Prince Sultan University

Deanship of Educational Services
Department of Mathematics
and
General Sciences

COURSE DETAILS:

DIFFERENTIAL EQUATIONS	MATH 225	FINAL EXAM
Semester:	Fall Semester --Term 181	
Date:	Saturday, December 15, 2018	
Time Allowed:	180 minutes	

STUDENT DETAILS:

Student Name:	
Student ID Number:	
Section:	493 (Lecture starts at 10.00 AM), 495 (Lecture starts at 11.00 AM)
Instructor's Name:	Jehad 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. 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 2	Page 3	Page 4	Page 5	Total
Questions	**Q.1, Q.2 (20 pts)**	**Q.3, Q.4 (22 pts)**	**Q.5, Q.6 (20 pts)**	**Q.7, Q.8 (18 pts)**	**80**
Student Marks					

Q.1 (12 points) Consider the equation $(-xy\sin x + 2y\cos x)dx + (2x\cos x)dy = 0.$

a) Verify that the equation is not exact.

b) Multiply the equation by the integrating factor $\mu = xy$ and verify that the new equation is exact.

c) Solve the equation.

Q.2 (8 points) Solve the Cauchy Euler equation $x^2y'' + xy' + y = 0,\ y(1) = 1,\ y'(1) = 2.$

Q.3 (10 points) Fill in the blanks:

a) The Laplace of $f(t) = e^{-3t} \sin 2t$ is ----------

b) The singular points of the equation $x^3\left(x^2 - 25\right)y'' + 4xy' + y = 0$ are ----------

c) The solution of $y' = \dfrac{10x}{y^3}$ is ----------

d) The annihilator operator for the function $f(x=)3 + e^x \cos 2x$ is----------

e) The differential equation, for which the roots of its characteristic equation are 1 and and -2, has the form----------.

Q.4 (12) Solve the equation $y''' - 3y'' + 3y' - y = x - 4e^x$ by method of undetermined coefficients. Evaluate the constant of the particular solution.

Q.5 (8 points) Use Laplace transform to solve the IVP: $y'' - 2y' + y = e^t, \quad y(0) = 0, \;\; y'(0) = 5.$

Q.6 (12 points) Find the power series solution of $y'' + x^2 y = 0$ about the ordinary point $x_0 = 0$.

Q.7 (15 points) Consider the function $f(x)=\begin{cases} 1, & -2 < x < -1 \\ -x, & -1 \le x < 0 \\ x, & 0 \le x < 1 \\ 1, & 1 \le x < 2 \end{cases}$.

a) Sketch the graph of f and determine whether it is even, odd or neither.

b) Expand f in an appropriate cosine or sine series.

c) Draw one period extension of f backward and forward (Use different color).

Q.8 (3 points) Classify the equation $3u_{xx} + 5u_{yx} + u_{yy} = 0$ as hyperbolic, parabolic an elliptic.