Total No. of printed pages = 5

Sc-303/Maths-III/3rd Sem/2016/N

MATHEMATICS – III

Full Marks – 70

Pass Marks – 28

Time – Three hours

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

GROUP – A

1. (a) State the order and degree of the differential equation : 2

$$\left(\frac{d^3y}{dx^3}\right)^2 + \left(\frac{d^2y}{dx^2}\right)^5 + 6\frac{dy}{dx} + y = x^3.$$

(b) Find the complementary function of

$(D^2 + 4)y = x^2$. 1

(c) Form a differential equation from the relation

$y = Ae^{2x} + Be^{-2x}$. 3

[Turn over

2. Solve the following differential equations. (any *four*) : 3×4=12

(a) $(1 + y^2)\, dx + (1 + x^2)\, dy = 0$

(b) $(x^2 + y^2)\, dx - 2xy\, dy = 0$

(c) $(x + y + 2)\, dx + (x - y + 4)\, dy = 0$

(d) $\frac{dy}{dx} + y \cot x = \cos x$

(e) $\frac{dy}{dx} + xy = x^3y^3$

(f) $\frac{d^2y}{dx^2} - 7\frac{dy}{dx} + 10y = 0$

3. Solve the following differential equations. (any *three*) : 4×3=12

(a) $\frac{d^2y}{dx^2} + 4\frac{dy}{dx} + 13y = e^{2x}$

(b) $\frac{d^2y}{dx^2} + 9y = x^2$

(c) $(D^2 - 5D + 6)y = e^{3x}$

(d) $(D^2 - 4D + 4)y = \sin x$

(e) $p^2 + 2px + py + 2xy = 0$

where $p = \frac{dy}{dx}$.

GROUP – B

Answer any *two* questions. 2×5=10

4. (a) Solve graphically $\cos x = 2x$, $0 < x < \frac{\pi}{2}$

(b) Solve the equation $x^3 + 2x - 5 = 0$ graphically for positive real roots.

(c) The following values of x and y satisfy approximately the relation $y = ax^2 + b$. Find graphically the values of a and b.

x :	20	40	60	80	100
y :	20.60	40.72	60.91	81.20	101.56

GROUP – C

Answer any *three* questions. 3×6=18

5. (a) Find the mean, median and mode of the following distribution :

Class :	10-15	15-20	20-25	25-30	30-35	35-40
Frequency :	4	6	8	12	7	3

(b) The following is the distribution of marks obtained by 60 students in a class. Calculate the standard deviation for the distribution.

Marks	:	20-30	30-40	40-50	50-60	60-70	70-80	80-90
Nos. of students	:	3	6	13	15	14	5	4

(c) Find the mean deviation from the mean of the following distribution :

Class	:	0-6	6-12	12-18	18-24	24-30
Frequency	:	8	10	12	9	5

(d) Find the co-efficient of correlation for the following data :

x :	1	2	3	4	5
y :	3	6	4	9	8

GROUP – D

Answer any *two* questions.

6. (a) If α, β, γ are the angles made by a line with the axes, prove that

$$\sin^2 \alpha + \sin^2 \beta + \sin^2 \gamma = 2$$ 3

(b) Show that the points A (1, 2, 3), B (1, 1,1) and C (2, –1, 1) are the vertices of an isosceles triangle. 3

7. (a) A straight line makes angles 30° and 60° with x-axis and y-axis respectively. Find the angle made by the line with z-axis. 3

(b) If $\vec{a} = 3\hat{i} + 5\hat{j} + 10\hat{k}$ and $\vec{b} = 2\hat{i} + 15\hat{j} - 3\hat{k}$, find $\vec{a} \cdot \vec{b}$, $\vec{a} \times \vec{b}$ and $|\vec{a} + \vec{b}|$. 3

8. (a) Find a unit vector perpendicular to the vectors $\vec{a} = 2\hat{i} - \hat{j} + \hat{k}$ and $\vec{b} = 3\hat{i} + 4\hat{j} - \hat{k}$ 3

(b) Find the ratio in which the line joining the points (1, 2, 3) and (4, 6, –5) is divided by XY plane. 3