

Third Semester B.E./B.Tech. Degree Examination, Dec.2025/Jan.2026 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. M : Marks , L: Bloom's level , C: Course outcomes.
3. Use of Statistical tables and Mathematical handbook is permitted.*

Module – 1				M	L	C															
Q.1	a.	Compute the constant term and first harmonics in the Fourier series for $f(x)$ given by the following data: <table><tr><td>x</td><td>0</td><td>60</td><td>120</td><td>180</td><td>240</td><td>300</td><td>360</td></tr><tr><td>f(x)</td><td>1.0</td><td>1.4</td><td>1.9</td><td>1.7</td><td>1.5</td><td>1.2</td><td>1.0</td></tr></table>	x	0	60	120	180	240	300	360	f(x)	1.0	1.4	1.9	1.7	1.5	1.2	1.0	07	L3	CO1
x	0	60	120	180	240	300	360														
f(x)	1.0	1.4	1.9	1.7	1.5	1.2	1.0														
	b.	Obtain a Fourier series for $f(x) = x^3$ in $(-\pi, \pi)$	07	L2	CO1																
	c.	Find the Fourier half-range cosine series of the function $f(x) = (x - 1)^2$ in $(0, 1)$.	06	L2	CO1																
OR																					
Q.2	a.	Find the Fourier series of $f(x) = x + x^2$ in $(-\pi, \pi)$. Hence deduce that $\frac{\pi^2}{12} = \frac{1}{1^2} - \frac{1}{2^2} + \frac{1}{3^2} - \dots$	07	L2	CO1																
	b.	Obtain a Fourier series expansion of $f(x) = \begin{cases} \pi x, & 0 \leq x \leq 1 \\ \pi(2 - x), & 1 \leq x \leq 2 \end{cases}$	07	L2	CO1																
	c.	For the periodic function $f(x)$ of period 6 specified by the following table over the interval $(0, 6)$, find the Fourier coefficients a_0 , a_1 and b_1 . <table><tr><td>x</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td></tr><tr><td>f(x)</td><td>9</td><td>18</td><td>24</td><td>28</td><td>26</td><td>20</td><td>9</td></tr></table>	x	0	1	2	3	4	5	6	f(x)	9	18	24	28	26	20	9	06	L3	CO1
x	0	1	2	3	4	5	6														
f(x)	9	18	24	28	26	20	9														
Module – 2																					
Q.3	a.	Find the Fourier transform of $f(x) = \begin{cases} a^2 - x^2, & x \leq a \\ 0, & x > a \end{cases}$ where 'a' is positive constant. Hence evaluate $\int_0^\infty \frac{\sin x - x \cos x}{x^3} dx = \frac{\pi}{4}$	07	L2	CO2																
	b.	Find the Fourier sine transform of $f(x) = e^{- x }$. Hence evaluate $\int_0^\infty \frac{\sin mx}{1 + x^2} dx$; $m > 0$	07	L2	CO2																
	c.	Find the Discrete Fourier Transform (DFT) of a sequence $X(n) = \{1, 1, 0, 0\}$ and find the IDFT of $\tau(k) = \{1 \ 0 \ 1 \ 0\}$	06	L3	CO2																

1 of 3

OR

Q.4	a.	Find the Fourier transform of the function $f(x) = \begin{cases} 1, & \text{for } x \leq a \\ 0, & \text{for } x > a \end{cases}$ Hence evaluate $\int_0^{\infty} \frac{\sin x}{x} dx$	07	L2	CO2
	b.	Find the Fourier sine and cosine transform of $f(x) = \begin{cases} x, & 0 < x < 2 \\ 0, & \text{else where} \end{cases}$	07	L2	CO2
	c.	Solve the Integral equation of $\int_0^{\infty} f(\theta) \cos \alpha \theta d\theta = \begin{cases} 1-\alpha, & 0 \leq \alpha \leq 1 \\ \alpha > 1 \end{cases}$ Hence evaluate $\int_0^{\infty} \frac{\sin^2 t}{t^2} dt$	06	L3	CO2
Module – 3					
Q.5	a.	Find the z-transforms of $(2n-1)^2 + \sin 3n$.	06	L1	CO3
	b.	Find the inverse z-transform of $\frac{3z^2 + 2z}{(5z-1)(5z+2)}$	07	L3	CO3
	c.	Using z-transforms, solve the difference equation $y_{n+2} - 5y_{n+1} + 6y_n = 2$; $y_0 = 0$; $y_1 = 7$	07	L3	CO3
OR					
Q.6	a.	Find the z-transforms of $\cos \left[\frac{n\pi}{2} + \frac{\pi}{4} \right]$	06	L1	CO3
	b.	Obtain the inverse z-transform of $\frac{4z^2 - 2z}{(z-1)(z-2)^2}$	07	L3	CO3
	c.	If $\bar{y}(z) = \frac{2z^2 + 3z + 12}{(z-1)^4}$, evaluate u_2 .	07	L3	CO3
Module – 4					
Q.7	a.	Solve : $\frac{d^2 y}{dx^2} + y = \cos 2x$	06	L2	CO4
	b.	Solve : $\frac{d^2 y}{dx^2} - 4 \frac{dy}{dx} + 3y = (e^x + 1)^2$	07	L2	CO4
	c.	Solve : $x^3 \frac{d^3 y}{dx^3} + 3x^2 \frac{d^2 y}{dx^2} + x \frac{dy}{dx} = \log x$	07	L3	CO4

OR

Q.8	a.	Solve : $[D^2 - 4D + 4]y = e^{2x} + x$	06	L2	CO4
	b.	Solve : $(1+x)^2 y'' + (1+x)y' + y = 2\sin[\log(1+x)]$	07	L3	CO4
	c.	In an LCR circuit, the charge q on a plate of a condenser is given by $L \frac{d^2 q}{dt^2} + R \frac{dq}{dt} + \frac{q}{c} = E \sin pt$ Solve the above equation.	07	L3	CO4

Module – 5

Q.9	a.	Find the equation of the least fitting straight line $y = ax + b$ for the following data: <table><tr><td>x</td><td>5</td><td>10</td><td>15</td><td>20</td><td>25</td></tr><tr><td>y</td><td>16</td><td>19</td><td>23</td><td>26</td><td>30</td></tr></table>	x	5	10	15	20	25	y	16	19	23	26	30	06	L2	CO5																					
x	5	10	15	20	25																																	
y	16	19	23	26	30																																	
	b.	Compute the coefficient of correlation and the equations of the lines of regression for the data: <table><tr><td>x</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td></tr><tr><td>y</td><td>2</td><td>5</td><td>3</td><td>8</td><td>7</td></tr></table>	x	1	2	3	4	5	y	2	5	3	8	7	07	L3	CO5																					
x	1	2	3	4	5																																	
y	2	5	3	8	7																																	
	c.	Ten competitors in a beauty contest are ranked by two Judges A and B in the following data: <table><tr><td>ID No.</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td></tr><tr><td>Judge A</td><td>1</td><td>6</td><td>5</td><td>10</td><td>3</td><td>2</td><td>4</td><td>9</td><td>7</td><td>8</td></tr><tr><td>Judge B</td><td>6</td><td>4</td><td>9</td><td>8</td><td>1</td><td>2</td><td>3</td><td>10</td><td>5</td><td>7</td></tr></table> Calculate the rank correlation coefficient.	ID No.	1	2	3	4	5	6	7	8	9	10	Judge A	1	6	5	10	3	2	4	9	7	8	Judge B	6	4	9	8	1	2	3	10	5	7	07	L3	CO5
ID No.	1	2	3	4	5	6	7	8	9	10																												
Judge A	1	6	5	10	3	2	4	9	7	8																												
Judge B	6	4	9	8	1	2	3	10	5	7																												

OR

Q.10	a.	Fit a parabola of second degree $y = a + bx + cx^2$ for the data <table border="1"><tr><td>x</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td></tr><tr><td>y</td><td>1</td><td>1.8</td><td>1.3</td><td>2.5</td><td>2.3</td></tr></table>	x	0	1	2	3	4	y	1	1.8	1.3	2.5	2.3	06	L2	CO5										
x	0	1	2	3	4																						
y	1	1.8	1.3	2.5	2.3																						
	b.	The lines of regression are $2x + 3y + 1 = 0$, $x + 6y - 4 = 0$. Compute $\bar{x}$, $\bar{y}$ and 'r'.	07	L3	CO5																						
	c.	Compute the rank correlation coefficient for the following data: <table border="1"><tr><td>x</td><td>78</td><td>36</td><td>98</td><td>25</td><td>75</td><td>82</td><td>90</td><td>62</td><td>65</td><td>39</td></tr><tr><td>y</td><td>84</td><td>51</td><td>91</td><td>60</td><td>68</td><td>62</td><td>86</td><td>58</td><td>53</td><td>47</td></tr></table>	x	78	36	98	25	75	82	90	62	65	39	y	84	51	91	60	68	62	86	58	53	47	07	L3	CO5
x	78	36	98	25	75	82	90	62	65	39																	
y	84	51	91	60	68	62	86	58	53	47																	
