyze and assess risks of the professional practice in the mechanical engineering contexts.
• **Professional and Practical Skills:** Upon successful completion of the **Advanced Solid Mechanics and Engineering Materials Course,** the graduates will be able to:		• **Professional and Practical Skills:** Upon successful completion of the **MSc. In Mechanical Engineering Program,** the graduates will be able to:
		C1. Use modern manufacturing processes and materials, experimental tests, appropriate software packages and other modern tools for the design analysis and manufacture of mechanical components and systems.
c1.	**Apply** the different mathematical tasks for mechanical problems as well as analyze, interpret and predict behavior.	**C2.** Conduct research and studies to solve mechanical engineering problems professionally, ethically and responsibly within realistic constraints.
c2.	**Use** Laplace and Fourier transforms, complex analysis, numerical methods and modern.	**C3.** Demonstrate an in-depth understanding of the mechanical engineering business environment, including environmental aspects, and apply quality issues, modern operations and business management techniques and good practices in a range of contexts.
• **Transferable Skills:** Upon successful completion of the **Advanced Solid Mechanics and Engineering Materials Course,** the graduates will be able to:		• **Transferable Skills:** Upon successful completion of the **MSc. In Mechanical Engineering Program,** the graduates will be able to:
		D1. Adopt effectively IT capabilities and other different resources of information to develop a scientific research in mechanical engineering fields.
d1.	Effectively manage tasks, time, and resources.	**D2.** Communicate, present, challenge and defend research ideas, results and conclusions in both orally and writing forms to different audiences in contexts.
d2.	Communicate and work effectively in group and individually	**D3.** Identify a need for the latest relevant knowledge and technologies and undertake life-long learning.
		D4. Collaborate effectively within multidisciplinary teams and lead them in different professional contexts

• Alignment of CILOs to Teaching and Assessment Strategies

• Alignment of Knowledge and Understanding CILOs:

	Knowledge and Understanding CILOs	Teaching Strategies	Assessment Strategies
a1.	**Demonstrate an advanced concepts and knowledge of** Partial differential equations, integral transforms, complex Integration, and Residue Integration, as well as to complex Analysis to Potential Theory.	▪ Lectures. ▪ Self-Learning Problems/Studies, ▪ Interactive class discussions. ▪ Exercises and home works.	▪ Oral & Writing Exams ▪ Individual Projects and Studies Reports, ▪ Assignments ▪ Home works and assignments
a2.	**Introduce** the concepts and mathematical methods to understand and analyze mechanical engineering fields.	▪ Lectures. ▪ Self-Learning Problems/Studies, ▪ Interactive class discussions. ▪ Exercises and home works.	▪ Oral & Writing Exams ▪ Individual Projects and Studies Reports, ▪ Assignments ▪ Home works and assignments
a3.	**Select** appropriate mathematical methods for solve a engineering problems governing by partial differential equations, as well as analyze, interpret the results and predict behavior.	▪ Lectures. ▪ Self-Learning Problems/Studies, ▪ Interactive class discussions. ▪ Exercises and home works.	▪ Oral & Writing Exams ▪ Individual Projects and Studies Reports, ▪ Assignments ▪ Home works and assignments

• Alignment of Intellectual Skills CILOs:

	Intellectual Skills CILOs	Teaching Strategies	Assessment Strategies
b1.	**Construct** the mathematical models through differential equations and associated analytical and numerical methods to solve various computational problems related to mechanical and interpret the results.	▪ Lectures. ▪ Self-Learning Problems/Studies, ▪ Interactive class discussions. ▪ Exercises & home works Computer hands-on sessions.	▪ Oral & Writing Exams ▪ Individual Projects and Studies Reports ▪ Home works and assignments
b2.	**Develop** fundamental skills to complex variable analysis and apply it in solving differential equations through Laplace transform.	▪ Lectures. ▪ Self-Learning Problems/Studies, ▪ Interactive class discussions. ▪ Exercises & home works ▪ Computer hands-on sessions.	▪ Oral & Writing Exams ▪ Individual Projects and Studies Reports ▪ Home works and assignments
b3.		▪	▪
b4.		▪	▪

• Alignment of Professional and Practical Skills CILOs:

Professional and Practical Skills CILOs		Teaching Strategies	Assessment Strategies
c1.	**Apply** the different mathematical tasks for mechanical problems as well as analyze, interpret and predict behavior.	▪ Lectures. ▪ Self-Learning Problems/Studies, ▪ Interactive class discussions. ▪ Exercises & home works ▪ Computer hands-on sessions.	▪ Oral & Writing Exams ▪ Individual Projects and Studies Reports ▪ Home works and assignments
c2.	**Use** Laplace and Fourier transforms, complex analysis, numerical methods and modern. computational tools to analysis a given solid mechanics problem.	▪ Lectures. ▪ Self-Learning Problems/Studies, ▪ Interactive class discussions. ▪ Exercises & home works Computer hands-on sessions.	▪ Oral & Writing Exams ▪ Individual Projects and Studies Reports ▪ Home works and assignments

- **Alignment of Transferable (General) Skills CILOs:**

Transferable (General) Skills CILOs		Teaching Strategies	Assessment Strategies
d1.	Effectively manage tasks, time, and resources.	▪ Independent Study, ▪ Individual/Group Projects and Studies, ▪ Presentation,	▪ Presentation, ▪ Written Report
d2.	Communicate and work effectively in group and individually.	▪ Independent Study, ▪ Individual/Group Projects and Studies,	▪ Presentation, ▪ Written Report.

• Course Content

- **Theoretical Aspect**

Order	Topic List / Units	Sub -Topics List	Number of Weeks	Contact Hours	Course ILOs
1	**Fourier Analysis**	Fourier Series Arbitrary Period. Even and Odd Functions. Half-Range Expansions Forced Oscillations. Approximation by Trigonometric Polynomials. Sturm–Liouville Problems.	1	3	a1, a2, a3, b1, b2, c1, c2
		Orthogonal Functions. Orthogonal Series. Generalized Fourier Series.	1	3	a1, a2, a3, b1, b2, c1, c2
		Fourier Integral. Fourier Cosine and Sine Transforms. Fourier Transform. Discrete and Fast Fourier Transforms	1	3	a1, a2, a3, b1, b2, c1, c2

2	**Partial Differential Equations (PDEs)**	Basic Concepts of PDEs. Modeling: Vibrating String, Wave Equation. Solution by Separating Variables. Use of Fourier Series. D'Alembert's Solution of the Wave Equation. Characteristics.	1	3	a1, a2, a3, b1, b2, c1, c2
		Modeling: Heat Flow from a Body in Space. Heat Equation. Heat Equation: Solution by Fourier Series. Steady Two-Dimensional Heat Problems. Dirichlet Problem Heat Equation: Modeling Very Long Bars. Solution by Fourier Integrals and Transforms	2	6	a1, a2, a3, b1, b2, c1, c2
3	**Complex Numbers and Functions**	Complex Differentiation. Complex Numbers and Their Geometric Representation. Polar Form of Complex Numbers. Powers and Roots. Derivative. Analytic Function. Cauchy–Riemann Equations.	1	3	a1, b2
4	**Midterm Exam**		1	3	
5	**Complex Numbers and Functions**	Laplace's Equation. Exponential Function. Trigonometric and Hyperbolic Functions. Euler's Formula Logarithm. General Power. Principal Value	1	3	a1, b2
6	**Complex Integration**	Line Integral in the Complex Plane. Cauchy's Integral Theorem. Cauchy's Integral Formula. Derivatives of Analytic Functions.	1	3	a1, a2, a3, b1, b2, c1, c2
7	**Power Series, Taylor Series**	Sequences, Series, Convergence Tests. Power Series. Functions Given by Power Series Taylor and Maclaurin Series	1	3	a1, b2
8	**Laurent Series. Residue Integration**	Laurent Series. Singularities and Zeros. Infinity. Residue Integration Method. Residue Integration of Real Integrals	1	3	a1, a2, b1, b2, c1, c2
9	**Complex Analysis and Potential Theory**	Electrostatic Fields. Use of Conformal Mapping. Modeling. Heat Problems Fluid Flow	1	3	a1, a2, a3, b1, b2, c1, c2
		Poisson's Integral Formula for Potentials. General Properties of Harmonic Functions.	1	3	a1, a2, a3, b1, b2, b3,

		Uniqueness Theorem for the Dirichlet Problem			b4
10	**Advanced numerical analysis**	approximations of functions, Euler's method Runge-Kutta methods systems of ordinary differential equations (Normal Form and Euler's Method for Systems in Normal Form) eigenvalue/eigenvector problems, optimization, Boundary value problems Finite-difference method	**1**	**3**	a1, a2, a3, b1, b2, c1, c2
11	**Final Theoretical Exam**	All Previous Topics	**1**	**3**	a1, a2, a3, b1, b2, c1, c2
Number of Weeks /and Contact Hours Per Semester			**16**	**48**	

- **Practical Aspect**

Order	Practical / Tutorials topics	Number of Weeks	Contact Hours	Course ILOs
1				
Number of Weeks /and Contact Hours Per Semester				

- **Tutorial Aspect:**

No.	Tutorial	Number of Weeks	Contact Hours	Learning Outcomes (CILOs)
1				
Number of Weeks /and Units Per Semester				

• Teaching Strategies:

- Lectures,
- Self-Learning Problems/Studies,
- Interactive class discussions.
- Computer hands-on sessions.
- Independent Study, and
- Presentation
- Exercises and home works.

• Assessment Methods of the Course:

- Oral & Writing Exams
- Individual Projects and Studies Reports,
- Assignments

• Assessment Methods of the Course:

- Home works and assignments.
- Written Report

• Tasks and Assignments:

No	Assignments/ Tasks	Individual/ Group	Mark	Week Due	CILOs (symbols)
1	Assignments on Fourier analysis.	**Group**	**5**	**3rd week**	a1, a2, b1, b2, c1, c2
2	Assignments on solutions of partial differential equations.	**Individual**	**10**	**5th week**	a1, a2, a3, b1, c1, c2
3	Assignments on complex integrations and Residue Integration.	**Group**	**5**	**9th week**	a1, b1, b2, c1, c2
4	Assignments on numerical methods.	**Individual**	**10**	**11th week**	a1, a2, b1, b2, c1, c2
	Total Score		**30**	==	===

• Learning Assessment:

No.	Assessment Tasks	Week due	Mark	Proportion of Final Assessment	CILOs
1	**Tasks and Assignments**	**3,5,9,11**	**30**	**20%**	**a1, a2, a3, b1, b2, c1, c2, d1,d2**
2	**Quizzes**	**4th & 10Th**	**10**	**6.7%**	**a1, a2, a3, b1, b2, c1, c2, d1,d2**
3	**Midterm Exam (Theoretical)**	**8th week**	**30**	**20%**	**a1, a2, a3, b1, b2, c1, c2, d1,d2**
4	**Final Exam (Theoretical)**	**16th week**	**80**	**53.3%**	**a1, a2, a3, b1, b2, c1, c2, d1,d2**
Total			**150**	**100%**	**===**

• Learning Resources :

1. **Required Textbook(s) :**

1. Dennis G. Zill, 2018, **Advanced Engineering Mathematics,** 6th Edition, Jones & Bartlett Learning, LLC, an Ascend Learning Company.

2. **Essential References:**

1. Dean G. Duffy, 2017, Advanced Engineering Mathematics with MATLAB, 4th Edition, CRC Press Taylor & Francis Group

2. Erwin Kreyszig , 2011, ADVANCED ENGINEERING MATHEMATICS, , 10th Edition, John Wiley & Sons, Inc.

3. Alan Jeffrey, 2002, Advanced Engineering Mathematics, HARCOURT/ACADEMIC/PRESS

4. K. F. Riley, M. P. Hobson and S. J. Bence, 1998, Mathematical methods for physics and engineering, A comprehensive guide Second edition, Cambridge University Press .

3. **Electronic Materials and Web Sites *etc.***

Courses Websites:

1. Mitopencourseware
https://ocw.mit.edu/courses/find-by-topic/#cat=mathematics&subcat=appliedmathematics
2. Wikipedia
https://en.wikipedia.org/wiki/Partial_differential_equation
3. Paul's online notes
https://tutorial.math.lamar.edu/classes/de/de.aspx
4. Johns Hopkins University
https://mathematics.jhu.edu/online/registration/?gclid=CjwKCAjwybyJBhBwEiwAvz4G78iM2KjrDBI6_1RV6n49xuo2YZSd8-g_EDmLtfJL3gOEAvvyQBchPBoCIdgQAvD_BwE
5. About Encyclopedia of Mathematics
https://encyclopediaofmath.org/index.php?title=Differential_equation,_partial
6. world of mathematics equations
http://eqworld.ipmnet.ru/en/methods/meth-pde.htm
http://eqworld.ipmnet.ru/en/solutions/eqindex/eqindex-pde.htm
http://eqworld.ipmnet.ru/en/pde-en.htm
7. From MathWorld--A Wolfram Web Resource
https://mathworld.wolfram.com/PartialDifferentialEquation.html

Journals

1. **Journal of differential equations**

https://www.elsevier.com/mathematics

2. **European-American journals**

https://www.eajournals.org/keywords/laplace-transform/

3. **Applied mathematics**

https://m.scirp.org/journal/am?utm_campaign=826331897_119154924641&utm_source=lixiaofang&utm_medium=adwords&utm_content=kwd-298314862467&gclid=CjwKCAjwybyJBhBwEiwAvz4G753M86Iz8PThqHYMXfkkHRh0T9shEnymZlEvcYVYPG-lx2KRgojgnRoCwVkQAvD_BwE

Other Websites:

1. iLectureonline
http://www.ilectureonline.com/lectures/subject/MATH/36/272
2. wolframMathworld
http://mathworld.wolfram.com/topics/CalculusandAnalysis.html
3. studypug
https://www.studypug.com/
4. khan academy
http://www. Khanacademy.org/math
5. UCDAVIS mathematics
https://www.math.ucdavis.edu/
6. Patrick's Just Math Tutorials
http://patrickjmt.com/

7. Paul's Online Notes
   http://tutorial.math.lamar.edu/
8. Voovers
   https://www.voovers.com/

• **الضوابط والسياسات المتبعة في المقرر Course Policies**	
بعد الرجوع للوائح الجامعة يتم كتابة السياسة العامة للمقرر فيما يتعلق بالآتي:	
سياسة حضور الفعاليات التعليمية Class Attendance: - يلتزم الطالب بحضور 75% من المحاضرات ويحرم في حال عدم الوفاء بذلك. - يقدم أستاذ المقرر تقريرا بحضور وغياب الطلاب للقسم ويحرم الطالب من دخول الامتحان في حال تجاوز الغياب 25% ويتم اقرار الحرمان من مجلس القسم.	1
الحضور المتأخر Tardy: - يسمح للطالب حضور المحاضرة إذا تأخر لمدة ربع ساعة لثلاث مرات في الفصل الدراسي، وإذا تأخر زيادة عن ثلاث مرات يحذر شفويا من أستاذ المقرر، وعند عدم الالتزام يمنع من دخول المحاضرة.	2
ضوابط الامتحان Exam Attendance/Punctuality: - لا يسمح للطالب دخول الامتحان النهائي إذا تأخر مقدار (20) دقيقة من بدء الامتحان - إذا تغيب الطالب عن الامتحان النهائي تطبق اللوائح الخاصة بنظام الامتحان في الكلية.	3
التعيينات والمشاريع Assignments & Projects: - يحدد أستاذ المقرر نوع التعيينات في بداية الفصل ويحدد مواعيد تسليمها وضوابط تنفيذ التكليفات وتسليمها. - إذا تأخر الطالب في تسليم التكليفات عن الموعد المحدد يحرم من درجة التكليف الذي تأخر في تسليمه.	4
الغش Cheating: - في حال ثبوت قيام الطالب بالغش في الامتحان النصفي أو النهائي تطبق عليه لائحة شؤون الطلاب. - في حال ثبوت قيام الطالب بالغش او النقل في التكليفات والمشاريع يحرم من الدرجة المخصصة للتكليف.	5
الانتحال Plagiarism: - في حالة وجود شخص ينتحل شخصية طالب لأداء الامتحان نيابة عنه تطبق اللائحة الخاصة بذلك	6
سياسات أخرى Other policies: - أي سياسات أخرى مثل استخدام الموبايل أو مواعيد تسليم التكليفات ..... الخ	7

Academic Year: ……....

Course Plan (Syllabus) Advanced Engineering Mathematics
Course Code (ME501)

• Information about Faculty Member Responsible for the Course:

Name	**Dr. Adnan Al-Salihi**	**Office Hours**					
Location &Telephone No.	Sana'a University 770499879	**SAT**	**SUN**	**MON**	**TUE**	**WED**	**THU**
E-mail	**Adnans2000@gmail.com**						

• General information about the course:

1.	**Course Title**	Advanced Engineering mathematics			
2.	**Course Code and Number**	ME501			
3.	**Credit Hours**	**Credit Hours**			**Total**
		Lecture	**Practical**	**Seminar/Tutorial**	
		3	--	--	**3**
4.	**Study Level and Semester**	1st Level / 1st Semester			
5.	**Pre-requisites**	**None**			
6.	**Co –requisite**	**ME 502**			
7.	**Program (s) in which the course is offered**	MSc. In Mechanical Engineering Program			
8.	**Language of teaching the course**	English			
9.	**Location of teaching the course**	Faculty Buildings			

• Course Description:

The objective of this course is to study in-depth and applications of the advance mathematics that will be used for solving mathematical problems that arise in science and engineering. Topics include: Fourier Analysis, Orthogonal Functions and Partial Differential Equations (PDE) with application on Heat, Wave and Laplace equations, Complex Numbers and Functions, Complex Integration, Power Series, Taylor Series, Laurant Series and Residue Integration, Special Linear Fractional Transformations, Complex Analysis to Potential Theory. introduction to numerical analysis include approximations of functions, systems of ordinary differential equations, eigenvalue/eigenvector problems, optimization, partial differential equations.

• Course Intended Learning Outcomes (CILOs):

Upon successful completion of **Advanced Solid Mechanics and Engineering Materials Course**, the graduates will be able to:

a1. **Demonstrate an advanced concepts and knowledge of** Partial differential equations, integral transforms, complex Integration, and Residue Integration, as well as to complex Analysis to Potential Theory.

a2. Introduce the concepts and mathematical methods to understand and analyze mechanical engineering fields.

a3. Select appropriate mathematical methods for solve a engineering problems governing by partial

differential equations, as well as analyze, interpret the results and predict behavior.

b1. Construct the mathematical models through differential equations and associated analytical and numerical methods to solve various computational problems related to mechanical and interpret the results.

b2 Develop fundamental skills to complex variable analysis and apply it in solving differential equations through Laplace transform.

c1. Apply the different mathematical tasks for mechanical problems as well as analyze, interpret and predict behavior.

c2. Use Laplace and Fourier transforms, complex analysis, numerical methods and modern. computational tools to analysis a given solid mechanics problem.

d1. Effectively manage tasks, time, and resources.

d2. Communicate and work effectively in group and individually.

• Course Content

1. Theoretical Aspect

Order	Units	Sub Topics	Week Due	Contact Hours
1	**Fourier Analysis**	Fourier Series Arbitrary Period. Even and Odd Functions. Half-Range Expansions Forced Oscillations. Approximation by Trigonometric Polynomials. Sturm–Liouville Problems.	**1**	**3**
		Orthogonal Functions. Orthogonal Series. Generalized Fourier Series.	**1**	**3**
		Fourier Integral. Fourier Cosine and Sine Transforms. Fourier Transform. Discrete and Fast Fourier Transforms	**1**	**3**
2	**Partial Differential Equations (PDEs)**	Basic Concepts of PDEs. Modeling: Vibrating String, Wave Equation. Solution by Separating Variables. Use of Fourier Series. D'Alembert's Solution of the Wave Equation. Characteristics.	**2**	**6**
		Modeling: Heat Flow from a Body in Space. Heat Equation. Heat Equation: Solution by Fourier Series. Steady Two-Dimensional Heat Problems. Dirichlet Problem Heat Equation: Modeling Very Long Bars. Solution by Fourier Integrals and Transforms	**1**	**3**

3	**Complex Numbers and Functions**	Complex Differentiation. Complex Numbers and Their Geometric Representation. Polar Form of Complex Numbers. Powers and Roots. Derivative. Analytic Function. Cauchy–Riemann Equations.	1	3
4	**Midterm Exam**		**1**	**3**
5	**Complex Numbers and Functions**	Laplace's Equation. Exponential Function. Trigonometric and Hyperbolic Functions. Euler's Formula Logarithm. General Power. Principal Value	**1**	**3**
6	**Complex Integration**	Line Integral in the Complex Plane. Cauchy's Integral Theorem. Cauchy's Integral Formula. Derivatives of Analytic Functions.	**1**	**3**
7	**Power Series, Taylor Series**	Sequences, Series, Convergence Tests. Power Series. Functions Given by Power Series Taylor and Maclaurin Series	**1**	3
8	**Laurent Series. Residue Integration**	Laurent Series. Singularities and Zeros. Infinity. Residue Integration Method. Residue Integration of Real Integrals	**1**	**3**
9	**Complex Analysis and Potential Theory**	Electrostatic Fields. Use of Conformal Mapping. Modeling. Heat Problems Fluid Flow	**1**	**3**
		Poisson's Integral Formula for Potentials. General Properties of Harmonic Functions. Uniqueness Theorem for the Dirichlet Problem	**1**	**3**
10	**Advanced numerical analysis**	Approximations of functions, Euler's method Runge-Kutta methods Systems of ordinary differential equations (Normal Form and Euler's Method for Systems in Normal Form) eigenvalue/eigenvector problems, Optimization, Boundary value problems Finite-difference method	**2**	**6**
11	**Final Theoretical Exam**	All Previous Topics	**1**	**3**

Number of Weeks /and Contact Hours Per Semester	16	48

- **Practical Aspect**

Order	Practical / Tutorials topics	Number of Weeks	Contact Hours	Course ILOs
1	▪ None			
Number of Weeks /and Contact Hours Per Semester				

- **Training/ Tutorials/ Exercises Aspects:**

Order	Tutorials/ Exercises	Week Due	Contact Hours
1	▪ None		
Number of Weeks /and Contact Hours Per Semester			

• Teaching Strategies:

- Lectures,
- Self-Learning Problems/Studies,
- Interactive class discussions.
- Computer hands-on sessions.
- Independent Study, and
- Presentation
- Exercises and home works.

• Assessment Methods of the Course:

- Oral & Writing Exams
- Oral & Writing Exams
- Individual Projects and Studies Reports,
- Assignments
- Home works and assignments.

Written Report

• Tasks and Assignments:

No	Assignments	Individual /Groups	Mark	Week Due
1	Assignments on Fourier analysis.	Group	5	3rd week
2	Assignments on solutions of partial differential equations.	Individual	10	5th week
3	Assignments on complex integrations and Residue Integration.	Group	5	9th week
4	Assignments on numerical methods.	Individual	10	11th week
	Total Score		30	

• Learning Assessment:

No	Assessment Method	Week Due	Mark	Proportion of Final Assessment %
1	Tasks and Assignments	3,5,9,11	30	20%
2	Quizzes	4th & 10Th	10	6.7%
3	Midterm Exam (Theoretical)	8th week	30	20%
4	Final Exam (Theoretical)	16th week	80	53.3%
	Total		150	100%

• Learning Resources:

1. **Required Textbook(s) :**

1. Dennis G. Zill, 2018, **Advanced Engineering Mathematics,** 6th Edition, Jones & Bartlett Learning, LLC, an Ascend Learning Company.

2. **Essential References:**

1. Dean G. Duffy, 2017, Advanced Engineering Mathematics with MATLAB, 4th Edition, CRC Press Taylor & Francis Group

2. Erwin Kreyszig , 2011, ADVANCED ENGINEERING MATHEMATICS, , 10th Edition, John Wiley & Sons, Inc.

3. Alan Jeffrey, 2002, Advanced Engineering Mathematics, HARCOURT/ACADEMIC/PRESS

4. K. F. Riley, M. P. Hobson and S. J. Bence, 1998, Mathematical methods for physics and engineering, A comprehensive guide Second edition, Cambridge University Press .

3. **Electronic Materials and Web Sites etc.**

Courses Websites:

8. Mitopencourseware
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9. Wikipedia
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12. About Encyclopedia of Mathematics
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4. **Journal of differential equations**

https://www.elsevier.com/mathematics

5. **European-American journals**

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Other Websites:

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14. Patrick's Just Math Tutorials
http://patrickjmt.com/
15. Paul's Online Notes
http://tutorial.math.lamar.edu/
16. Voovers
https://www.voovers.com/

• الضوابط والسياسات المتبعة في المقرر Course Policies	
بعد الرجوع للوائح الجامعة يتم كتابة السياسة العامة للمقرر فيما يتعلق بالآتي:	
سياسة حضور الفعاليات التعليمية Class Attendance: - يلتزم الطالب بحضور 75% من المحاضرات ويحرم في حال عدم الوفاء بذلك. - يقدم أستاذ المقرر تقريرا بحضور وغياب الطلاب للقسم ويحرم الطالب من دخول الامتحان في حال تجاوز الغياب 25% ويتم اقرار الحرمان من مجلس القسم.	1
الحضور المتأخر Tardy: - يسمح للطالب حضور المحاضرة إذا تأخر لمدة ربع ساعة لثلاث مرات في الفصل الدراسي، وإذا تأخر زيادة عن ثلاث مرات يحذر شفويا من أستاذ المقرر، وعند عدم الالتزام يمنع من دخول المحاضرة.	2

3	**ضوابط الامتحان Exam Attendance/Punctuality:** - لا يسمح للطالب دخول الامتحان النهائي إذا تأخر مقدار (20) دقيقة من بدء الامتحان - إذا تغيب الطالب عن الامتحان النهائي تطبق اللوائح الخاصة بنظام الامتحان في الكلية.
4	**التعيينات والمشاريع Assignments & Projects:** - يحدد أستاذ المقرر نوع التعيينات في بداية الفصل ويحدد مواعيد تسليمها وضوابط تنفيذ التكليفات وتسليمها. - إذا تأخر الطالب في تسليم التكليفات عن الموعد المحدد يحرم من درجة التكليف الذي تأخر في تسليمه.
5	**الغش Cheating:** - في حال ثبوت قيام الطالب بالغش في الامتحان النصفي أو النهائي تطبق عليه لائحة شؤون الطلاب. - في حال ثبوت قيام الطالب بالغش او النقل في التكليفات والمشاريع يحرم من الدرجة المخصصة للتكليف.
6	**الانتحال Plagiarism:** - في حالة وجود شخص ينتحل شخصية طالب لأداء الامتحان نيابة عنه تطبق اللائحة الخاصة بذلك
7	**سياسات أخرى Other policies:** - أي سياسات أخرى مثل استخدام الموبايل أو مواعيد تسليم التكليفات ..... الخ