Total No. of printed pages = 6

Sc-303/Maths-III/3rd Sem/2013/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 following differential equations : 2

(i) $\left(\frac{dy}{dx}\right)^4 + \left(\frac{dy}{dx}\right)^3 + \left(\frac{dy}{dx}\right)^2 + y = x$

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

(b) Form a differential equation from the equation $y = Ae^{2x} + Be^{3x}$. 3

[Turn over

2. Solve the differential equation (any *three*) : $3\times3=9$

(a) $\text{Sec}^2x \tan y\, dx + \sec^2 y \tan x\, dy = 0$

(b) $(x+y+3)dy = (x+y-3)dx$

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

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

(e) $y=x\frac{dy}{dx}+\sqrt{\left(\frac{dy}{dx}\right)^2-1}$

3. 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. 4

4. Solve the differential equation (any *three*) : $4\times3=12$

(a) $\frac{d^2y}{dx^2}+6y=\sin 4x$

(b) $\frac{d^2y}{dx^2}-2a\frac{dy}{dx}+a^2y=e^{ax}$

(c) $\frac{d^2y}{dx^2} = \cos x,\ y = 2$ when $x = \frac{\pi}{2}$

(d) $\frac{d^3y}{dx^3} - 2\frac{d^2y}{dx^2} + 4\frac{dy}{dx} - 8y = 1$

GROUP – B

5. Answer any *two* questions : 6×2=12

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

(b) Solve graphically the equation $x^2 - 7x + 10 = 0$

(c) Following are the observations for x and y under the law $y = a + bx^2$, find a and b.

x	1·1	1·8	2·5	2·9	3·6	4·3	4·8
y	1·91	2·13	2·42	2·65	3·09	3·66	4·09

GROUP – C

Answer any *two* questions.

6. (a) Find the direction cosines of the line joining the points (4, 3, –5) and (–2, 1, –8). 2½

(b) If the position vectors of A and B are i+2j+4k and (2i+3j+4k), find the position vector of a point C that divides AB in the ratio 2 : 3. 2½

7. (a) If a straight line makes angles 60° and 45° with x and y-axis respectively, find the angle made by the line with z-axis. 2½

(b) If $\vec{a} = 3i - j - 4k$ and $\vec{b} = -2i + 4j - 3k$, find a unit vector parallel to $\vec{a} + \vec{b}$. 2½

8. (a) If $\vec{a} + \vec{b} + \vec{c} = 0$, show that $\vec{a} \times \vec{b} = \vec{b} \times \vec{c} = \vec{c} \times \vec{a}$. 2½

(b) A particle is acted by a force $4i + j - 3k$ is displaced from the point $i + 2j + 3k$ to the point 5i+4j+k. Find the amount of work done by the force. 2½

GROUP – D

9. Answer any *three* questions :

(a) Find the standard deviation of the following frequency distribution : 6

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

(b) The following are the marks secured by the students of a class in Mathematics Paper-I and Paper-II.

Paper-I	80	45	55	56	58	60	65	68	70	75	85
Paper-II	81	56	50	48	60	62	64	65	70	74	90

Find the coefficient of correlation. 6

(c) Calculate the mean, median and mode of the following frequency distribution : 6

Weekly wages (in Rs.)	No. of persons
4·5 – 12·5	4
12·5 – 20·5	24
20·5 – 28·5	21
28·5 – 36·5	18
36·5 – 44·5	5
44·5 – 52·5	3
52·5 – 60·5	5
60·5 – 68·5	8
68·5 – 76·5	2

(d) (i) A bag contains 7 red and 8 black balls. Find the probability of drawing a red ball. 2

(ii) A problem in Mathematics is given to three students A, B and C whose chances of solving it are $\frac{1}{2}$, $\frac{3}{4}$ and $\frac{1}{4}$ respectively. What is the probability that the problem will be solved ? 4