UNIVERSITY OF THE PUNJAB

Third Semester – 2019
Examination: B.S. 4 Years Program

PAPER: Differential Equations-I
Course Code: MATH-221/MTH-21334   Part – II

MAX. TIME: 2 Hrs. 30 Min.
MAX. MARKS: 50

ATTEMPT THIS (SUBJECTIVE) ON THE SEPARATE ANSWER SHEET PROVIDED

Q.2.   Give short answers of following: **(5 x 4 = 20)**

1. Solve the initial-value problem

$$\frac{dy}{dx} = -\frac{x}{y}, \qquad y(4) = -3.$$

2. Solve

$$\frac{dy}{dx} = e^{-x^2}, \qquad y(3) = 5.$$

3. Solve

$$(x+1)\frac{dy}{dx} + y = \ln x, \qquad y(1) = 10.$$

4. Solve

$$x\frac{dy}{dx} - 4y = x^6 e^x.$$

5. Solve

$$x^3\frac{d^3y}{dx^3} + 5x^2\frac{d^2y}{dx^2} + 7x\frac{dy}{dx} + 8y = 0.$$

Q.3.   Give detailed answers: **(5 x 6 = 30)**

1. Solve the differential equation by using undetermined coefficients

$$\frac{d^2y(x)}{dx^2} + 25y(x) = 6\sin(x).$$

2. Solve the given differential equation

$$\frac{dy}{dx} = 1 + e^{y-x+5}.$$

3. Solve

$$\left(\frac{3y^2 - t^2}{y^5}\right)\frac{dy}{dt} + \frac{t}{2y^4} = 0, \qquad y(1) = 1.$$

4. Solve the system of linear differential equations

$$\left(D^2 + 5\right)x(t) - 2y(t) = 0,$$
$$-2x(t) + \left(D^2 + 2\right)y(t) = 0,$$

where $D = \frac{d}{dt}, D^2 = \frac{d^2}{dt^2}$.

5. Solve

$$x^2\frac{d^2y}{dx^2} + x\frac{dy}{dx}\left(x^2 - \frac{1}{4}\right)y = x^{3/2},$$

by using variation of parameters (Note: The linearly independent solutions of the associated homogeneous differential equations are $y_1(x) = x^{-1/2}\cos x$, $y_2(x) = x^{-1/2}\sin x$).

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Roll No. in Fig. ....

Roll No. in Words. ....

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PAPER: Differential Equations-I

Course Code: MATH-221/MTH-21334 Part–I (Compulsory)

MAX. TIME: 30 Min.
MAX. MARKS: 10

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Signature of Supdt.:

Attempt this Paper on this Question Sheet only.
Please encircle the correct option. Division of marks is given in front of each question.
This Paper will be collected back after expiry of time limit mentioned above.

Q.1. Mark True / False and Fill in the blanks.   **(1x10=10)**

1. The first order differential equation $\frac{dr}{d\theta} = r\theta + r + \theta + 1$ is not separable.   (True/False)

2. Every autonomous differential equation $\frac{dy}{dx} = f(y)$ is separable.   (True/False)

3. $y = -1 + x$ is a solution of $\frac{dy}{dx} - y = x$.   (True/False)

4. $y = \pm a$ are two constant solutions of $\frac{dy}{dx} = y^2 + a^2$.   (True/False)

5. The set of functions $f_1(x) = \cos ax$, $f_2(x) = \sin ax$ is linearly dependent on interval $(-\infty, \infty)$. (True/False)

6. $\left(\frac{d}{dx} + \alpha^2\right)\left(e^{\alpha x}\sin(\beta x)\right) = 0$.   (True/False)

7. $\left(\frac{d}{dx} + \alpha\right)\left(xe^{\alpha x}\right) = $ ....

8. $W(\cos 3x, \sin 3x, \cos 6x) = $ ....

9. If $y_1 = e^x$ and $y_2 = e^{-x}$ are solutions of homogeneous second order linear ordinary differential equation, then necessarily $y = -5e^{-x} + 10e^x$ is also a solution of the same differential equation.   (True/False)

10. $y_p = Ax^2$ is a particular solution of $\frac{d^3y}{dx^3} + \frac{d^2y}{dx^2} = 1$ for $A = $ ....