25035

University of Sargodha

BS 3rd Term Examination 2019

Subject: Computer Science   **Paper: Differential Equations (MATH:2215)**

Time Allowed: 2:30 Hours

Maximum Marks: 80

Note: Objective part is compulsory. Attempt any four questions from subjective part.

Objective Part   (Compulsory)

Q.1. Write short answers of the following in 2-3 lines each on your answer sheet.   (2*16)

i. Define partial differential equation.
ii. Define explicit solution.
iii. Determine whether the DE $u\,dv + (v + uv - ve^u)du$ is linear in u.
iv. Verify that $y = e^{-x/2}$ is an explicit solution of the DE: $2y' + y = 0$.
v. State the Newton's law of cooling and warming and give its mathematical model.
vi. Find the integrating factor of the linear equation. $3\frac{dy}{dx} + 12y = 4$
vii. Write general form of homogeneous linear nth-order differential equation.
viii. Determine that the set of functions $f_1(x) = x$, $f_2(x) = x - 1$, $f_3(x) = x + 3$ is linearly independent on the interval $(-\infty, \infty)$.
ix. Write the auxiliary equation, the roots and the corresponding general solution of DE:
$$y'' - 10y' + 25y = 0$$
x. What will be the assumed particular solution y_p for $g(x) = 3x^2 - 5\sin 2x + 7xe^x$
xi. Verify that the differential operator 2D-1 annihilates the function $y = 4e^{x/2}$.
xii. Find the linear differential operator that annihilates the function $y = x + 3xe^{6x}$.
xiii. Write Maclaurin series for xe^{3x} in summation notation.
xiv. Write the standard form of first order linear differential equation.

Write the general solution of the Bessel's equation: $x^2y'' + xy' + \left(x^2 - \frac{1}{9}\right)y = 0$.

Define separable equation.

Subjective Part (4*12)

Q.2. a) Solve the given IVP by using proper substitution.
$$\frac{dy}{dx} = \frac{3x+2y}{3x+2y+2}, \quad y(-1) = -1$$
b) Determine whether the given DE is exact. If exact, then solve it. $(x^3 + y^3)dx + 3xy^2 dy = 0$

Q.3. A tank contains 200 liters of fluid in which 30 grams of salt are dissolved. Brine containing 1 gram of salt per liter is then pumped into the tank at a rate of 4 L/min; the well mixed solution is pumped out the same rate. Find the number $A(t)$ of grams of salt in the tank at time t.

Q.4. Solve the given differential equation by the method of undetermined coefficients-superposition approach. $y'' + y = 2x\sin x$

Q.5. Solve the given system of differential equations by systematic elimination.
$$\frac{dx}{dt} = 2x - y$$
$$\frac{dy}{dt} = x$$

Q.6. Find the power series solution of the DE $y'' + x^2y' + xy = 0$ about the ordinary point $x = 0$.

Q.7. Use the improved Euler's method to obtain a four decimal approximation of the value $y(1.5)$ for the solution of the initial value problem $y' = 2xy$, $y(1) = 1$ by using $h = 0.1$.