Total No. of Printed Pages: 3

SUBJECT CODE NO:- 2040
FACULTY OF SCIENCE AND TECHNOLOGY
B.Sc. F.Y Sem-I
Examination March/April-2022 (To be held in June/July-2022)
Mathematics MAT - 102
(Differential Equations)

[Time: 1:53 Hours]   [Max. Marks:50]

Please check whether you have got the right question paper.

N.B.
i)   Attempt all Questions.
ii) Figure to the right indicate full marks.

Q.1 A) Attempt any one.   08

a) Prove that the necessary and sufficient condition for the differential equation M dx + N dy = 0 to be exact is that $\frac{\partial M}{\partial y} = \frac{\partial N}{\partial x}$, M and N are functions of x and y.

b) With usual notation, Prove that

$$\frac{1}{f(D)}\, e^{ax} \cdot V = e^{ax}\, \frac{1}{f(D+a)}\, V,$$

Where V is any function of x.

B) Attempt any one.   07

c) Solve
$$\frac{d^2y}{dx^2} - 5\frac{dy}{dx} + 6y = e^{4x}.$$

d) Solve
$$x\frac{dy}{dx} - ay = x + 1.$$

Q.2 A) Attempt any one.   08

a) Explain the method of solving the differential equation

$$(a+bx)^n \frac{d^n y}{dx^n} + P_1 (a+bx)^{n-1} \frac{d^{n-1} y}{dx^{n-1}} + \cdots\cdots + P_{n-1}(a+bx)\frac{dy}{dx} + P_n y = f(x),$$

Where $P_1, P_2, \ldots, P_n$ are constants.

b) Explain the method of solving the differential equation

$$\frac{d^n y}{dx^n} + P_1 \frac{d^{n-1} y}{dx^{n-1}} + P_2 \frac{d^{n-2} y}{dx^{n-2}} + \cdots + P_n y = X$$

Where $P_1, P_2, \ldots, P_n$ are constants and X is function of x.

1

B) Attempt any one.
    c) Solve
$$x^2 \frac{d^2y}{dx^2} - x\frac{dy}{dx} + y = 2\log x.$$

    d) Solve
$$\frac{d^2y}{dx^2} + 3\frac{dy}{dx} + 2y = e^{2x} \cdot \text{Sin x}.$$

Q.3 A) Attempt any one.   05
    a) Explain the method of solving the differential equation of the form
$$\frac{d^2y}{dx^2} = f(y).$$

    b) Form the Partial differential equation by eliminating an arbitrary function $\phi\ (u, v) = 0$, where u and v are functions of x, y, z.

B) Attempt any one.   05
    c) Solve
$$\frac{xdx}{y^2z} = \frac{dy}{xz} = \frac{dz}{yz}.$$

    d) Form the Partial differential equation corresponding to
$$(x-h)^2 + (y-k)^2 + z^2 = c^2.$$
    By eliminating h and k.

Q.4   Choose the correct alternative.   10

    i) The integrating factor of differential equation $\frac{\partial y}{\partial x} + y = e^{-x}$ is _____.
    a) e^x
    b) e^{-x}
    c) e^{2x}
    d) $\log x$

    ii) The general solution of the differential equation $\frac{d^2y}{dx^2} + 3 - 54y = 0$ is _____.
    a) $y = c_1e^{-6x} + c_2e^{9x}$
    b) $y = c_1e^{6x} + c_2e^{-9x}$
    c) $y = c_1e^{6x} + c_2e^{9x}$
    d) $y = c_1e^{-6x} + c_2e^{-9x}$

    iii) The Particular integral of differential equation $\frac{d^3y}{dx^3} + y = 5e^{-x}$ is _____.
    a) $5xe^{-x}$
    b) xe^{-x}
    c) $\frac{3}{5}xe^{-x}$
    d) $\frac{5}{3}xe^{-x}$

    iv) The Partial differential equation corresponding to equation z = ax + by + ab is _____.

2

a) $z = px + qy$
b) $z = pq$
c) $z = px + qy + pq$
d) None of these

v) The differential equation $(x^2 - 4xy - 2y^2)dx + (y^2 - 4xy - 2x^2)dy = 0$ is _____.
a) Exact
b) Non-exact
c) Linear
d) None of these