Prince Sultan University

Deanship of Educational Services

Department of Mathematics
and General Sciences

COURSE DETAILS:

DIFFERENTIAL EQUATIONS	MATH 225	MAJOR EXAM I
Semester:	Spring Semester --Term 172	
Date:	Sunday, February 24, 2018	
Time Allowed:	90 minutes	

STUDENT DETAILS:

Student Name:	
Student ID Number:	
Section:	640, 159
Instructor's Name:	J. Alzabut

INSTRUCTIONS:

- You may use a scientific calculator that does not have programming or graphing capabilities. NO borrowing calculators.
- NO talking or looking around during the examination.
- NO mobile phones. If your mobile is seen or heard, your exam will be taken immediately.
- Show all your work and be organized.
- You may use the back of the pages for extra space, but be sure to indicate that on the page with the problem.

GRADING:

	Page 1	Page 2	Page 3	Page 4	Total
Questions	1,2,3	4	5	6	
Marks	18	12	16	14	60

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Q.1 (5 points) Find the values of m so that $y = x^m$ is a solutions of the differential equation $x^2 y'' - 7xy' + 15y = 0$.

Q.2 (6 points) Find a differential equation whose general solution has the form $y = c_1 e^{-t/2} + c_2 e^{-4t}$.

Q.3 (7 points) Show that $y_1 = e^{-t}$ and $y_2 = e^{2t}$ form a fundamental set of solutions for $y'' - y' - 2y = 0$.

Q.4 Consider the differential equation $(2y-2)y' = 2x-1$.

a) (3 points) Verify that $y^2 - 2y = x^2 - x + c$ is an implicit solution of the differential equation.

b) (3 points) Find a particular solution of the differential equation that satisfies $y(0) = 1$.

c) (6 points) Find the interval of existence in which the particular solution of the IVP is valid.

Q.5 Consider the differential equation $\left(-xy\sin x+2y\cos x\right)dx+\left(2x\cos x\right)dy=0$.

a) (4 points) Verify that the differential equation is not exact.

b) (5 points) Multiply the differential equation by the integrating factor $\mu=xy$ and then verify that the resulting equation is exact.

c) (7 points) Solve the differential equation.

Q.6 Consider the IVP $y'' + 2y' + 6y = 0, \quad y(0) = 2, \quad y'(0) = \alpha > 0.$

a) (4 points) Find a particular solution for the IVP.

b) (7 points) Find α such that $y(1) = 0.$

c) (3 points) Determine the end behavior of the solution. Draw a sketch taking into account the initial point $y(1) = 0.$