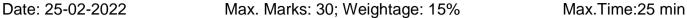
BITS PILANI, DUBAI CAMPUS

SECOND SEMESTER 2021- 2022

MATHEMATICS-III (MATH F211) QUIZ- I

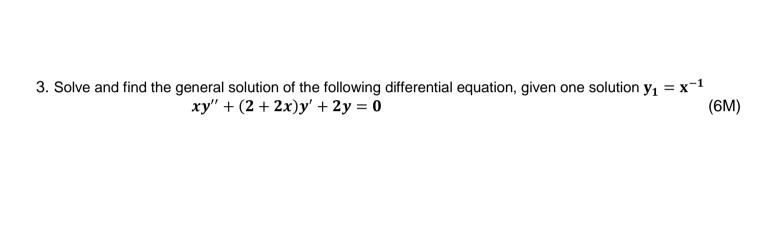


NAME: ID: SECTION:

Answer all the five questions

1. Solve using suitable exact differential formulae or otherwise: $(y - xy^2)dx - (x + x^2y)dy = 0$ (6M)

2. Solve $\frac{1}{x} \frac{dy}{dx} + 4y = 2$ (6M)



4. Solve

$$y'' - 2y' + 10y = 0, y(0) = 4, y'(0) = 1$$
 (6M)

5. Solve by Reduction of order method: $xy'' = \sqrt{1 + (y')^2}$

$$xy'' = \sqrt{1 + (y')^2}$$
 (6M)

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BITS PILANI, DUBAI CAMPUS SECOND SEMESTER 2021- 2022

MATHEMATICS-III (MATH F211) MID-TERM (Open Book).

Date: 25-03-2022 Max. Marks: 60 Weightage: 30% Max.time:90 min.

Answer all the questions

1. Solve
$$(3x^2 + 2xy^2)dx + 2x^2ydy = 0$$
, given $y(2) = -3$. [6]

2. Solve using exact differential formula (or) by any other method:

$$y(1+xy)dx + x(1+xy+x^2y^2)dy = 0$$
 [6]

3. Solve:
$$2x^2y' + 6xy - 3e^{-2x} = 0$$
. [6]

4. Solve:
$$y \sin x - \frac{dy}{dx} \cos x = y^2$$
 [6]

5. Solve
$$xy'' + x(y')^2 - y' = 0$$
 using the reduction of order method. [6]

6. Solve
$$y''' - 3y'' + 4y = 0$$
, $y(0) = 1$, $y'(0) = 0$, $y''(0) = -1$. [6]

7. Solve
$$(1+x)^2 y'' + (1+x)y' + y = 0$$
 given one solution as $y_1 = \cos(\log(1+x))$ [6]

8. Solve
$$y'' + 3y' + 2y = \sin(e^x)$$
 using the method of variation of parameters. [6]

9. Solve
$$y'' + 4y = 2\cos^2(x)$$
 using the method of undetermined coefficients. [6]

10. Solve
$$2y'' - 3y' - y = x^2$$
 using the operator method. [6]

BITS PILANI, DUBAI CAMPUS

SECOND SEMESTER 2021-2022

MATHEMATICS-III (MATH F211) COMPREHENSIVE EXAMINATION (CLOSED BOOK).

Date: 06-06-2022 Marks: 80 Weightage: 40% Time: 3 hours

Answer all the questions

1. Solve
$$(y^4 + 2y)dx + (xy^3 + 2y^4 - 4x)dy = 0$$
 [4]

- 2. Find the general solution of $yy'' + (y')^2 = y'$ by reduction of order method. [4]
- 3. Find the general solution of $y'' + y = x \cot(x)$ by variation of parameter method. [4]
- 4. Find the general solution of $(D^2 + 2D)y = e^x \sin(x)$ by undetermined coefficient method. [4]
- 5. Find the power series solution of $(1-x^2)y'' + 2xy' y = 0$. about the ordinary point x = 0
- 6. Solve the following hypergeometric differential equation in terms of hypergeometric function, near the regular singular point x=0

$$8x(1-x)y'' + (4-14x)y' - y = 0.$$
 [4]

- 7. Using the generating function for Legendre polynomials prove that $P_n'(1) = \frac{n(n+1)}{2}$ where $P_n(x)$ represent Legendre polynomial [4]
- 8. Find the eigen values and eigen functions for the equation $y'' + \lambda y = 0$ where y(0) = 0, y(2b) = 0 when b > 0
- 9. Find the Fourier series of the function $f(x)=3x+2x^2, -\pi \le x < \pi$. Hence deduce the sum of the series $\frac{1}{1^2}-\frac{1}{2^2}+\frac{1}{3^2}-\frac{1}{4^2}+\dots$ [6]

10. Solve
$$x(x-1)y'-y=x^2(x-1)^2$$
 [4]

- 11. Verify that one solution of xy'' (2x+1)y' + (x+1)y = 0 is given by $y_1 = e^x$, and find the general solution. [4]
- 12. Solve $y'' 2y' + y = \frac{e^x}{x^3}$ by operator method. [4]
- 13. Find the general solution of the following system:

$$\frac{dx}{dt} = 4x - 2y, \quad \frac{dy}{dt} = 5x + 2y$$

14. Find the Frobenius series solution about x = 0 of 4xy'' + 2y' + 2y = 0. [6]

15. Given that
$$J_{1/2}(x) = \sqrt{\frac{2}{\pi x}} \sin x$$
; $J_{-1/2}(x) = \sqrt{\frac{2}{\pi x}} \cos x$, express $J_{3/2}(x)$ and $J_{-3/2}(x)$ in terms of trigonometric functions.

16. Find
$$L \left[e^{4t} \left(t^2 + 3t + 5 \right) \right]$$
 [4]

17. Solve
$$y'' - 10y' + 9y = 5t$$
, $y(0) = -1$, $y'(0) = 2$ using Laplace transform. [6]

18. Suppose that a string of length π is stretched and fixed on both ends and is plucked in the

middle such that it has the initial shape
$$f(x) = \begin{cases} \frac{x}{10}, & \text{if } 0 \le x \le \frac{\pi}{2} \\ \frac{\pi - x}{10}, & \text{if } \frac{\pi}{2} < x \le \pi \end{cases}$$

Find the deflection of the string at any point x at any time t.

[4]