

sSTELLA MARIS COLLEGE (AUTONOMOUS) CHENNAI – 86
(For candidates admitted from the academic year 2023 – 2024 and thereafter)

B.Sc. DEGREE EXAMINATION, APRIL 2024
BRANCH I - MATHEMATICS
SECOND SEMESTER

COURSE : **ALLIED CORE**
PAPER : **MATHEMATICS FOR CHEMISTRY II**
SUBJECT CODE : **23MT/AC/MC25**
TIME : **3 HOURS** **MAX. MARKS: 100**

Q. No.	SECTION A (5 × 2 = 10) Answer ANY FIVE Questions	CO	KL
1.	Find $L(t^2 + 5t + 4)$	1	1
2.	Find $L^{-1}\left(\frac{3}{(s+2)^2 + 4}\right)$.	1	1
3.	Find the Fourier coefficient a_0 for $f(x) = \frac{\pi - x}{2}$ in the interval $(0, 2\pi)$.	1	1
4.	Define correlation.	1	1
5.	Define cyclic group and give an example.	1	1
6.	Define order of an element in a group and give an example.	1	1

Q. No.	SECTION B (10 × 1 = 10) Answer ALL Questions	CO	KL
7.	$L(e^{-at}) =$ (a) $\frac{1}{s+a}$ (b) $\frac{a}{s+a}$ (c) $\frac{1}{s-a}$ (d) $\frac{a}{s-a}$	2	2
8.	$L(1) =$ (a) 1 (b) -1 (c) $\frac{1}{s}$ (d) $\frac{-1}{s}$	2	2
9.	$L^{-1}\left(\frac{2}{s^2 + 4}\right)$ (a) $\sin 2t$ (b) $\cos 2t$ (c) $\sinh 2t$ (d) $\cosh 2t$	2	2
10.	$L^{-1}\left(\frac{3}{s-3}\right) =$ (a) e^{3t} (b) e^{-3t} (c) $3e^{3t}$ (d) $3e^{-3t}$		
11.	Which of the following is an even function? (a) $\sin x$ (b) $\cos x$ (c) $\tan x$ (d) $\sin 2x$	2	2
12.	The coefficient of correlation (a) has no limits (b) can be less than -1 (c) can be more than 1 (d) none of these	2	2

13.	If $f(x)$ is an odd function, the Fourier coefficient (a) $b_n = 0$ (b) $a_n = 1$ (c) $a_n = 2$ (d) $a_n = 0$	2	2
14.	If r is the coefficient of correlation, b_{xy} and b_{yx} are the regression coefficients, then $r =$ _____ (a) $\sqrt{b_{yx}b_{xy}}$ (b) $b_{yx}b_{xy}$ (c) $\frac{b_{yx}}{b_{xy}}$ (d) $b_{yx} + b_{xy}$	2	2
15.	The order of e in $(G, .)$ is (a) 1 (b) 2 (c) 3 (d) 0	2	2
16.	If $\sigma = \begin{pmatrix} 1 & 2 & 3 & 4 \\ 2 & 4 & 1 & 3 \end{pmatrix}$ and $\tau = \begin{pmatrix} 1 & 2 & 3 & 4 \\ 1 & 3 & 4 & 2 \end{pmatrix}$, then $\sigma\tau =$ (a) $\begin{pmatrix} 1 & 2 & 3 & 4 \\ 3 & 2 & 1 & 4 \end{pmatrix}$ (b) $\begin{pmatrix} 1 & 2 & 3 & 4 \\ 1 & 4 & 2 & 3 \end{pmatrix}$ (c) $\begin{pmatrix} 1 & 2 & 3 & 4 \\ 3 & 4 & 1 & 2 \end{pmatrix}$ (d) $\begin{pmatrix} 1 & 2 & 3 & 4 \\ 1 & 2 & 3 & 4 \end{pmatrix}$	2	2

Q. No.	SECTION C ($2 \times 15 = 30$) Answer ANY TWO Questions	CO	KL
17.	(a) Find $L(f''(t))$ (b) Find $L^{-1}\left(\frac{1}{(s-3)^5} + \frac{2}{(s+4)^2 + 6}\right)$. (5+10)	3	3
18.	Find the half range sine series for $f(x) = x$ in the interval $(0, \pi)$	3	3
19.	(a) Write the difference between correlation and regression. (b) What is scatter diagram? Explain its uses. (7+8)	3	3
20.	(a) Prove that identity element of a group is unique. (b) Find the number of generators of a cyclic group of order 8. (7+8)	3	3

Q. No.	SECTION D ($2 \times 15 = 30$) Answer ANY TWO Questions	CO	KL
21.	(a) Find $L(te^{-t} \sin 2t)$. (b) Find $L^{-1}\left(\frac{s}{(s+2)^2 + 1}\right)$ (7+8)	4	4
22.	Solve $\frac{d^2y}{dt^2} + 4\frac{dy}{dt} - 5y = 5$ given that $y = 0, \frac{dy}{dt} = 2$ when $t = 0$ using Laplace transform.	4	4

23.	Find the coefficient of correlation for the following data.	4	4																						
	<table border="1"> <tr> <td>X</td> <td>92</td> <td>89</td> <td>87</td> <td>86</td> <td>77</td> <td>71</td> <td>63</td> <td>53</td> <td>50</td> <td>86</td> </tr> <tr> <td>Y</td> <td>86</td> <td>83</td> <td>91</td> <td>68</td> <td>85</td> <td>52</td> <td>82</td> <td>37</td> <td>57</td> <td>77</td> </tr> </table>	X	92	89	87	86	77	71	63	53	50	86	Y	86	83	91	68	85	52	82	37	57	77		
X	92	89	87	86	77	71	63	53	50	86															
Y	86	83	91	68	85	52	82	37	57	77															
24.	Show that the set of complex numbers is an abelian group under addition.	4	4																						

Q. No.	SECTION E (2 × 10 = 20) Answer ANY TWO Questions	CO	KL																
25.	(a) Find $L(\sin 3t \cos t)$ (b) Find $L^{-1}\left(\frac{s}{(s+2)^2+1}\right)$ (10+10)	5	5																
26.	Solve $y'' + 2y' - 3y = \sin t$ given that $y=0, \frac{dy}{dt}=0$ when $t=0$ using Laplace transform.	5	5																
27.	Find the Fourier series expansion of $\begin{cases} -\pi, & -\pi < x < 0 \\ x, & 0 < x < \pi \end{cases}$. Hence deduce that $\frac{\pi^2}{8} = 1 + \frac{1}{3^2} + \frac{1}{5^2} + \frac{1}{7^2} + \dots$	5	5																
28.	Find the lines of regression for the following data.	5	5																
	<table border="1"> <tr> <td>X</td> <td>25</td> <td>28</td> <td>35</td> <td>32</td> <td>36</td> <td>36</td> <td>29</td> </tr> <tr> <td>y</td> <td>43</td> <td>46</td> <td>49</td> <td>41</td> <td>36</td> <td>32</td> <td>31</td> </tr> </table>	X	25	28	35	32	36	36	29	y	43	46	49	41	36	32	31		
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