HABIB UNIVERSITY

Engineering Mathematics
MATH202

Fall Semester - 2020

Instructor	Dr. M. Shahid Shaikh		
Class Timing and Location*	Section L5:	TuTh 10:00 AM – 11:15 AM	CPE Classroom
Office Hours	TBA URL		
Office Location	First Floor Dean's Pod		
Contact	shahid.shaikh@sse.habib.edu.pk		

Instructor	Dr. Abdullah Khalid		
Class Timing and Location*	Section L3:	TuTh 1:00 PM – 2:15 PM	E-121 Soorty Hall
	Section L4:	WeFr 3:50 PM – 5:05 PM	C-015
Office Hours	TBA URL		
Office Location	C-115 (faculty pod above gym)		
Contact	abdullah.khalid@sse.habib.edu.pk		

Instructor	Rameez Ragheb		
Class Timing and Location*	Section L1:	MoWe 8:30 AM – 9:45 AM	W-110 Math Lab
	Section L2:	TuTh 8:30 AM – 9:45 AM	E-012
Office Hours	TBA URL		
Office Location	W-304		
Contact	rameez.ragheb@sse.habib.edu.pk		

*whenever in-person classes resume, else classes will happen online

Course LMS URL	[insert link] Ask IT for a common URL for all sections
Course Prerequisites	MATH 101, MATH 102
Hardware Prerequisites	Laptop, headphones with mic, Internet connectivity
Software Prerequisites	Zoom, Microsoft Onenote (Comes with Windows, Mac users would have to download), Acrobat Reader
Content Area	This course meets requirements for CS, EE and ECE programs as well as minor in Mathematics and Physics
Campus Safety Policy	Please read the campus safety policy and protocols if the classes are in-person

I. Rationale:

This course is designed to equip engineering and computer science students with some necessary mathematical tools and analytical reasoning methods that are an integral part of their future professions. Topics in the course have a wide range of applications such as, optimization problems, electrical circuit analysis, signal processing, mathematical modelling etc.

II. Student Learning Objectives:

i. CLOs

By the end of this course, students should be able to

CLO1. Calculate and estimate curl and divergence of vector fields
CLO2. Apply theorems of vector calculus to determine circulation and flux of a vector field.
CLO3. Solve first order ODEs by separability, exactness and integrating factor.
CLO4. Solve second order linear ODEs with constant coefficients.
CLO5. Apply Power Series and Laplace Transform methods to solve non-linear ODEs.

ii. Mapping of Quiz/Assignment/Exam with Course Learning Outcomes (CLOs)

TBA

iii. CLOs mapped to Program Learning Outcomes:

	Program Learning Outcomes (PLOs) mapped to MATH 202		
	CLOs of the course are designed to cater following EE PLOs: **PLO 1 : Engineering Knowledge** **PLO 2 : Problem Analysis** CLOs of the course are designed to cater following CS PLOs: **PLO 1: Analysis** **PLO 6: Self-learning**		
PLOs	**Distribution of CLO weightages for each PLO**		
	CLO 1	**CLO 2**	**CLO 3**

EE PLO 1	50%		50%
EE PLO 2		100%	
CS PLO 1	50%	50%	
CS PLO 2			100%

III. Format and Procedures:

The topics in the course will be taught in a series of prerecorded videos, synchronous lectures and demonstrations. Additionally the course will have in class worksheets, assignments and quizzes.

1. Medium of Instruction
    a. Students are expected to watch pre-recorded video before joining the live session. Around 30% course engagement will take place through these pre-recorded videos. The live sessions will be used for groups discussions, problem solving etc.
    b. Students are expected to work up to 6 hours per week outside of the class for this course.
    c. Link to pre-recorded videos
2. Recording Policy
    a. As per HU's teaching policy during Covid-19, all synchronous and synchronous sessions must be recorded and uploaded on our Video Management System (Panopto). *Link to the folder of recordings should be available to all students*.
3. Engagement, Net-etiquettes and Participation Rules
    a. Students are not expected to keep their cameras or microphones on, however it is highly encouraged for active participation in the class as written communication is harder in mathematics classes then simply opening up your mic and asking.
    b. There will be multiple engagement opportunities during the course in the form of breakout rooms, discussions through LMS, social bookmarking and open questions. For synchronous sessions, you are expected to participate in all of these activities. For asynchronous sessions, you have to comment whenever requested during the videos on the comments thread inside Panopto.
    c. You are expected to respect each other, donot interrupt when others are talking, and raise your hand if you have a question in the middle of an explanation from the instructor (more on proper communication during the first few sessions).

IV. Course Readings:

a. FOR VECTOR CALCULUS: Thomas' Calculus, Early Transcendentals by George B. Thomas, Maurice D. Weir and Joel R. Hass
b. FOR DIFFERENTIAL EQUATIONS: Advanced Engineering Mathematics by E. Kreyszig (any edition, Chp: 1, 2, 4, 5, 6, 10).

V. Assessments and Grading Procedures:

Assessments: Grades will be based on:

a. Weekly Assignments (30%)
b. In-Class Worksheets (20%)
c. Announced Quizzes ($4 \times 7.5\% = 30\%$)
d. Final Exam (20%)

1. Late Submission Policy:
    - You are expected to submit in-class worksheets before the start of the next session. For worksheets and assignments, a 10% grade reduction will be applied for every delay of 24 hours. Quizzes and Final Exam must be submitted within the designated time.
2. Final Exam Policy
    - Please refer to the final exam policy specially designed to address the unique challenges faced due to COVID-1.

Rubrics of Grading: All written instruments (exams, mids and quizzes) will follow the following assessing criteria

a. The criteria for marking all assessment tasks will focus on correct working and appropriate reasoning in solutions and not just on correctness of answers.
b. Consequently, a wrong attempt producing an answer coinciding with the correct answer **will be discarded**.
c. No mistake will be penalized twice and a logical output of a mistake will be graded. This means error progression will be taken into account unless the student is making conceptual mistakes all over the solution.
d. In the course you will learn variety of methods, some generally applicable and some for specific problems, and as long as the question does not restrict you to use a certain method you can use any method.
e. When solving any problem, please make sure that your solution is well-written, clear and shows your conceptual understanding.
f. If you use any new symbol to help you solve, please make sure to define that symbol explicitly.

GRADING SCALE

GRADING SCALE		
LETTER GRADE	GPA POINTS	PERCENTAGE
A+	4.00	[95-100]
A	4.00	[90-95)
A-	3.67	[85-90)
B+	3.33	[80-85)
B	3.00	[75-80)
B-	2.67	[70-75)
C+	2.33	[67-70)
C	2.00	[63-67)
C-	1.67	[60-63)
F	0.00	[0-60)

VI. Attendance Policy:

Students are expected to watch all pre-recorded sessions and attend all synchronous sessions. Faculty members will measure attendance in dynamic ways including in class participation, feedback on recorded sessions, performance in assessments etc. Students failing to join any live session must inform their instructor within 24 hours along with the reason. If a student can't attend any or majority of the live sessions and the nature of the class requires in-class participation then the student can be dropped from the course. Please refer to the COVID-19 attendance policy for more details.

VII. Accommodations for students with disabilities

In compliance with the Habib University policy and equal access laws, I am available to discuss appropriate academic accommodations that may be required for student with disabilities. Requests for academic accommodations are to be made during the first two weeks of the semester, except for unusual circumstances, so arrangements can be made. Students are encouraged to register with the Office of Academic Performance to verify their eligibility for appropriate accommodations.

VIII. Inclusivity Statement

We understand that our members represent a rich variety of backgrounds and perspectives. Habib University is committed to providing an atmosphere for learning that respects diversity. While working together to build this community we ask all members to:

- share their unique experiences, values and beliefs
- be open to the views of others
- honor the uniqueness of their colleagues
- appreciate the opportunity that we have to learn from each other in this community
- value each other's opinions and communicate in a respectful manner
- keep confidential discussions that the community has of a personal (or professional) nature
- use this opportunity together to discuss ways in which we can create an inclusive environment in this course and across the Habib community

IX. Office hours:

Office hours have been scheduled, circulated, and a link to online rooms has been provided above. During these hours the course instructor will be available to answer questions or provide additional help. Before approaching the instructor, see the TA to resolve your problem.

Every student enrolled in this course must meet individually with the course instructor during course office hours at least once during the semester. The first meeting should happen within the first five weeks of the semester but must occur before midterms. Any student who does not meet with the instructor may face a grade reduction or other penalties at the discretion of the instructor and will have an academic hold placed by the Registrar's Office.

X. Academic Integrity

Each student in this course is expected to abide by the Habib University Student Honor Code of Academic Integrity. Any work submitted by a student in this course for academic credit will be the student's own work.

Scholastic dishonesty shall be considered a serious violation of these rules and regulations and is subject to strict disciplinary action as prescribed by Habib University regulations and policies. Scholastic dishonesty includes, but is not limited to, cheating on exams, plagiarism on assignments, and collusion.

PLAGIARISM: Plagiarism is the act of taking the work created by another person or entity and presenting it as one's own for the purpose of personal gain or of obtaining academic credit. As per University policy, plagiarism includes the submission of or incorporation of the work of others without acknowledging its provenance or giving due credit according to established academic practices. This includes the submission of material that has been appropriated, bought, received as a gift, downloaded, or obtained by any other means. Students must not, unless they have been granted permission from all faculty members concerned, submit the same assignment or project for academic credit for different courses.

CHEATING: The term cheating shall refer to the use of or obtaining of unauthorized information in order to obtain personal benefit or academic credit.

COLLUSION: Collusion is the act of providing unauthorized assistance to one or more person or of not taking the appropriate precautions against doing so.
All violations of academic integrity will also be immediately reported to the Student Conduct Office.

You are encouraged to study together and to discuss information and concepts covered in lecture and the sections with other students. You can give "consulting" help to or receive "consulting" help from such students. However, this permissible cooperation should never involve one student having possession of a copy of all or part of work done by someone else, in the form of an e-mail, an e-mail attachment file, a diskette, or a hard copy.

Should copying occur, the student who copied work from another student and the student who gave material to be copied will both be in violation of the Student Code of Conduct.

During examinations, you must do your own work. Talking or discussion is not permitted during the examinations, nor may you compare papers, copy from others, or collaborate in any way. Any collaborative behavior during the examinations will result in failure of the exam, and may lead to failure of the course and University disciplinary action.

Penalty for violation of this Code can also be extended to include failure of the course and University disciplinary action.

XI. Tentative week wise schedule

Week	Topic(s)	Specific topics for the week and Relevant topics and sections from the course book.	Remarks

Week 1 August 17 – 21	*Theorems of Vector Calculus and their applications.* Curl, Divergence, Greens Theorem and their applications.	• Physical and mathematical concepts of Curl and Divergence of vector field. • Calculating the Curl and Divergence of Vector fields (in Cartesian/Cylindrical/Spherical coordinates) • Derivation of Greens Theorem • Application of Greens theorem in simplifying problems.	
Week 2 August 24 – 27		• Introduction to Surfaces • Parametrization of Surfaces and Normal Vectors • Flux Integral	
August 28 – 30		† Ashura Break	
Week 3 August 31 – September 04		• Derivation of the Divergence theorem. • Physical meaning of the Divergence theorem in terms of flux of the field. • Application of Divergence Theorem in simplifying problems with diagrams. • Application of Divergence Theorem in simplifying problems with diagrams. Relevant sections from the book, 10.7: Triple Integrals *(starting from section of Divergence Theorem of Gauss)* 10.8: Further applications of Divergence Theorem *(Optional, for additional practice and deeper understanding)*	**Quiz 1** (Till Greens Theorem)
Week 4 September 7 – 11	. *Theorems of Vector Calculus and their applications* Divergence and Stoke's theorem and its application.	• Derivation of the Stoke's theorem. • Application of Stoke's Theorem in simplifying problems. Relevant sections from the book, 10.9: Stokes's Theorem	
Week 5 September 14 – 18	Ordinary Differential Equations (ODEs) Introduction to Ordinary	• Introduction to what differential equations are. • Categories of differential equations (linear-nonlinear, homogeneous-inhomogeneous and order) • Introduction to Ordinary Differential equations (ODEs).	

	Differential Equations (ODEs) First Order ODEs. Analytical solution of various first order ODEs	• Initial Value Problems (IVPs) in first order ODEs. • Making direction field of first order ODEs and their importance in understanding the trend of the solution. • Solving first order separable ODEs (and ODEs that can be converted into separable ODEs). Relevant sections from the book 1.1: How differential equation arise in practical problems, solution of an ODE. 1.2: Visualizing a first order ODE. 1.3: Solution of separable ODEs. (section on modeling will be covered later).	
Week 6 September 21 – 26	Ordinary Differential Equations (ODEs) First Order ODEs. Analytical solution of various first order ODEs. Existence and uniqueness of solution of first order ODE.	• Exact and In-Exact ODEs and their solutions. • Inexact ODEs which can be converted to exact ODEs. • Solution of general linear ODEs. • Existence and Uniqueness of solution of first order ODE. Relevant sections from the book, 1.4: Exact and inexact ODEs, Inexact ODEs convertible to exact ODEs (integrating factor). 1.5: General Solution of linear ODEs. 1.7: Existence and Uniqueness of solution of First order ODE.	**Quiz 2** (Till Week 4) **Note: The quiz will test all of Vector Calculus even if some topics are covered in Week 5**
Week 7 September 28 – October 2	Ordinary Differential Equations (ODEs) Second order ODEs Analytical solution of second order ODEs Categories of second order ODEs	• Introduction to second order ODEs. • Categories of Second order ODEs (linear-nonlinear, homogeneous-inhomogeneous). • Nature of the solution (Superposition of solutions) • Solving linear second order ODEs with constant coefficients. • Initial Value Problems in second order ODEs. Relevant sections from the book,	

	Homogeneous linear second order ODEs	2.1: Nature of the solution of Homogeneous Linear second order ODE (Superposition of solutions). 2.2: Homogeneous Linear second order ODE with constant coefficients.	
Week 8 October 5 – 9	Ordinary Differential Equations (ODEs) Analytical solution of Linear second order ODEs. Existence and uniqueness of solution BVPs in second order ODEs Inhomogeneous linear second order ODEs	• Existence and Uniqueness of solution of second order ODE. • Boundary Value Problems (BVPs) in second order ODEs • Solution of Inhomogeneous second order ODEs using Undetermined Coefficient Methods. • Solution of Inhomogeneous second order ODEs using Variation of Parameter Methods. Relevant sections from the book, 2.6: Existence, Uniqueness and Linear Independence of the solutions. 2.7: Non-homogeneous Linear ODEs Methods of solving Non-Homogeneous Linear ODEs o Method of Undetermined Coefficients Variation of Parameters.	† Arbaeen / Chehlum Imam Hussain: **October 8, 2020**
Week 9 October 12 – 16	Ordinary Differential Equations (ODEs) Modeling physical systems with ODEs. Physical systems involving Inhomogeneous second order ODE	• Physical problems involving ODEs. • Understanding the behavior and properties of systems from the solution of ODEs. Relevant sections from the book, 2.4: Modeling physical systems with second order ODE.	**Quiz 3** (Till Week 8)
October 19-23		† Meta Curricular Week Board of Faculty	
Week 10 October 26 – 30	Ordinary Differential Equations (ODEs) Solution of ODE using Power Series	• Basics of what a mathematical series • Introducing Power series and, its application, Taylor series. • Convergence of a series and radius of convergence.	

	Basics of Power series Method of solving an ODE using Power series Theory of using the Power series to solve ODEs.	• Concepts of analytic functions, regular points and singular points. • ODE. Relevant sections from the book, 5.2: Theory of Power Series Method: Convergence of Power Series solution	
Week 11 November 2 – 6	Ordinary Differential Equations (ODEs) Solution of ODE using Power Series Method of solving an ODE using Power series	• Using Power series to solve an ODE around a regular point. • Problems in series solution of ODE. Relevant sections from the book, 5.1: Power Series Method of solving ODEs.	
Week 12 November 9 – 13	Ordinary Differential Equations (ODEs) Solution of ODE using Power Series Legendre Equation Existence and uniqueness of series solution of an ODE	• Solution of Legendre Equation. • Discussion on the orthogonality of Legendre Polynomials. • Discuss one application of Legendre equation in engineering. • Existence and uniqueness of series solution of an ODE Relevant sections from the book, 5.3: Legendre Equation and Legendre Polynomial	
Week 13 November 16 – 20	Ordinary Differential Equations (ODEs) Solution of ODE using Laplace Transform Solving ODEs with Laplace Transforms	• Introduction of Laplace Transforms • Taking Laplace transform of ODEs. Relevant sections from the book, • 6.1: Laplace Transform, Inverse Laplace Transform and the s-shifting.	**Quiz 4** (Till Week 12)
Week 14 November 23 – 27	Ordinary Differential Equations (ODEs)	• Solving ODEs using Laplace transform. • Solving ODEs with Impulse function and Unit step function	

	Solution of ODE using Laplace Transform Differential Equations with Step function.	Relevant sections from the book, • 6.2: Laplace Transform of differential equations, solving ODEs using Laplace Transform. • 6.3: Unit Step Function: t-shifting	
Week 15 November 30 – December 4	Partial Differential Equations (PDEs) Solution of Wave Equation and Heat Equation using Separation of Variable method.	• Review of ODE solutions using different methods. • An Introduction to Partial Differential Equations (PDEs).	
December 5 -7 2020	**Reading Days**		
December 8 – 12 & 14 – 18, 2020	End Term Examinations Days Last Date for Incomplete Grade: **December 18, 2020**		
December 24, 2020	Final Grades Due by the Faculty: Fall 2020		

† No Classe(s)

Note: University's Examination Policy available in the Academic Policies folder on the Faculty / Staff Portal.