COURSE OUTLINE

Department & Faculty : Dept. of Mathematical Sciences, Faculty of Science	**Page : 1 of 3**
Subject & Code: DIFFERENTIAL EQUATIONS (SSCE 1793/SSE 1793) **Total Lecture Hours**: 42 hours	**Semester:** Semester II **Academic Session:** 2015/16

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Synopsis :
This is an introductory course on differential equations. Topics include first order ordinary differential equations (ODEs), linear second order ODEs with constant coefficients up to fourth order, the Laplace transform and its inverse, Fourier series, and partial differential equations (PDEs). Students will learn how to classify and solve first order ODEs, use the techniques of undetermined coefficients, variation of parameters and the Laplace transform to solve ODEs with specified initial and boundary conditions, and use the technique of separation of variables to solve linear second order PDEs and the method of d'Alembert to solve wave equation.

Objectives:
On completing the course, students should be able to:
1. Use appropriate techniques to find the solution of first order differential equation.
2. Use the method of undetermined coefficients and the method of variation of parameters to find the solution of second order linear differential equations with constant coefficients up to fourth order.
3. Produce the Laplace transforms and its inverses for standard functions.
4. Solve initial, boundary value problems and system of differential equations using Laplace transforms.
5. Produce Fourier series of given functions.
6. Solve second order heat, wave and Laplace equations using the method of separation of variables and the method of d'Alembert for unbounded wave equations.
7. Communicate effectively in written forms using mathematical language.

Course Text:
1. Abd Wahid Md. Raji and Mohd Nor Mohamad (2015); Differential Equations for Engineering Students, Jabatan Matematik, UTM.

Supplementary Texts:
2. Glynn James, (2005). Advanced Modern Engineering Mathematics, Prentice Hall.
3. Kreyzig, Erwin (1993). Advanced Engineering Mathematics, John Wiley, New York (TA 330 K7 1993)
4. Stroud K.A (1996). Advanced Engineering Mathematics; MacMillan Ltd.
5. Alan Jeffrey (2002). Advanced Engineering Mathematics, Academic Press.
6. Nagel et al. (2004). Fundamentals of Differential Equations, 5th ed., Addison Wesley Longman.(QA371 N33 2004)
7. Normah Maan, et. al., (2008) Differential Equations Module, Jabatan Matematik, UTM.

Assessment

1.	Test 1	15%	28/3/16, 8.00-9.45 pm	Weeks 1-4
2.	Test 2	20%	02/5/16, 8.00-10.00 pm	Weeks 5-9
3.	Assignment/quiz	15%	Time to time	
4.	Final	50%		Weeks 1-14

Prepared by: **Name: Normah Maan** **Signature:** **Date:** 2 February 2016	**Certified by:** **Name:** **Signature:** **Date:**

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Weekly Schedule

Week	Lecture Topics	Notes
1 14/2-18/2/16	**First order ordinary differential equations**: Definition and classification of differential equations. Basic ideas; solutions of differential equations, initial and boundary value problems. Solving separable and linear equations.	
2 21/2-25/2/16	Methods of solution of homogeneous equations, exact equations, Bernoulli equations and other substitutions.	
3 28/2-03/3/16	Applications such as law of cooling , the free fall and chemical reactions .	
4 06/3-10/3/16	**Linear second order ordinary differential equations with constant coefficients**: Second order homogeneous differential equations. Solution of non-homogenous equations. Method of undetermined coefficients.	
5 13/3-17/3/16	Method of the undetermined coefficients to higher order ODE's up to fourth order, method of variation of parameters.	
6 20/3-24/3/16	Applications of second order differential equations: mechanical vibrations, damped and undamped free vibrations, and electrical circuits, circuits with and without impedance/resistance	**Meeting penyelarasan ujian 1- Selasa 22/3/2016**
7 27/3-31/3/16	**Laplace transforms**: Definition of Laplace transforms, derivation of Laplace transforms for standard elementary functions. Linearity property, first shifting theorem, multiplication by t^n.	**Test 1: 28/3/16 (Mon)**
01/4-09/4/16	**SEMESTER BREAK**	
8 10/4-14/4/16	Laplace transforms of unit step functions, Laplace transforms of Delta Dirac functions and periodic functions; Second shifting Theorem, Laplace transforms of the derivatives.	
9 17/4-21/4/16	Inverse Laplace transforms and Convolution theorem;	
10 24/4-28/4/16	Solving initial value problems (IVP), boundary value problems (BVP) and system of differential equation using Laplace transform.	**Meeting penyelarasan ujian 2- selasa 26/4/16**
11 01/5-5/5/16	Fourier series: Even and odd functions. Fourier series for periodic functions. Fourier series for even and odd functions, Half-range Fourier series,	**Test 2: 2/5/16 (Mon)**
12 08/5-12/5/16	**Partial differential equations.** Basic concepts, classifications. Method of d'Alembert for solving wave equations.	
13 15/5-19/5/16	Method of separation of variables for solving heat equation (consolidation theory), wave equations.	
14 22/5-26/5/16	Method of separation of variables for solving Laplace equations.	
29/5-04/6/16	**Revision week**	

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Learning Outcomes

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

No.	Course Learning Outcomes	Programme Learning Outcome(s) Addressed	Assessment Methods
CO1	Use appropriate techniques to find the solution of first order differential equation.	PO1	Test 1, Quiz, Final
CO2	Use the method of undetermined coefficients and the method of variation of parameters to find the solution of second order linear differential equations with constant coefficients up to fourth order.		Test 1, Test 2, Final
CO3	Produce the Laplace transforms and its inverses for standard functions.		Test 2, Final
CO4	Solve initial, boundary value problems and solve system of differential equations using Laplace transforms.		Quiz, Final
CO5	Produce Fourier series of given functions.		Final
CO6	Solve second order linear partial differential equations using the method of separation of variables and the method of d'Alembert for wave equations.		Final
CO7	Communicate effectively in written forms using mathematical language.		Assignments

Student Learning Time

Teaching and Learning Activities			Student Learning Time
1.	**Face-to-face Learning**		
	a.	Lecture-Centered Learning	
		Lecture (2.5 hrs lecture) x 14 weeks	35
	b.	In-class exercise (0.5 hr) x 14 weeks	7
2.	**Self-Directed Learning**		
	a.	Assignments (4 hrs x 6)	24
	b.	Revision (preparation for lectures, tutorials and assignments)	39
	c.	Preparations for Assessments	**9**
3.	**Formal Assessments**		
	a.	Continuous Assessment (2 tests)	**3**
	b.	Final Examination (3 hrs)	**3**
	Total SLT		**120**

Teaching Methods

(a) Lecture and Discussions

(b) Problem Solving-Individual Assignments

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