



**Third Semester B.E./B.Tech. Degree Supplementary Examination,
June/July 2024**

AV Mathematics-III for EC/BM Engineering

Time: 3 hrs.

Max. Marks: 100

- Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. VTU Formula Hand Book and Statistical table are permitted.
3. M : Marks, L: Bloom's level, C: Course outcomes.*

Module - 1			M	L	C																
Q.1	a.	Obtain the Fourier Series expansion of $f(x) = x^2$ in $[-\pi, \pi]$.	7	L2	CO1																
	b.	Obtain half range Fourier sine series for $f(x) = x(\ell - x)$ in $(0, \ell)$.	7	L2	CO1																
	c.	Find the constant term and the first harmonics of the Fourier Series of $y = f(x)$, given that	6	L3	CO1																
<table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td style="padding: 2px;">x</td> <td style="padding: 2px;">0</td> <td style="padding: 2px;">$\frac{\pi}{3}$</td> <td style="padding: 2px;">$\frac{2\pi}{3}$</td> <td style="padding: 2px;">π</td> <td style="padding: 2px;">$\frac{4\pi}{3}$</td> <td style="padding: 2px;">$\frac{5\pi}{3}$</td> <td style="padding: 2px;">2π</td> </tr> <tr> <td style="padding: 2px;">y</td> <td style="padding: 2px;">7.9</td> <td style="padding: 2px;">7.2</td> <td style="padding: 2px;">3.6</td> <td style="padding: 2px;">0.5</td> <td style="padding: 2px;">0.9</td> <td style="padding: 2px;">6.8</td> <td style="padding: 2px;">7.9</td> </tr> </table>			x	0	$\frac{\pi}{3}$	$\frac{2\pi}{3}$	π	$\frac{4\pi}{3}$	$\frac{5\pi}{3}$	2π	y	7.9	7.2	3.6	0.5	0.9	6.8	7.9			
x	0	$\frac{\pi}{3}$	$\frac{2\pi}{3}$	π	$\frac{4\pi}{3}$	$\frac{5\pi}{3}$	2π														
y	7.9	7.2	3.6	0.5	0.9	6.8	7.9														
OR																					
Q.2	a.	Obtain Fourier Series expansion of $f(x) = \frac{1}{4}(\pi - x)^2$ in $(0, 2\pi)$.	7	L2	CO1																
	b.	Obtain half range Fourier Cosine series for $f(x) = 2x - 1$ in $(0, 1)$	7	L2	CO1																
	c.	Find the constant term and the first harmonics in the Fourier Series of $y = f(x)$, given by	6	L3	CO1																
<table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td style="padding: 2px;">x</td> <td style="padding: 2px;">0</td> <td style="padding: 2px;">1</td> <td style="padding: 2px;">2</td> <td style="padding: 2px;">3</td> <td style="padding: 2px;">4</td> <td style="padding: 2px;">5</td> <td style="padding: 2px;">6</td> </tr> <tr> <td style="padding: 2px;">y</td> <td style="padding: 2px;">1.98</td> <td style="padding: 2px;">1.3</td> <td style="padding: 2px;">1.05</td> <td style="padding: 2px;">1.3</td> <td style="padding: 2px;">-0.88</td> <td style="padding: 2px;">-0.25</td> <td style="padding: 2px;">1.98</td> </tr> </table>			x	0	1	2	3	4	5	6	y	1.98	1.3	1.05	1.3	-0.88	-0.25	1.98			
x	0	1	2	3	4	5	6														
y	1.98	1.3	1.05	1.3	-0.88	-0.25	1.98														
Module - 2																					
Q.3	a.	Find the complex Fourier transform of, $f(x) = \begin{cases} 1 & \text{for } x \leq 1 \\ 0 & \text{for } x < 1 \end{cases}$, and hence evaluate $\int_0^{\infty} \frac{\sin x}{x} dx$.	7	L2	CO2																
	b.	Find the Fourier sine transform of $f(x) = \frac{e^{-ax}}{x}$, where 'a' is positive real.	7	L2	CO2																
	c.	Find the discrete Fourier transform of the sequence $\{1, 2, 1, 3\}$	6	L3	CO2																
OR																					
Q.4	a.	Find the Fourier Transform of $f(x) = e^{-a x }$.	7	L2	CO2																
	b.	Solve the integral equation, $\int_0^{\infty} f(x) \cos(ux) dx = \begin{cases} 1-u & \text{for } 0 \leq u \leq 1 \\ 0 & \text{for } u > 1 \end{cases}$	7	L3	CO2																
	c.	Solve the Integral equation, $\int_0^{\infty} f(\theta) \cos \alpha \theta = \begin{cases} 1-\alpha, & 0 \leq \alpha \leq 1 \\ 0, & \alpha > 1 \end{cases}$. Hence evaluate $\int_0^{\infty} \frac{\sin^2 t}{t^2} dt$.	6	L3	CO2																

Module – 3																										
Q.5	a.	Find the z-transform of, (i) $\sin(n\theta)$ (ii) $\cosh(n\theta)$	7	L2	CO3																					
	b.	Find the inverse z-transform of $\frac{z^2 - z}{(z-3)^2}$	7	L2	CO3																					
	c.	Solve $y_{n+2} - 4y_{n+1} + 3y_n = 1$, given that $y_0 = 0, y_1 = 1$	6	L3	CO3																					
OR																										
Q.6	a.	Find the z-transform of, $\cos\left(\frac{n\pi}{4}\right) + 3^n n^2$	7	L2	CO3																					
	b.	If $z\{u_n\} = \frac{2z^2 + 3z + 4}{(z-3)^3}$; then find u_0, u_1 and u_2 .	7	L2	CO3																					
	c.	Solve $y_{n+2} + 2y_{n+1} + y_n = n$, given $y_0 = 0, y_1 = 0$.	6	L3	CO3																					
Module – 4																										
Q.7	a.	Solve $y'' + 5y' + 6y = e^{-2x} + \sin x$	7	L2	CO4																					
	b.	Solve $2\frac{d^2y}{dx^2} + 2\frac{dy}{dx} + 3y = x^2 + 2x - 1$	7	L2	CO4																					
	c.	Solve $(2x+1)^2 y'' - 2(2x+1)y' - 12y = 6x + 5$	6	L3	CO4																					
OR																										
Q.8	a.	Solve $(D^3 - 6D^2 + 11D - 6)y = e^{-2x} + \cos x$	7	L2	CO4																					
	b.	Solve $x^2 y'' - 3xy' + 5y = 3\sin(\log x)$	7	L3	CO4																					
	c.	An emf of $E\sin(pt)$ is applied at $t = 0$ to a circuit containing capacitance C and inductance L , the current i satisfies. $L\frac{di}{dt} + \frac{1}{C}\int i dt = E\sin(pt)$ If $p^2 = \frac{1}{LC}$ and initially current and charge q are zero, then find the current i at any time t .	6	L3	CO4																					
Module – 5																										
Q.9	a.	Fit a parabola $y = a + bx + cx^2$ by the method of least squares for the following data: <table border="1" style="margin-left: 20px;"> <tr><td>x</td><td>2</td><td>4</td><td>6</td><td>8</td><td>10</td></tr> <tr><td>y</td><td>3.07</td><td>12.85</td><td>31.47</td><td>57.38</td><td>91.29</td></tr> </table>	x	2	4	6	8	10	y	3.07	12.85	31.47	57.38	91.29	7	L2	CO5									
	x	2	4	6	8	10																				
	y	3.07	12.85	31.47	57.38	91.29																				
b.	Obtain the lines of regression for the data, also find co-efficient correlation. <table border="1" style="margin-left: 20px;"> <tr><td>x</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td></tr> <tr><td>y</td><td>9</td><td>8</td><td>10</td><td>12</td><td>11</td><td>13</td><td>14</td></tr> </table>	x	1	2	3	4	5	6	7	y	9	8	10	12	11	13	14	7	L2	CO5						
x	1	2	3	4	5	6	7																			
y	9	8	10	12	11	13	14																			
c.	Compute the rank correlation co-efficient for the data : <table border="1" style="margin-left: 20px;"> <tr><td>x</td><td>68</td><td>64</td><td>75</td><td>50</td><td>64</td><td>80</td><td>75</td><td>40</td><td>55</td><td>64</td></tr> <tr><td>y</td><td>62</td><td>58</td><td>68</td><td>45</td><td>81</td><td>60</td><td>68</td><td>48</td><td>50</td><td>70</td></tr> </table>	x	68	64	75	50	64	80	75	40	55	64	y	62	58	68	45	81	60	68	48	50	70	6	L3	CO5
x	68	64	75	50	64	80	75	40	55	64																
y	62	58	68	45	81	60	68	48	50	70																

OR															
Q.10	a.	Fit a least square curve $y = ax^b$ for the data :					7	L2	CO5						
		x	1	2	3	4				5					
		y	0.5	2	4.5	8	12.5								
	b.	Given the regression lines $x = 19.13 - 0.87y$ and $y = 11.64 - 0.5x$. Compute mean of data x and mean of data y, also find co-efficient of correlation.					7	L3	CO5						
	c.	Ten competitors in a music contest are ranked by 3 judges A, B and C in the following order. Find the pair of judges have the nearest approach to common taste of music.					6	L3	CO5						
		A	1	6	5	10				3	2	4	9	7	8
		B	3	5	8	4				7	10	2	1	6	9
		C	6	4	9	8				1	2	3	10	5	7
