B.Sc. (Part—I) Semester-II Examination

MATHEMATICS

(Differential Equations : Ordinary & Partial)

Paper—III

Time : Three Hours] [Maximum Marks : 60

Note :— (1) Question No. **1** is compulsory and attempt it once only.

(2) Attempt **ONE** question from each unit.

1. Choose the correct alternative :

(1) The order of the D.E. $\left(\frac{d^3y}{dx^3}\right)^4 - \left(\frac{dy}{dx}\right)^5 - y = 0$ is : 1

(a) 1 (b) 2

(c) 3 (d) 4

(2) The particular solution of the D.E. y" + Py' + Qy = 0 is $y = e^x$ if : 1

(a) P + xQ = 0 (b) 1 + P + Q = 0

(c) 1 – P + Q = 0 (d) $m^2 + Pm + Q = 0$

(3) The roots of the auxiliary equations of the D.E. y" – 5y' + 6y = 0 are : 1

(a) Real and equal (b) Complex

(c) Real and distinct (d) None of these

(4) The D.E. Mdx + Ndy = 0 is exact if : 1

(a) $\frac{\partial M}{\partial x} = \frac{\partial N}{\partial x}$ (b) $\frac{\partial M}{\partial y} = \frac{\partial N}{\partial y}$

(c) $\frac{\partial M}{\partial x} = \frac{\partial N}{\partial y}$ (d) $\frac{\partial M}{\partial y} = \frac{\partial N}{\partial x}$

(5) The integrating factor of the D.E. $\frac{dy}{dx} - xy = x^2$ is : 1

(a) $e^{-x^2/2}$ (b) $e^{x^2/2}$

(c) e^x (d) e^{-x}

(6) The PI of $f(D)y = e^{ax}$ is given by : 1

(a) $\frac{1}{f(D+a)} e^x$ (b) $\frac{1}{f(a)} e^x$; $f(a) \neq 0$

(c) $\frac{1}{f(D-a)} e^{ax}$ (d) $\frac{1}{f(a)} e^{ax}$; $f(a) \neq 0$

(7) Lagranges form of the PDE of order one is : 1

(a) $Pp + Qq = R$ (b) $Pp - Qq = R$

(c) $Pq + Qp = R$ (d) None of these

(8) The solution of PDE $r = a^2 t$ is : 1

(a) $z = F_1(y + ax) + F_2(y - ax)$ (b) $z = F_1(y - ax) + F_2(y - ax)$

(c) $z = F(y + ax)$ (d) None of these

(9) The general solution of the PDE $F(D, D')z = 0$ is consist of : 1

(a) C.F. only (b) P.I. only

(c) C.F. and P.I. both (d) None of these

(10) The P.I. of the PDE $(2D - 3D')z = e^{x-y}$ is : 1

(a) $\frac{1}{5}e^{x-y}$ (b) $-\frac{1}{5}e^{x-y}$

(c) e^{x-y} (d) $-e^{x-y}$

UNIT—I

2\. (a) Solve the D.E. $xy - \frac{dy}{dx} = y^3 e^{-x^2}$. 5

(b) Show that D.E. :

$(e^y + 1) \cos x dx + e^y \sin y \, dy = 0$ is exact

and hence solve it. 5

3\. (p) Find the D.E. satisfied by the system of parabolas $y^2 = 4a(x + a)$ and show that the orthogonal trajectories of the system belong to the system itself. 5

(q) Solve the D.E. $(p - xy)(p - x^2)(p - y^2) = 0$. 5

UNIT—II

4\. (a) Solve the D.E. $y'' - 4y' + 4y = e^{2x} + \sin 2x$. 5

(b) Solve the D.E. $(x^2D^2 - 3xD + 5)y = x^2 \sin(\log x)$. 5

5\. (p) Solve the D.E. $y'' + 3y' + 2y = e^{5x}$. 5

(q) Solve the D.E. $y'' + 2y' + 2y = x^2$. 5

UNIT—III

6\. (a) Solve the D.E. $y'' - y = \frac{2}{1 + e^x}$ by the method of variation of parameters. 5

(b) Solve the simultaneous DEs $\frac{dx}{dt} + 2\frac{dy}{dt} - 2x + 2y = 3e^t$; $3\frac{dx}{dt} + \frac{dy}{dt} + 2x + y = 4e^{2t}$. 5

7\. (p) Solve the D.E. by changing the independent variable $x^6 y'' + 3x^5 y' + a^2 y = \frac{1}{x^2}$. 5

(q) Solve the D.E. by reducing it to normal form $y'' - 2xy' + (x^2 + 2)y = e^{(x^2 + 2x)/2}$. 5

http://www.sgbauonline.com/

UNIT—IV

8. (a) Solve the PDE $x(y^2 - z^2)p + y(z^2 - x^2)q = z(x^2 - y^2)$. 5

(b) Solve the PDE $p^2 + q^2 = x^2 + y^2$. 5

9. (p) Solve :

$$\frac{dx}{x(y-z)} = \frac{dy}{y(z-x)} = \frac{dz}{z(x-y)}.$$ 5

(q) Solve the PDE $z^2(1 + p^2 + q^2) = k^2$. 5

UNIT—V

10. (a) Apply Charpit's method to solve $z^2 = pqxy$. 5

(b) Solve PDE $r - 3s + 2t = e^{2x + 3y} + \sin(x - 2y)$. 5

11. (p) Solve the PDE $D(D - 2D' - 3)z = e^{x+2y}$. 5

(q) Solve the PDE $r + s - 6t = y \cos x$. 5