Total No. of printed pages = 5

Sc-303/Maths-III/3rd Sem/2014/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

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

(b) Form differential equation from the following (any *one*) : 3

(i) $y = A\cos 2x + B\sin 2x$

(ii) $y = Ax^2 + Bx + C$

[Turn over

2. Solve the following differential equations (any *three*) : 3×3=9

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

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

(iii) $\frac{dy}{dx} + y \cot x = \text{cosec } x$

(iv) $y = x\frac{dy}{dx} + \left(\frac{dy}{dx}\right)^2$

(v) $x\,dx + y\,dy = \frac{x\,dy + y\,dx}{x^2+y^2}$

3. Solve the following differential equations (any *two*) : 4×2=8

(i) $\frac{d^2y}{dx^2} - 5\frac{dy}{dx} + 6y = x^2$

(ii) $\frac{d^2y}{dx^2} - 2\frac{dy}{dx} + y = e^x$

(iii) $\frac{d^2y}{dx^2} + y = \cos x$

(iv) $\frac{d^2y}{dx^2} + 3\frac{dy}{dx} + y = \sin 2x$

4. In a circuit a resistance of 100 ohms, an inductance of 0.5 henry are connected in series with a battery of 20 volts. Find the current in the circuit as a function of time. 5

GROUP – B

Answer any *two* questions. 5×2=10

5. (a) Draw the graph of $y = \sin x$, $-\pi \leq x \leq \pi$

(b) In the following table some observed values of x and y are given :

x :	2	3	4	5	6	7
y :	4	5	5.71	6.25	6.67	7

(c) Solve graphically the equation $x^2 - 3x + 2 = 0$.

GROUP – C

Answer any *two* questions.

6. (a) Find the direction cosines of the line joining (3, –1, 1) and (–2, –3, –1). 3

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

7. (a) If a straight line makes equal angles with X–, Y– and Z– axes, find the direction cosines of the line. 3

(b) If $\vec{a} = 3i - j - 4k$ and $\vec{b} = 2i + j - 3k$, find the unit vector perpendicular to the plane of $\vec{a}$ and $\vec{b}$. 3

8. (a) Find the length of projection of the line joining (1, –1, 2) and (3, 2, 1) on a line whose direction ratios are 1, 2 and –1. 3

(b) A particle is acted on by a force $2i + j - 3k$ is displaced from the point $i - 2j + k$ to the point $3i + 4j + 5k$. Find the amount of work done by the force. 3

GROUP – D

Answer any *three* questions.

9. Calculate the mean, median and mode of the following frequency distribution : 2+3+2=7

Class Interval	Frequency
0–10	6
10–20	5
20–30	8
30–40	15
40–50	7
50–60	6
60–70	3

10. Calculate the standard deviation for the following table giving the age distribution of 542 members. 7

Age group :	20–30	30–40	40–50	50–60
No. of members :	3	61	132	153

Age group :	60–70	70–80	80–90
No. of members :	140	51	2

11. (a) Two unbiased dice are thrown. Find the probability that both the dice show the same number. 3

(b) An urn contains 6 white, 4 red and 9 black balls. If 3 balls are drawn at random, find the probability that (i) two balls are white and one black (ii) three balls are of different colours. 4

12. Calculate the correlation coefficient for the following heights (in inches) of fathers (X) and their sons (Y) : 7

X :	65	66	67	67	68	69	70	72
Y :	67	68	65	68	72	72	69	71