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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 Formula hand book is permitted.

Module – 1				M	L	C														
Q.1	a.	Find the Fourier Series expansion of the function $f(x) = x $ in $(-\pi, \pi)$.		06	L2	CO1														
	b.	Find the half range Fourier sine series for function, $f(x) = \begin{cases} \frac{1}{4} - x & \text{in } 0 < x < \frac{1}{2} \\ x - \frac{3}{4} & \text{in } \frac{1}{2} < x < 1 \end{cases}$		07	L2	CO1														
	c.	Find the constant term and the first co-efficients of cosine and sine terms in the Fourier series expansion for the following data : <table border="1" style="margin: 5px 0;"> <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>9</td><td>18</td><td>24</td><td>28</td><td>26</td><td>20</td></tr> </table>	x	0	1	2	3	4	5	y	9	18	24	28	26	20		07	L3	CO1
x	0	1	2	3	4	5														
y	9	18	24	28	26	20														
OR																				
Q.2	a.	Obtain the Fourier series of the square wave given by, $f(x) = \begin{cases} -K & \text{in } -\pi < x < 0 \\ K & \text{in } 0 < x < \pi \end{cases}$		06	L2	CO1														
	b.	Obtain the half range cosine series for $f(x) = (x-1)^2$ in $0 \leq x \leq 1$.		07	L2	CO1														
	c.	Obtain the constant term and coefficients of first cosine and sine terms in the expansion of 'y' from the following table : <table border="1" style="margin: 5px 0;"> <tr> <td>x°</td><td>0</td><td>60°</td><td>120°</td><td>180°</td><td>240°</td><td>300°</td></tr> <tr> <td>y</td><td>7.9</td><td>7.2</td><td>3.6</td><td>0.5</td><td>0.9</td><td>6.8</td></tr> </table>	x°	0	60°	120°	180°	240°	300°	y	7.9	7.2	3.6	0.5	0.9	6.8		07	L3	CO1
x°	0	60°	120°	180°	240°	300°														
y	7.9	7.2	3.6	0.5	0.9	6.8														
Module – 2																				
Q.3	a.	Find the Fourier transform of $f(x) = \begin{cases} 1- x , & x \leq a \\ 0, & x > a \end{cases}$. Hence evaluate $\int_0^{\infty} \frac{\sin^2 t}{t^2} dt.$		06	L3	CO2														
	b.	Find the Fourier cosine transform of the function $f(x) = e^{-\alpha x}$. Evaluate $\int_0^{\infty} \frac{\cos mx}{\alpha^2 + x^2} dx$		07	L2	CO2														
	c.	Find the DFT of a sequence $x(n) = \{1, 1, 0, 0\}$ and also find the IDFT of $Y(K) = \{1, 0, 1, 0\}$.		07	L3	CO2														
OR																				

Q.4	a.	Find the Fourier transform of $f(x) = \begin{cases} 1-x^2, & x < 1 \\ 0, & x \geq 1 \end{cases}$	06	L2	CO2												
	b.	Find the Fourier cosine transform of $f(x) = \begin{cases} 4x, & \text{for } 0 < x < 1 \\ 4-x, & \text{for } 1 < x < 4 \\ 0, & \text{for } x > 4 \end{cases}$	07	L1	CO2												
	c.	Find the Fourier sine transform of $f(x) = e^{- x }$ and hence evaluate $\int_0^{\infty} \frac{x \sin mx}{1+x^2} dx, m > 0$.	07	L3	CO2												
Module – 3																	
Q.5	a.	Find the z-transform of : (i) $(n+1)^2$ (ii) $\sinh n \theta$.	06	L2	CO3												
	b.	Find the inverse z-transform of $\frac{z}{(z-1)(z-2)}$.	07	L3	CO3												
	c.	Solve the difference equation of $y_{n+2} - 4y_n = 0$, given that $y_0 = 0$ and $y_1 = 2$ using Z-transform.	07	L3	CO3												
OR																	
Q.6	a.	Find the z-transform of $\sin(3n+5)$.	06	L2	CO3												
	b.	Obtain the inverse z-transform of $\frac{2z^2+3z}{(z+2)(z-4)}$.	07	L3	CO3												
	c.	If $U(z) = \frac{2z^2+3z+4}{(z-3)^3}$, evaluate u_2 and u_3 .	07	L3	CO3												
Module – 4																	
Q.7	a.	Solve $(D^3 - 3D^2 + 3D - 1)y = 0$.	06	L2	CO4												
	b.	Solve $\frac{d^2y}{dx^2} - 4y = \cosh(2x-1) + 3^x$	07	L2	CO4												
	c.	Solve $x^2 \frac{d^2y}{dx^2} - x \frac{dy}{dx} + 2y = \sin(\log x)$	07	L3	CO4												
OR																	
Q.8	a.	Solve $\frac{d^2y}{dx^2} + 4 \frac{dy}{dx} + 4y = 3 \sin x$.	06	L2	CO4												
	b.	Solve $(3x+2)^2 y'' + 3(3x+2)y' - 36y = 4(3x+2)^2$	07	L2	CO4												
	c.	In an LCR circuit the charge 'q' on a plate of a condenser is given by, $L \frac{d^2q}{dt^2} + R \frac{dq}{dt} + \frac{q}{c} = E \sin pt$. Solve the above equation.	07	L3	CO4												
Module – 5																	
Q.9	a.	Find a least square straight line for the following data : <table border="1" data-bbox="373 1691 706 1769"> <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 $\bar{x}$, $\bar{y}$ and r from the following equation of the regression lines $2x+3y+1=0$; $x+6y-4=0$.	07	L3	CO5												

	c.	Ten students got the following percentage of marks in two subjects say x and y, compute their rank correlation co-efficient.	07	L3	CO5																						
		<table><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			
x	78	36	98	25	75	82	90	62	65	39																	
y	84	51	91	60	68	62	86	58	53	47																	
OR																											
Q.10	a.	Fit a parabola $y = ax^2 + bx + c$ by the method of least squares for the following data :	06	L2	CO5																						
		<table><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													
x	2	4	6	8	10																						
y	3.07	12.85	31.47	57.38	91.29																						
	b.	Find the correlation co-efficient between x and y for the following data :	07	L3	CO5																						
		<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													
x	1	2	3	4	5																						
y	2	5	3	8	7																						
	c.	Find the two regression lines from the following data :	07	L3	CO5																						
		<table><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									
x	1	2	3	4	5	6	7																				
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