# III/ MAT (iii)

**2015**

( 3rd Semester )

MATHEMATICS

THIRD PAPER

**( Differential Equation )**

( Math–231 )

*Full Marks* : 75

*Time* : 3 hours

( PART : B—DESCRIPTIVE )

( *Marks* : 50 )

*The figures in the margin indicate full marks for the questions*

Answer **five** questions, taking **one** from each Unit

UNIT—I

**1.** *(a)* Solve : 5

$$(x^2 \quad x^2y)dy \quad (xy^2 \quad y^2)dx \quad 0$$

*(b)* Solve : 5

$$x^2dy \quad y(x \quad y)dx \quad 0$$





**2.** *(a)* Solve : 5

$$\frac{dy}{dx} \quad \frac{y}{x}\log y \quad \frac{y}{x^2}(\log y)^2$$

*(b)* Solve : 5

$$(1 \quad 3e^{x/y})dx \quad 3e^{x/y}\ 1 \quad \frac{x}{y}\ dy \quad 0$$

UNIT—II

**3.** *(a)* Solve

$$(D^2 \quad 5 \quad 2D)y \quad 10\sin x$$

where $D \quad \frac{d}{dx}$. 5

*(b)* Solve

$$(D^2 \quad 4)y \quad e^x \quad \sin 2x$$

where $D \quad \frac{d}{dx}$. 5

**4.** *(a)* Solve : 5

$$\frac{d^2y}{dx^2} \quad 2\frac{dy}{dx} \quad y \quad x\sin x$$

*(b)* Solve

$$(D^2 \quad 3D \quad 2)y \quad e^{2x}\sin x$$

where $D \quad \frac{d}{dx}$. 5

UNIT—III

**5.** *(a)* Solve

$$p^2 \quad 7p \quad 10 \quad 0$$

where $p \quad \frac{dy}{dx}$. 5

*(b)* Find the orthogonal trajectories of the family of curves given by

$$r \quad \frac{2a}{1 \quad \cos}$$ 5

**6.** *(a)* Solve

$$y \quad 2px \quad yp^2$$

where $p \quad \frac{dy}{dx}$. 5

*(b)* Find the general and singular solution of $y \quad px \quad \frac{a}{p}$, where $p \quad \frac{dy}{dx}$. 5

UNIT—IV

**7.** *(a)* Solve : 5

$$\frac{dx}{dt} \quad 2x \quad 3y \quad 0$$

$$3x \quad \frac{dy}{dt} \quad 2y \quad 2e^{3t}$$

*(b)* Solve the differential equation

$$\sin^2 x \frac{d^2y}{dx^2} \quad 2y$$ 5





**8.** *(a)* Solve

$$\frac{d^2y}{dx^2} \quad 4\frac{dy}{dx} \quad 4y \quad e^{2x} \sin x$$

by the method of variation of parameters. 5

*(b)* Solve : 5

$$(yz \quad z^2)dx \quad xzdy \quad xydz \quad 0$$

UNIT—V

**9.** *(a)* Solve the partial differential equation

$$\cos(x \quad y)p \quad \sin(x \quad y)q \quad z$$

by Lagrange's method. 5

*(b)* Find the surface which intersects the surfaces of the system $z(x \quad y) \quad C(3z \quad 1)$ orthogonally and which passes through the circle $x^2 \quad y^2 \quad 1, z \quad 1$. 5

**10.** *(a)* Find the complete integral of

$$pxy \quad pq \quad qy \quad yz \quad 0$$

by Charpit's method. 6

*(b)* Solve the partial differential equation

$$9(p^2z \quad q^2) \quad 4$$ 4

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**Subject Code : III/ MAT (iii)**

**Booklet No. A**

Date Stamp .....

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**To be filled in by the Candidate**

DEGREE 3rd Semester
(Arts / Science / Commerce / ..... ) Exam., **2015**

Subject .....
Paper .....

**To be filled in by the Candidate**

DEGREE 3rd Semester
(Arts / Science / Commerce / ..... ) Exam., **2015**

Roll No. .....
Regn. No. .....

Subject .....
Paper .....

Descriptive Type
Booklet No. B .....

**INSTRUCTIONS TO CANDIDATES**

1. **The Booklet No. of this script should be quoted in the answer script meant for descriptive type questions and vice versa.**
2. **This paper should be ANSWERED FIRST and submitted within 1 (one) Hour of the commencement of the Examination.**
3. **While answering the questions of this booklet, any cutting, erasing, over-writing or furnishing more than one answer is prohibited. Any rough work, if required, should be done only on the main Answer Book. Instructions given in each question should be followed for answering that question only.**

*Signature of Scrutiniser(s)* *Signature of Examiner(s)* *Signature of Invigilator(s)*

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( 3rd Semester )

**MATHEMATICS**

THIRD PAPER

**( Differential Equation )**

( Math–231 )

( PART : A—OBJECTIVE )

( *Marks* : 25 )

Answer **all** questions

SECTION—A

( *Marks* : 10 )

*Each question carries 1 mark*

Put a Tick ☑ mark against the correct answer in the box provided :

**1.** The order and degree of the differential equation

$$\frac{d^2y}{dx^2} \quad \sqrt{1 \quad \frac{dy}{dx}^3}$$

are

*(a)* 2, 1 ☐

*(b)* 2, 2 ☐

*(c)* 2, 3 ☐

*(d)* 3, 1 ☐

**2.** The solution of

$$\frac{dy}{dx} \quad \sqrt{\frac{y^2}{1 \quad x^2}} \quad 0$$

is

*(a)* $\sin^{1} x \quad x^2 y \quad C$ □

*(b)* $\cos x \quad \frac{x}{y} \quad C$ □

*(c)* $\sin^{1} x \quad \sin^{1} y \quad C$ □

*(d)* $\sin^{1} x \quad xy \quad C$ □

**3.** The general solution of

$$(D^2 \quad 25)y \quad 0$$

where $D \quad \frac{d}{dx}$ is

*(a)* $y \quad (c_1 \quad c_2 x)e^{5x}$ □

*(b)* $y \quad c_1 \sin 5x \quad c_2 \cos 5x$ □

*(c)* $y \quad c_1 e^{5x} \quad c_2 e^{5x}$ □

*(d)* $y \quad c_1 e^{5x} \quad c_2 e^{\ 5x}$ □

**4.** The particular integral (PI) of the differential equation

$$(D^2 \quad D \quad 1)y \quad e^{\ x}$$

where $D \quad \frac{d}{dx}$ is

*(a)* $e^x$ □

*(b)* $e^{\ x}$ □

*(c)* $e^{2x}$ □

*(d)* $e^{\ 2x}$ □

**5.** The general solution of

$$y \quad px \quad p^3$$

where $p \quad \frac{dy}{dx}$ is

*(a)* $y \quad cx \quad c^3$ □

*(b)* $y \quad cx \quad c$ □

*(c)* $y \quad c^3x \quad c$ □

*(d)* $y \quad cx \quad c^3x^2$ □

**6.** The orthogonal trajectories of the family of curves given by

$$xdy \quad 2ydx \quad 0$$

are

*(a)* $x^2 \quad 2y^2 \quad c$ □

*(b)* $2x^2 \quad y^2 \quad c$ □

*(c)* $2x^2 \quad 2y^2 \quad c$ □

*(d)* $x^2 \quad y^2 \quad c$ □

**7.** If in the differential equation

$$\frac{d^2y}{dx^2} \quad P\frac{dy}{dx} \quad Qy \quad 0$$

$P \quad Qx \quad 0$, then $y$

*(a)* $e^x$ □

*(b)* $e^{\ x}$ □

*(c)* $x$ □

*(d)* $\frac{1}{x}$ □

**8.** The differential equation $Pdx \quad Qdy \quad Rdz \quad 0$ is integrable if

*(a)* $P \frac{Q}{z} \frac{R}{y} \quad Q \frac{R}{x} \frac{P}{z} \quad R \frac{P}{y} \frac{Q}{x} \quad 0$ ☐

*(b)* $P \frac{Q}{x} \frac{R}{y} \quad Q \frac{R}{y} \frac{P}{z} \quad R \frac{P}{z} \frac{Q}{x} \quad 0$ ☐

*(c)* $P \frac{P}{y} \frac{Q}{x} \quad Q \frac{R}{x} \frac{P}{z} \quad R \frac{Q}{z} \frac{R}{y} \quad 0$ ☐

*(d)* $P \frac{R}{x} \frac{P}{x} \quad Q \frac{P}{y} \frac{R}{x} \quad R \frac{Q}{z} \frac{P}{y} \quad 0$ ☐

**9.** The solution of a linear partial differential equation by eliminating arbitrary constants $a$ and $b$ from $z \quad (x \quad a)(y \quad b)$ is

*(a)* $z \quad pq$ ☐

*(b)* $p \quad zq$ ☐

*(c)* $q \quad zp$ ☐

*(d)* $z \quad p \quad q$ ☐

**10.** Which of the following could not be the general solution of the first-order linear partial differential equation $p \quad q \quad 1$?

*(a)* $(x \quad y, z \quad y) \quad 0$ ☐

*(b)* $(x \quad z, y \quad z) \quad 0$ ☐

*(c)* $(x \quad y, y \quad z) \quad 0$ ☐

*(d)* None of the above ☐

## SECTION—B

( *Marks* : 15 )

*Each question carries 3 marks*

**1.** Find the differential equation of a family of curves given by $y \quad a\cos(mx \quad b)$, $a$ and $b$ being arbitrary constants.

**2.** Solve :

$$\frac{d^2y}{dx^2} \quad 4y \quad e^{3x}$$

**3.** Find the orthogonal trajectories of the system of curves $x^{2/3}$ $y^{2/3}$ $a^{2/3}$, where $a$ is parameter.

**4.** Solve :

$$x^2 \frac{d^2y}{dx^2} \quad 2x \frac{dy}{dx} \quad 4y \quad x^4$$

**5.** Solve the partial differential equation

$$(mz - ny)p + (nx - lz)q = ly - mx$$

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