REV-00
MSM/39/44

2017/12

M. Sc. MATHEMATICS
FIRST SEMESTER
DIFFERENTIAL EQUATION
MSM - 102

Duration: 3 Hrs. **Marks: 70**

Part : A (Objective) = 20
Part : B (Descriptive) = 50

[PART-B : Descriptive]

Duration: 2 Hrs. 40 Mins. **Marks: 50**

[Answer question no. One (1) & any four (4) from the rest]

1. State Legendre Equation and find its solution. 2+8=10

2. What is application of Charpit's Method? Describe Charpit's Method? 3+7=10

3. What do you mean by non homogeneous equation?Solve 2+8=10
$(D - D' - 1)(D - D' - 2)Z = Sin(2x + 3y)$

4. What is the relation between exactness and integrability of a Total differential equation? 2+8=10
Solve $(y^2 + yz)dx + (xz + z^2)dy + (y^2 - xy)dz = 0$

5. What do you mean by Linear Differential equation of second degree? 2+8=10
Solve $\frac{d^2y}{dx^2} + (1 - \cot x)\frac{dy}{dx} - y\cot x = \sin^2 x$

6. Find complete integral of 5+5=10
(a) $z = px + qy + p^2 + q^2$,
(b) $q = 3p^2$

7. Find the 3rd approximation of the second solution of the equation 8+2=10
$\frac{dy}{dx} = z, \frac{dz}{dx} = x^3(y + z)$ by Picard's Method where $y = 1, z = 1/2$ when $x = 0$.what do you mean by Picard's Method.

8. What is the difference between Ordinary and Singular point?Determine whether $x = 0$ is an ordinary point or a regular singular point of the differential equation $2x^2 \frac{d^2y}{dx^2} + 7x(x+1)\frac{dy}{dx} - 3y = 0$ .Write a power series in $(x - x_0)$. 2+6+2 =10

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[PART-A : Objective]

Choose the correct answer from the following: **1×20=20**

1. Which of the following is n[th] approximation Y_n In Picard's Method.

   a. $y_n(x) = y_0 + \int_{x_0}^{x} f(x, y_{n-1})dx$

   b. $y_1(x) = y_0 + \int_{x_0}^{x} f(x, y_{n-1})dx$

   c. $y_n(x) = y_0 + \int_{x_0}^{x} f(x, y_n)dx$

   d. $y_n(x) = y_0 + \int_{x}^{x_0} f(x, y_n)dx$

2. In Lipschiz Condition $|f(x,y_2) - f(x,y)| \le k$ where (x,y_2) and (x,y_2) both lie in D .In which of the following $f(x,y)$ satisfy Lipschiz Condition.
   a. Z-Plan
   b. X-Plan
   c. yz plan
   d. XY Plan

3. For which reason Existence Theorem is called Existence
   a. It has no solution
   b. It does have a solution
   c. It has a unique solution
   d. It has two solution

4. For which reason Uniqueness Theorem is called uniqueness
   a. more than one solution
   b. only one solution
   c. two solution
   d. All of above

5. The solution of a differential equation $Pdx + Qdy + Rdz = 0$ is
   a. $f(x,y,t) = k(const)$
   b. $f(x,y,z) = k(const)$
   c. $\phi(x,y,t) = k(const)$
   d. x, y

6. The equation $(\frac{\partial z}{\partial x})^2 + \frac{\partial^3 z}{\partial y^3} = 2x\frac{\partial z}{\partial x}$
   a. Linear
   b. Semi linear
   c. non-linear
   d. quasi linear

7. The condition of exactness of an equation $Pdx + Qdy + Rdz = 0$ is
   a. $\frac{\partial Q}{\partial x} = \frac{\partial P}{\partial y}, \frac{\partial Q}{\partial Z} = \frac{\partial R}{\partial y}, \frac{\partial R}{\partial x} = \frac{\partial P}{\partial z}$
   b. $\frac{\partial Q}{\partial x} = \frac{\partial R}{\partial y}, \frac{\partial Q}{\partial Z} = \frac{\partial P}{\partial y}, \frac{\partial R}{\partial x} = \frac{\partial P}{\partial z}$
   c. $\frac{\partial Q}{\partial x} = -\frac{\partial P}{\partial y}, \frac{\partial Q}{\partial Z} = \frac{\partial R}{\partial y}, \frac{\partial R}{\partial x} = \frac{\partial P}{\partial z}$
   d. $\frac{\partial Q}{\partial x} = \frac{\partial P}{\partial y}, \frac{\partial Q}{\partial Z} = \frac{\partial R}{\partial y}, \frac{\partial P}{\partial x} = \frac{\partial R}{\partial z}$

8. $(D^4 - D'^4)Z = 0, m = ?$
   a. $m = 1,-1,i,-i$
   b. $m = -i,-i,-i,1$
   c. $m = 1,1,1,i$
   d. $m = 1,-i,-i,-i$

9. In complete primitive of a differential equation in variation parameter method A and B are
   a. Variable
   b. Constant
   c. Parameter
   d. function

10. The condition for $f(x)$ to be Analytic function is
    a. (i) converges to $f(x)$
    b. (ii)) its Taylor's Series does not exists and converges to $f(x)$
    c. (iii) Both of (i) and (ii)
    d. (iv) its Taylor's Series exists and converges to $f(x)$ for all x

11. An example of power series is
    a. Logarithm function
    b. Exponential Function
    c. Analytic Function
    d. Hyperbolic function

12. The general solution of $Pp + Qq = R$ is
    a. $\phi(x,y) = 0$ where x and y two dependent solution
    b. $\phi(x) = 0$
    c. $\phi(u,v) = 0$ where u and v two independent solution
    d. none of the above

13. The Clariaut's form of a partial differential equation is
    a. 3rd order
    b. Order two
    c. linear
    d. first order equation

14. Singular integral of $z = px + qy + pq$ is
    a. $z = -xy$
    b. $z = y/x$
    c. $z = y + y$
    d. $z = xy$

15. In Legendre's polynomial $P_0(x) = ?$
    a. 2
    b. 0
    c. 1
    d. -1

16. In Bessel's equation n is
    a. constant
    b. negative constant
    c. intezer
    d. Non-negative constant

17. In the solution of Legendre's equation $P_n(x)$ and $Q_n(x)$ are
    a. Dependent solutions
    b. Linearly independent solutions
    c. independent solutions
    d. Positive solution

18. The general solution of Bessel's equation A and B is
    a. parameter
    b. constant
    c. variable
    d. Negative constant

19. For solving the equation $Y_2 + \frac{F(x)}{x}Y_1 + \frac{G(x)}{x^2}Y = 0$,we apply
    a. Frobenious Method
    b. Clairaut's Formula
    c. Lagrange Method
    d. none of the above

20. A power series represents a
    a. Analytic function within its interval of convergence
    b. Discontinuous function within its interval of convergence
    c. continuous function within its interval of convergence
    d. Open function within its interval of convergence

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UNIVERSITY OF SCIENCE & TECHNOLOGY, MEGHALAYA

[PART (A) : OBJECTIVE]

Duration : 20 Minutes

Serial no. of the main Answer sheet

Course : .....

Semester : ..... **Roll No :** .....

Enrollment No : ..... **Course code :** .....

Course Title : .....

Session : 2017-18 **Date :** .....

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Instructions / Guidelines

- The paper contains twenty (20) / ten (10) questions.
- Students shall tick (✓) the correct answer.
- No marks shall be given for overwrite / erasing.
- Students have to submit the Objective Part (Part-A) to the invigilator just after completion of the allotted time from the starting of examination.

Full Marks	Marks Obtained
20	

Scrutinizer's Signature *Examiner's Signature* *Invigilator's Signature*