

CBCS SCHEME - Make-Up Exam



BMATEC301/BEC301/BBM301

Third Semester B.E/B.Tech. Degree Examination, June/July 2025

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 table and hand book permitted.

Module – 1			M	L	C																
1	a.	Find the Fourier Series expansion of the function $f(x) = x $ in $-\pi \leq x \leq \pi$. Hence deduce that $\frac{\pi^2}{8} = \frac{1}{1^2} + \frac{1}{3^2} + \dots$	6	L2	CO1																
	b.	Find the cosine half range series for $f(x) = x(\ell - x)$ in $0 \leq x \leq \ell$.	7	L2	CO1																
	c.	Compute the first two harmonics of the Fourier series of $f(x)$ given the following table : <table><tr><td>x</td><td>0</td><td>$\frac{\pi}{3}$</td><td>$\frac{2\pi}{3}$</td><td>π</td><td>$\frac{4\pi}{3}$</td><td>$\frac{5\pi}{3}$</td><td>2π</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	$\frac{\pi}{3}$	$\frac{2\pi}{3}$	π	$\frac{4\pi}{3}$	$\frac{5\pi}{3}$	2π	f(x)	1.0	1.4	1.9	1.7	1.5	1.2	1.0	7	L3	CO1
x	0	$\frac{\pi}{3}$	$\frac{2\pi}{3}$	π	$\frac{4\pi}{3}$	$\frac{5\pi}{3}$	2π														
f(x)	1.0	1.4	1.9	1.7	1.5	1.2	1.0														
OR																					
2	a.	Find a Fourier series to represent $f(x) = x - x^2$ from $x = -\pi$ to $x = \pi$.	6	L2	CO1																
	b.	Obtain the cosine half range series of $f(x) = x \sin x$ in $0 < x < \pi$. Hence shown that $\frac{1}{1.3} - \frac{1}{3.5} + \frac{1}{5.7} - \dots = \frac{\pi - 2}{4}$	7	L2	CO1																
	c.	Obtain the first three coefficients in the Fourier cosine series for y, where y is given in the following table : <table><tr><td>x</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td></tr><tr><td>y</td><td>4</td><td>8</td><td>15</td><td>7</td><td>6</td><td>2</td></tr></table>	x	0	1	2	3	4	5	y	4	8	15	7	6	2	7	L3	CO1		
x	0	1	2	3	4	5															
y	4	8	15	7	6	2															
Module – 2																					
3	a.	Find the Fourier transform of, $f(x) = \begin{cases} 1 - x^2, & x \leq 1 \\ 0, & x > 1 \end{cases}$, Hence evaluate $\int_0^\infty \frac{x \cos x - \sin x}{x^3} \cos \frac{x}{2} dx$.	6	L3	CO2																

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	b.	Find the Fourier cosine transform of the function, $f(x) = \begin{cases} 4x, & 0 < x < 1 \\ 4 - x, & 1 < x < 4 \\ 0, & x > 4 \end{cases}$	7	L2	CO2
	c.	Find the Discrete Fourier Transform of the sequence $x(n) = \{1, 1, 0, 0\}$, $N = 4 = L$.	7	L3	CO2
OR					
4	a.	Find the Fourier transform of, $f(x) = \begin{cases} x^2, & x < a \\ 0, & x > a \end{cases}$, where 'a' is a positive constant.	6	L3	CO2
	b.	Find the Fourier sine transform of $\frac{e^{-ax}}{x}$, $a > 0$	7	L2	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 $\int_0^\infty \frac{\sin^2 t}{t^2} dt$.	7	L3	CO2
Module – 3					
5	a.	Find the z-transform of $\cos\left(n\frac{\pi}{2} + \frac{\pi}{4}\right)$.	6	L2	CO3
	b.	Find the inverse z-transform of $\frac{3z^2 + 2z}{(5z - 1)(5z + 2)}$.	7	L3	CO3
	c.	Solve the difference equation, $y_{n+2} + 2y_{n+1} + y_n = n$ with $y_0 = 0 = y_1$, using z-transforms.	7	L3	CO3
OR					
6	a.	Find the z-transform of (i) $(n+1)^2$ (ii) $\sin(3n+5)$	6	L2	CO3
	b.	Find the inverse z-transform of $\frac{z^3 - 20z}{(z-2)^3(z-4)}$	7	L3	CO3
	c.	Solve the difference equation, $y_{n+2} + 6y_{n+1} + 9y_n = 2^n$ with $y_0 = 0 = y_1$	7	L3	CO3
Module – 4					
7	a.	Solve $4 \frac{d^4 y}{dx^4} - 8 \frac{d^3 y}{dx^3} - 7 \frac{d^2 y}{dx^2} + 11 \frac{dy}{dx} + 6y = 0$.	6	L2	CO4
	b.	Solve $\frac{d^2 y}{dx^2} - 4y = \cosh(2x - 1)$	7	L2	CO4
	c.	Solve $x^2 y'' + xy' + 9y = 3x^2 + \sin(3 \log x)$	7	L3	CO4
OR					
8	a.	Solve $(D^3 + 8)y = x^4 + 2x + 1$	6	L2	CO4
	b.	Solve $(1+x)^2 y'' + (1+x)y' + y = \sin[2 \log(1+x)]$	7	L2	CO4
	c.	The damped LCR circuit governed by the equation $L \frac{d^2 q}{dt^2} + R \frac{dq}{dt} + \frac{q}{C} = 0$, where L, R, C are positive constants. Find the positive solution.	7	L3	CO4

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Module – 5

9	a.	Find a curve of best fit of the form, $y = ax^b$ to the following data :	6	L2	CO5																																	
		<table border="1" style="width: 100%; border-collapse: collapse;"><tr><td style="width: 5%;">x</td><td style="width: 5%;">1</td><td style="width: 5%;">2</td><td style="width: 5%;">3</td><td style="width: 5%;">4</td><td style="width: 5%;">5</td></tr><tr><td>y</td><td>0.5</td><td>2</td><td>4.5</td><td>8</td><td>12.5</td></tr></table>				x	1	2	3	4	5	y	0.5	2	4.5	8	12.5																					
x	1	2	3	4	5																																	
y	0.5	2	4.5	8	12.5																																	
	b.	Compute the coefficient of correlation and the equation of the lines of regression for the data : <table border="1" style="width: 100%; border-collapse: collapse;"><tr><td style="width: 5%;">x</td><td style="width: 5%;">10</td><td style="width: 5%;">14</td><td style="width: 5%;">18</td><td style="width: 5%;">22</td><td style="width: 5%;">26</td><td style="width: 5%;">30</td></tr><tr><td>y</td><td>18</td><td>12</td><td>24</td><td>6</td><td>30</td><td>36</td></tr></table>	x	10	14	18	22	26	30	y	18	12	24	6	30	36	7	L3	CO5																			
x	10	14	18	22	26	30																																
y	18	12	24	6	30	36																																
	c.	Three judges A, B, C the following ranks given. Find which pair of judges has common approach. <table border="1" style="width: 100%; border-collapse: collapse;"><tr><td style="width: 5%;">A</td><td style="width: 5%;">1</td><td style="width: 5%;">6</td><td style="width: 5%;">5</td><td style="width: 5%;">10</td><td style="width: 5%;">3</td><td style="width: 5%;">2</td><td style="width: 5%;">4</td><td style="width: 5%;">9</td><td style="width: 5%;">7</td><td style="width: 5%;">8</td></tr><tr><td>B</td><td>3</td><td>5</td><td>8</td><td>4</td><td>7</td><td>10</td><td>2</td><td>1</td><td>6</td><td>9</td></tr><tr><td>C</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>	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	7	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																												
OR																																						
10	a.	Fit a Parabola of the form $y = a + bx + cx^2$ to the following data : <table border="1" style="width: 100%; border-collapse: collapse;"><tr><td style="width: 5%;">x</td><td style="width: 5%;">0</td><td style="width: 5%;">1</td><td style="width: 5%;">2</td><td style="width: 5%;">3</td><td style="width: 5%;">4</td><td style="width: 5%;">5</td></tr><tr><td>y</td><td>1</td><td>3</td><td>7</td><td>13</td><td>21</td><td>31</td></tr></table>	x	0	1	2	3	4	5	y	1	3	7	13	21	31	6	L2	CO5																			
		x	0	1	2	3	4	5																														
y	1	3	7	13	21	31																																
	b.	If θ is the angle between the lines of regression, then shown that $\tan \theta = \frac{\sigma_x \sigma_y}{\sigma_x^2 + \sigma_y^2} \left(\frac{1-r^2}{r} \right)$. Explain the significance when $r=0$, $r = \pm 1$. CMRIT LIBRARY BANGALORE - 560 037	7	L3	CO5																																	
	c.	The scores for 10 students in English and Maths as follows. Compute the rank of students in 2 subjects and also the correlation coefficient. <table border="1" style="width: 100%; border-collapse: collapse;"><tr><td style="width: 10%;">English</td><td style="width: 5%;">56</td><td style="width: 5%;">75</td><td style="width: 5%;">45</td><td style="width: 5%;">71</td><td style="width: 5%;">62</td><td style="width: 5%;">64</td><td style="width: 5%;">58</td><td style="width: 5%;">80</td><td style="width: 5%;">76</td><td style="width: 5%;">61</td></tr><tr><td>Maths</td><td>66</td><td>70</td><td>40</td><td>60</td><td>65</td><td>56</td><td>59</td><td>77</td><td>67</td><td>63</td></tr></table>	English	56	75	45	71	62	64	58	80	76	61	Maths	66	70	40	60	65	56	59	77	67	63	7	L3	CO5											
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