CBCS SCHEME - Make-Up Exam

USN ☐☐☐☐☐☐☐☐☐☐

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.

<table>
<tr><th></th><th></th><th>Module – 1</th><th>M</th><th>L</th><th>C</th></tr>
<tr><td>1</td><td>a.</td><td>Find the Fourier Series expansion of the function $f(x)=|x|$ in $-\pi \le x \le \pi$.
Hence deduce that $\frac{\pi^2}{8}=\frac{1}{1^2}+\frac{1}{3^2}+\ldots\ldots$</td><td>6</td><td>L2</td><td>CO1</td></tr>
<tr><td></td><td>b.</td><td>Find the cosine half range series for $f(x)=x(\ell-x)$ in $0\le x\le \ell$.</td><td>7</td><td>L2</td><td>CO1</td></tr>
<tr><td></td><td>c.</td><td>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></td><td>7</td><td>L3</td><td>CO1</td></tr>
<tr><td colspan="6">OR</td></tr>
<tr><td>2</td><td>a.</td><td>Find a Fourier series to represent $f(x)=x-x^2$ from $x=-\pi$ to $x=\pi$.</td><td>6</td><td>L2</td><td>CO1</td></tr>
<tr><td></td><td>b.</td><td>Obtain the cosine half range series of $f(x)=x\sin x$ in $0<x<\pi$. Hence shown that $\frac{1}{1.3}-\frac{1}{3.5}+\frac{1}{5.7}-\ldots\ldots=\frac{\pi-2}{4}$</td><td>7</td><td>L2</td><td>CO1</td></tr>
<tr><td></td><td>c.</td><td>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></td><td>7</td><td>L3</td><td>CO1</td></tr>
<tr><td colspan="6">Module – 2</td></tr>
<tr><td>3</td><td>a.</td><td>Find the Fourier transform of,
$f(x)=\begin{cases}1-x^2, & |x|\le 1\\ 0, & |x|>1\end{cases}$. Hence evaluate $\int_0^{\infty}\frac{x\cos x-\sin x}{x^3}\cos\frac{x}{2}dx$.</td><td>6</td><td>L3</td><td>CO2</td></tr>
</table>

	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 $\dfrac{e^{-ax}}{x}$, $a>0$	7	L2	CO2
	c.	Solve the integral equation $\int_0^{\infty} f(\theta)\cos\alpha 0=\begin{cases}1-\alpha, & 0\le\alpha\le 1\\ 0, & \alpha>1\end{cases}$. Hence evaluate $\int_0^{\infty}\dfrac{\sin^2 t}{t^2}dt$.	7	L3	CO2
		Module – 3			
5	a.	Find the z-transform of $\cos\left(n\dfrac{\pi}{2}+\dfrac{\pi}{4}\right)$.	6	L2	CO3
	b.	Find the inverse z-transform of $\dfrac{3z^2+2z}{(5z-1)(5z+2)}$.	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 $\dfrac{z^3-20z}{(z-2)^3(z-4)}$	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 $4\dfrac{d^4y}{dx^4}-8\dfrac{d^3y}{dx^3}-7\dfrac{d^2y}{dx^2}+11\dfrac{dy}{dx}+6y=0$.	6	L2	CO4
	b.	Solve $\dfrac{d^2y}{dx^2}-4y=\cosh(2x-1)$	7	L2	CO4
	c.	Solve $x^2y''+xy'+9y=3x^2+\sin(3\log x)$	7	L3	CO4
		OR			
8	a.	Solve $(D^3+8)y=x^4+2x+1$	6	L2	CO4
	b.	Solve $(1+x)^2y''+(1+x)y'+y=\sin[2\log(1+x)]$	7	L2	CO4
	c.	The damped LCR circuit governed by the equation $L\dfrac{d^2q}{dt^2}+R\dfrac{dq}{dt}+\dfrac{q}{C}=0$, where L, R, C are positive constants. Find the positive solution.	7	L3	CO4

<table>
<tr><td colspan="6">Module – 5</td></tr>
<tr><td>9</td><td>a.</td><td>Find a curve of best fit of the form, $y = ax^b$ to the following 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>0.5</td><td>2</td><td>4.5</td><td>8</td><td>12.5</td></tr>
</table></td><td>6</td><td>L2</td><td>CO5</td></tr>
<tr><td></td><td>b.</td><td>Compute the coefficient of correlation and the equation of the lines of regression for the data :
<table>
<tr><td>x</td><td>10</td><td>14</td><td>18</td><td>22</td><td>26</td><td>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></td><td>7</td><td>L3</td><td>CO5</td></tr>
<tr><td></td><td>c.</td><td>Three judges A, B, C the following ranks given. Find which pair of judges has common approach.
<table>
<tr><td>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>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></td><td>7</td><td>L3</td><td>CO5</td></tr>
<tr><td colspan="6">OR</td></tr>
<tr><td>10</td><td>a.</td><td>Fit a Parabola of the form $y = a + bx + cx^2$ to the following data :
<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>1</td><td>3</td><td>7</td><td>13</td><td>21</td><td>31</td></tr>
</table></td><td>6</td><td>L2</td><td>CO5</td></tr>
<tr><td></td><td>b.</td><td>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 $r = 0$, $r = \pm 1$.</td><td>7</td><td>L3</td><td>CO5</td></tr>
<tr><td></td><td>c.</td><td>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>
<tr><td>English</td><td>56</td><td>75</td><td>45</td><td>71</td><td>62</td><td>64</td><td>58</td><td>80</td><td>76</td><td>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></td><td>7</td><td>L3</td><td>CO5</td></tr>
</table>

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