2017

(3rd Semester)

MATHEMATICS

THIRD PAPER

(Differential Equation)

Full Marks : 75

Time : 3 hours

(PART : B—DESCRIPTIVE)

(*Marks* : 50)

The figures in the margin indicate full marks for the questions

Answer *any* **one** question from each Unit

UNIT—I

1. *(a)* Solve : 5

$$(1 \quad x)ydx \quad (1 \quad y)xdy \quad 0$$

(b) Reduce the equation

$$(x^3y^2 \quad xy)dx \quad dy$$

to a linear differential equation and solve it. 5

2. *(a)* Solve : 5

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

(b) Reduce the following equation to exact form and solve it : 5

$$xdy \quad ydx \quad x\sqrt{x^2 \quad y^2}dx$$

UNIT—II

3. *(a)* Solve : 5

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

where

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

(b) Solve : 5

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

where

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

4. *(a)* Solve : 5

$$(D^3 \quad 3D^2 \quad 4D \quad 2)y \quad e^x$$

where

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

(b) Solve : 5

$$(D^2 \quad 4)y \quad x^2 \quad \cos 2x$$

where

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

UNIT—III

5. *(a)* Solve : 5

$$p \quad \frac{1}{p} \quad \frac{10}{3}$$

where

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

(b) Solve : 5

$$y \quad px \quad x^4 p^2$$

where

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

6. *(a)* By substituting $x^2 \quad u$ and $y^2 \quad v$, reduce $x^2(y \quad px) \quad yp^2$ into Clairaut's form and find the singular solution. 5

(b) Find the orthogonal trajectories of coaxial circles $x^2 \quad y^2 \quad 2gx \quad c \quad 0$, where c is a parameter. 5

UNIT—IV

7. *(a)* Solve : 5

$$\frac{dx}{dt} \quad \frac{dy}{dt} \quad 2y \quad 2\cos t \quad 7\sin t$$

$$\frac{dx}{dt} \quad \frac{dy}{dt} \quad 2x \quad 4\cos t \quad 3\sin t$$

(b) Solve : 5

$$\frac{d^2y}{dx^2} \quad \frac{2}{x}\frac{dy}{dx} \quad 1 \quad \frac{2}{x^2} \quad y \quad xe^x$$

8. *(a)* Solve by the method of variation of parameters

$$x\frac{dy}{dx} \quad y \quad (x \quad 1)\frac{d^2y}{dx^2} \quad x \quad 1$$ 6

(b) Solve : 4

$$yz\log z\,dx \quad zx\log z\,dy \quad xy\,dz \quad 0$$

UNIT—V

9. *(a)* Find the surface which intersect the surface 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

(b) Solve : 5

$$z(xp \quad yq) \quad y^2 \quad x^2$$

10. *(a)* Solve : 4

$$\frac{y \quad z}{yz}p \quad \frac{z \quad x}{zx}q \quad \frac{x \quad y}{xy}$$

(b) Solve $(p^2 \quad q^2)y \quad qz$ by Charpit's method. 6

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Subject Code : MATH/III/03

Booklet No. A

Date Stamp ....

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To be filled in by the Candidate

DEGREE 3rd Semester
(Arts / Science / Commerce /
......................) Exam., **2017**

Subject ....
Paper ....

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.**

To be filled in by the Candidate

DEGREE 3rd Semester
(Arts / Science / Commerce /
......................) Exam., **2017**

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

Subject ....
Paper ....

Descriptive Type
Booklet No. B ....

Signature of Scrutiniser(s)

Signature of Examiner(s)

Signature of Invigilator(s)

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(3rd Semester)

MATHEMATICS

THIRD PAPER

(Differential Equation)

(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 differential equation of the family of curves $y \quad e^{mx}$, where m is an arbitrary constant is

(a) $x\frac{dy}{dx} \quad y\log y$ ☐

(b) $x\frac{dy}{dx} \quad x\log y$ ☐

(c) $x\frac{dy}{dx} \quad y\log x$ ☐

(d) $y\frac{dy}{dx} \quad x\log y$ ☐

2. A solution to differential equation $\frac{dy}{dx} \quad e^{x \quad y}$ is

(a) $e^{x} \quad e^{\quad y}$ ☐

(b) $e^{x} \quad e^{y}$ ☐

(c) $e^{\quad x} \quad e^{y}$ ☐

(d) $e^{\quad x} \quad e^{\quad y}$ ☐

3. The general solution of the differential equation

$$\frac{d^2y}{dx^2} \quad 4\frac{dy}{dx} \quad 4y \quad 0$$

is

(a) $y \quad (A \quad B)e^{\quad 2x}$ ☐

(b) $y \quad (A \quad Bx)e^{\quad 2x}$ ☐

(c) $y \quad Ax \quad Be^{\quad 2x}$ ☐

(d) None of the above ☐

4. The particular integral (PI) of the differential equation $(D^2 \quad D \quad 1)y \quad e^{\quad x}$, where $D \quad \frac{d}{dx}$, is

(a) e^x ☐

(b) $2e^x$ ☐

(c) $e^{\quad x}$ ☐

(d) $2e^{\quad x}$ ☐

5. The complete primitive solution of the equation $p^2 \quad px \quad py \quad xy \quad 0$, where $p \quad \frac{dy}{dx}$, is

(a) $(2y \quad x^2 \quad c)(x \quad \log y) \quad 0$ ☐

(b) $(2y \quad x^2 \quad c)(x \quad \log y \quad c) \quad 0$ ☐

(c) $(2y \quad x^2 \quad c)(x \quad \log y) \quad 0$ ☐

(d) $(2y \quad x^2 \quad c)(x \quad \log y \quad c) \quad 0$ ☐

6. The orthogonal trajectory of the curve $y \quad ax^n$ is

(a) $x^2 \quad y^2 \quad c$ ☐

(b) $y \quad cx$ ☐

(c) $x^2 \quad ny^2 \quad c$ ☐

(d) $y^2 \quad cnx$ ☐

7. For the equation $(D^2 \quad PD \quad Q)y \quad 0$ where $D \quad \frac{d}{dx}$ and P, Q are functions of x or constants, then which of the following is incorrect?

(a) $y \quad x$ is a particular solution if $P \quad xQ \quad 0$ ☐

(b) $y \quad e^x$ is a particular solution if $1 \quad P \quad Q \quad 0$ ☐

(c) $y \quad e^{\quad x}$ is a particular solution if $1 \quad P \quad Q \quad 0$ ☐

(d) $y \quad e^{mx}$ is a particular solution if $mP \quad Q \quad 0$ ☐

8. Which of the following differential equations does not satisfy condition of integrability?

(a) $zdx \quad xdy \quad ydz \quad 0$ ☐

(b) $(y \quad z)dx \quad (z \quad x)dy \quad (x \quad y)dz \quad 0$ ☐

(c) $(yz \quad 2x)dx \quad (zx \quad 2y)dy \quad (xy \quad 2z)dz \quad 0$ ☐

(d) $yz\log zdx \quad zx\log zdy \quad xydz \quad 0$ ☐

9. The partial differential equation obtained by eliminating arbitrary function from the equation $y \quad F(x \quad at) \quad F(x \quad at)$ is

(a) $\frac{{}^{2}y}{x^{2}} \quad \frac{{}^{2}y}{t^{2}} \quad 0$ ☐

(b) $\frac{{}^{2}y}{x^{2}} \quad \frac{{}^{2}y}{t^{2}} \quad 0$ ☐

(c) $\frac{{}^{2}y}{t^{2}} \quad a^{2}\frac{{}^{2}y}{x^{2}}$ ☐

(d) None of the above ☐

10. The general solution of the partial differential equation $p \quad q \quad 1$ is

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

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

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

(d) $(x \quad z, y \quad z) \quad 0$ ☐

SECTION—B

(*Marks* : 15)

Each question carries 3 marks

1. Solve :

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

2. Solve

$$(D^2 \quad 2D \quad 5)y \quad 0$$

where

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

3. Solve :

$$\frac{dy}{dx} \quad \frac{dx}{dy} \quad 3\frac{1}{3}$$

4. Solve :

$$(y \quad z)dx \quad dy \quad dz \quad 0$$

5. Solve the partial differential equation

$$pz \quad qz \quad z^2 \quad (x \quad y)^2$$

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