QF01/0408-4.0E	Course Plan for Bachelor program - Study Plan Development and Updating Procedures/ Department of Mathematics

Study plan No.	**2021/2022**	**University Specialization**		**Bachelor of Mathematics**	
Course No.	**0101374**	**Course name**		**Partial Differential Equations**	
Credit Hours	**3**	**Prerequisite/ Co-requisite**		**Ordinary Differential Equations (1)**	
Course type	☐ MANDATORY UNIVERSITY REQUIREMENT	☐ UNIVERSITY ELECTIVE REQUIREMENTS	☐ FACULTY MANDATORY REQUIREMENT	☐ Support course family requirements	✓ **Mandatory requirements** ☐ Elective requirements
Teaching style	☐ Full online learning	✓ **Blended learning**		☐ Traditional learning	
Teaching model	☐ 1 Synchronous: 1 asynchronous	✓ **1 face to face : 1 asynchronous**		☐ 2 Traditional	

Faculty member and study divisions' information (to be filled in each semester by the subject instructor)

Name	Academic rank	Office No.	Phone No.	E-mail	
Division number	**Time**	**Place**	**Number of students**	**Teaching style**	**Approved model**
1				Blended	

Brief description

Partial differential equations of the first-order, Nonlinear pde's of the first–order, Linear pde's with constant coefficients, Linear pde's with variable coefficients, wave, heat, and Laplace equations.

Learning resources

Course book information (Title, author, date of issue, publisher ... etc)	"Elements of Partial Differential Equations", By: Ian Sneddon, 2006, Dover Publications, inc.			
Supportive learning resources (Books, databases, periodicals, software, applications, others)	1. "Introduction to Partial Differential Equations with Applications", By E.C. Zachmanoglou, and D.W. Thoe, 1976, Dover Publications. 2. Differential Equations with Applications and Historical Notes". By: G. Simmons, 2nd Edition, 1991. 3. Partial Differential Equations, Prasad, Phoolan, 2010, ISBN: 8122430684. 4. Ordinary & Partial Differential Equation, M D Raisinghania, S. Chand, 2006S.I. Grossman, 3 *ed* Edition, 1987			
Supporting websites	1. http://mathworld.wolfram.com/PartialDifferentialEquation.html 2. http://ocw.mit.edu/courses/mathematics/ 3. http://ocw.mit.edu/courses/mathematics/			
The physical environment for teaching	✓ Class room	☐ labs	✓ Virtual educational platform	☐ Others
Necessary equipment				

and software	
Supporting people with special needs	
For technical support	

Course learning outcomes (S= *Skills, C= Competences K= Knowledge,)*

No.	Course learning outcomes	The associated program learning output code
	Knowledge	
K1	Describe real-world systems using PDEs.	**MK1**
K2	Use knowledge of partial differential equations (PDEs), modelling, the general structure of solutions, and analytic and numerical methods for solutions.	**MK2**
K3	classify PDEs, apply analytical methods, and physically interpret the solutions	**MK2**
	Skills	
S1	Solve first order PDEs using the method of characteristics	**MS1**
S2	Formulate physical problems as PDEs using conservation laws	**MS1**
S3	Interpret solutions in a physical context, such as identifying travelling waves, standing waves, and shock waves.	**MS2**
S4	Demonstrate accurate and efficient use of Fourier analysis techniques and their applications in the theory of PDE's	**MS1**
	Competences	
C1	Solve linear second order PDEs using canonical variables for initial-value problems, Separation of Variables and Fourier series for boundary value problems.	**MC1**
C2	Demonstrate capacity to model physical phenomena using PDE's (in particular using the heat and wave equations).	**MC1**
C3	Apply a range of techniques to find solutions of standard Partial Differential Equations (PDE)	**MC2**

Mechanisms for direct evaluation of learning outcomes

Type of assessment / learning style	Fully electronic learning	Blended learning	Traditional Learning (Theory Learning)	Traditional Learning (Practical Learning)
Midterm exam	30%	**30%**	40%	30%
Participation / practical applications	0	**0**	10%	30%
Asynchronous interactive activities	30%	**20%**	0	0
Final exam	40%	**50%**	50%	40%

Schedule of simultaneous / face-to-face encounters and their topics

Week	Subject	learning style	Reference
1	Review of the first order ode's. Def. of (pde's, order, solution).	Lecture	1 – 23

	Def. of quasilinear, almost linear, and linear pde's.		
2	Origin of first order pde's. Cauchy's problem of first order equations	Lecture	24 – 34
3	The general solution of the first order pde's. Lagrange's method for finding the general solution of the first-order pde's of the form f z_x + g z_y = h.	Lecture	35 – 44
4	Integral surfaces passing through a given curve. Surfaces orthogonal to a given system of surfaces	Lecture	44 – 56
5	One and two parameter systems. Types of solutions of nonlinear pde's of the first-order**.**	Lecture	57 – 111
6	Charpit's method for solving first order nonlinear pde's of the form f (x, y, z , p , q) = 0.	Lecture	57 – 111
7	Solving special types of first order nonlinear equations.	Lecture	57 – 111
8	Second order partial differential equations. Fundamental types of second order pde's.**Mid Exam 30%**	Lecture	112 – 123
9	Basic theory of linear pde's with constant coefficients.	Lecture	124 – 130
10	Complementary functions for f (D_x, D_y) = 0 when the operator f (D_x, D_y) is reducible or irreducible.	Lecture	130 – 132
11	Short methods for obtaining the particular integral of the eqn. of the form f (D_x , D_y) z = g (x , y)	Lecture	132 – 136
12	Solving special types of pde's of second - order with variable coefficients.	Lecture	137 – 142
13	Laplace method for transforming second order pde's with variable coefficients to canonical forms.	Lecture	143 – 152
14	Deriving wave, heat, and Laplace equations and finding their solutions by using separation of variable method.	Lecture	153 – 166
15	Deriving wave, heat, and Laplace equations and finding their solutions by using separation of variable method.	Lecture	153 – 166
16	**Final Exam 40%**		

Schedule of asynchronous interactive activities (in the case of e-learning and blended learning)

Week	Task / activity	Reference	Expected results
1	Background	Ordinary Differential Equations	Self-reading and Discussion
2	Video 1 Solving exercises	E-learning	Discussion in the class
3	Home work1:	(Lecture notes and Ref.1)	Submit a pdf or word sheet
4	Quiz 1	On the subjects studied on the first three weeks	Submitting on the E-learning
5	Assignment 1:	Internet sources and the other Supportive learning resources	Presentation
6	Video 2	Solving exercises	Discussion in the class
7	Home work	(Lecture notes and Ref.1)	Submit a pdf or word sheet

8	Assignment 2:	Internet sources and the other Supportive learning resources	Submitted with the mid exam
9	Self-reading	Ordinary Differential Equations	Talk
10	Video3	E-learning	Discussion in the class
11	Home work 3:	(Lecture notes and Ref.1)	Submit a pdf or word sheet
12	Self-reading	Power Series	Talk
13	Quiz 2	On the subjects studied on the subject studied after midexam	Submitting on the E-learning
14	Presentation of the subject:	Internet sources and the reference book	Video
15	Video 4 Revision of all the course	E-learning	Video
16	**Final Exam**	-	