Sc-303/Maths-III/3rd Sem/ Elect,Etc,Comp,Inst/2017/M

MATHEMATICS – III

Full Marks – 70

Pass Marks – 28

Time – Three hours

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

GROUP – A

(Differential Equation)

1. Form a differential equation whose primitive is $y = c_1 e^{-2x} + c_2 e^{-7x}$. 3

2. Solve any *three* : $3 \times 3 = 9$

   (i) $(x + 1) \frac{dy}{dx} = y^2 + 1$

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

   (iii) $x^2 = 1 + p^2$ where $p = \frac{dy}{dx}$

(iv) $p^3x - p^2y - 1 = 0$

(v) $(12x + 5y - 9)\,dx + (5x + 2y - 4)\,dy = 0$

3. Solve any *three* : 3×4=12

(i) $(x^2 + y^2)\,dy = xy\,dx$

(ii) $\frac{dy}{dx}\left(x^2y^3 + xy\right) = 1$

(iii) $\frac{dy}{dx} = \frac{2x + 9y - 20}{6x + 2y - 10}$

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

(v) $\frac{d^2y}{dx^2} = e^{2x}$, $y = 1$ when $x = 0$.

4. Answer any *one* : 4

(a) In a circuit an inductance of 2 henries and a resistance of 20 ohms are connected in series with an emf of E volts. If the current is zero when 't' is zero, find the current at the end of 0.1 sec if E = 10 volts assuming it Obey's voltage law $L\frac{di}{dt} + Ri = E$, where 'i' is current and L is inductance.

(b) A resistance of 70 ohms and an inductance of 0.80 henry are connected in series with a battery of 10 volts. Determine the expression for current as a function of time after $t = 0$.

GROUP – B

(Statistics)

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

(i) Find Mean and Mode :

Classes	Frequency
0 - 10	4
10 - 20	3
20 - 30	9
30 - 40	11
40 - 50	7
50 - 60	2

(ii) Find standard deviation :

Wages (in Rs.) :	0-50	50-100	100-150
No. of workers :	5	15	32
Wages (in Rs.) :	150-200	200-250	
No. of workers :	20	8	

(iii) Calculate the Mean deviation from Median :

Class	0-10	10-20	20-30	30-40	40-50	50-60	60-70
f	3	2	5	4	3	2	1

(iv) Ten students got the following percentage of marks in Physics and Mathematics :

Physics	40	45	39	60	58	38
Mathematics	85	68	92	78	80	78

Physics	91	58	62	50
Mathematics	98	79	75	80

Calculate the coefficient of correlation.

6. Two cards are drawn from a pack of 52 cards. Find the probability that

(a) they are both kings

(i) 1 card is drawn, the card is replaced and 2nd card is drawn

(ii) 1 card is drawn, the card is not replaced and 2nd card is drawn.

(b) The two cards are red cards. 3

GROUP – C

(Graphics)

7. Answer any *three* questions : 5×3=15

(a) In a steam engine trials the following results were obtained :

H :	39.93	33.20	25.6	18.7	10.8
W :	655.42	564	443.2	336.1	219

H is indicated horse-power and W is the weight of steam per hour. Find an approximate linear law connecting H and W.

(b) Fit a line to the following data :

x :	2	9	15	17	20
y :	6	16	43	54	65

(c) Fit a law : $y = a + bx^2$ to the following observation :

x :	19	25	31	38	44
y :	1900	3230	4900	7330	9780

(d) Solve graphically : $\sin x = \cos x$ between $\lambda = \theta$ and $x = \frac{\pi}{2}$.

(e) Solve graphically : $x^3 + 3x - 25 = 0$.

GROUP – D

(Vector and Coordinate Geometry)

8. (a) Write the direction cosines of y - axis.

   (b) What is the dot product of $\bar{a}$ and $\bar{b}$ if $\bar{a} = 2i - j + k$ and $\bar{b} = i + j - 3k$?

   (c) What is the direction ratios of the line passing through P (2, 1, 3) and Q (0, –1, –6).

   1+1+1=3

9. Answer any *three* questions : 3×3=9

   (a) Show that the points (–2, 3, 5), (1, 2, 3) and (7, 0, –1) are collinear.

   (b) In what ratio does the z plane divides the join of (–1, –2, –3) and (4, 8, 12) ? Also write the direction cosines of the line joining these two points.

   (c) If the position vectors of P and Q are $2i + 3j - 7k$ and $4i - 3j + 4k$ respectively, find $\overline{PQ}$ and determine its direction cosines.

(d) A particle is acted on by a force $i + 2j - 6k$ and is displaced from the point $2i + j - k$ to the point $3i + 4j + 5k$. Find the amount of work done by the force.

(e) Find the angle between two diagonals of a cube.