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BMATEC301/BEC301/BBM301

Third Semester B.E./B.Tech. Degree Examination, June / July 2026 AV Mathematics – III for EC/BM Engineering

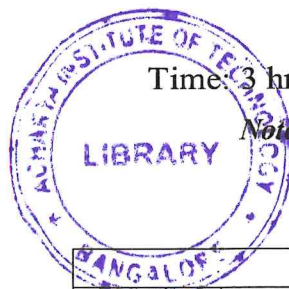
Time: 3 hrs.

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 VTU mathematics handbook, statistical table handbook 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 Cosine Series for $f(x) = (x - 1)^2$ in $0 \leq x \leq 1$	07	L2	CO1															
	c.	The following data gives the variations of periodic current over a period. <table border="1"><tr><td>t(Sec)</td><td>0</td><td>T/6</td><td>T/3</td><td>T/2</td><td>2T/3</td><td>5T/6</td><td>T</td></tr><tr><td>A (Amp)</td><td>1.98</td><td>1.30</td><td>1.05</td><td>1.03</td><td>-0.88</td><td>-0.25</td><td>1.98</td></tr></table> Find numerically the direct current part of the variable current and the amplitude of the first harmonic.	t(Sec)	0	T/6	T/3	T/2	2T/3	5T/6	T	A (Amp)	1.98	1.30	1.05	1.03	-0.88	-0.25	1.98	07	L3
t(Sec)	0	T/6	T/3	T/2	2T/3	5T/6	T													
A (Amp)	1.98	1.30	1.05	1.03	-0.88	-0.25	1.98													
OR																				
Q.2	a.	Obtain the Fourier Series of $f(x) = \frac{\pi - x}{2}$ in $0 < x < 2\pi$. Hence deduce that $1 - \frac{1}{3} + \frac{1}{5} - \frac{1}{7} + \dots = \frac{\pi}{4}$	06	L2	CO1															
	b.	Find the half range Fourier Sine Series for $f(x) = 2x - 1$ in $0 < x < 1$.	07	L2	CO1															
	c.	Obtain the constant term and the coefficients of the first cosine and sine terms in the Fourier Expansion of y from the table. <table border="1"><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														
Module – 2																				
Q.3	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 $\int_0^\infty \frac{\sin x}{x} dx$	06	L2	CO2															
	b.	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	L2	CO2															
	c.	Find the Discrete Fourier Transform of the signal $(3, 4, 5, 5)^T$.	07	L3	CO2															

1 of 3

OR

Q.4	a.	Find the Fourier transform of $f(x) = \begin{cases} x^2, & x < a \\ 0, & x > a \end{cases}$ where 'a' is positive constant.	06	L2	CO2
	b.	Find the Fourier sine and cosine transform of $2e^{-3x} + 3e^{-2x}$.	07	L2	CO2
	c.	Solve the Integral equation of $\int_0^\infty f(\theta) \cos \alpha \theta \, d\theta = \begin{cases} 1-\alpha, & 0 \leq \alpha \leq 1 \\ 0, & \alpha > 1 \end{cases}$ Hence evaluate $\int_0^\infty \frac{\sin^2 t}{t^2} dt$	07	L2	CO2

Module – 3

Q.5	a.	Obtain the z – transform of $\cos n\theta$ and $\sin n\theta$.	06	L2	CO3
	b.	Compute the inverse z-transform of $\frac{3z^2 + 2z}{(5z-1)(5z+2)}$	07	L2	CO3
	c.	Solve by using z-transforms : $y_{n+2} - 4y_n = 0$; gives that $y_0 = 0$ and $y_1 = 2$	07	L2	CO3

OR

Q.6	a.	Find the z-transforms of $2n + \sin(n\pi/4) + 1$.	06	L2	CO3
	b.	Obtain the inverse z-transform of $\frac{2z^2 + 3z}{(z+2)(z-4)}$	07	L2	CO3
	c.	Given $z_T(u_n) = \frac{2z^2 + 3z + 4}{(z-3)^3}$ show that $u_1 = 2, u_2 = 21$.	07	L3	CO3

Module – 4

Q.7	a.	Solve $\frac{d^4 y}{dx^4} + 2\frac{d^2 y}{dx^2} + y = 0$	06	L2	CO4
	b.	Solve $(D^2 + 3D + 2)y = 12x^2$	07	L2	CO4
	c.	Solve $x^2 \frac{d^2 y}{dx^2} + x \frac{dy}{dx} + 8y = 65 \cos(\log x)$	07	L3	CO4

OR

Q.8	a.	Solve $(D^2 - 4D + 3)y = e^{3x} + 2^x + 7$	06	L2	CO4
	b.	Solve : $(2x+1)y'' - 6(2x+1)y' + 16y = 8(2x+1)^2$	07	L2	CO4
	c.	An alternating EME Esinpt is applied to a circuit at $t = 0$. Given the equation for the charge q as $L \frac{d^2q}{dt^2} + R \frac{dq}{dt} + \frac{q}{c} = PE \sin pt$ Find q .	07	L3	CO4

Module – 5

Q.9	a.	Fit a straight line $y = ax + b$ for the following data: <table><tr><td>x</td><td>1</td><td>3</td><td>4</td><td>6</td><td>8</td><td>9</td><td>11</td><td>14</td></tr><tr><td>y</td><td>1</td><td>2</td><td>4</td><td>4</td><td>5</td><td>7</td><td>8</td><td>9</td></tr></table>	x	1	3	4	6	8	9	11	14	y	1	2	4	4	5	7	8	9	06	L2	CO4				
x	1	3	4	6	8	9	11	14																			
y	1	2	4	4	5	7	8	9																			
	b.	Show that if θ is the angle between the lines of regression, then $\tan \theta = \frac{\sigma_x \sigma_y}{\sigma_x^2 + \sigma_y^2} \left(\frac{1 - r^2}{r} \right)$	07	L3	CO5																						
	c.	Ten students got the following percentage of marks in two subjects x and y. Compute their rank correlation co-efficient. <table><tr><td>Marks in 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>Marks in 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>	Marks in x	78	36	98	25	75	82	90	62	65	39	Marks in y	84	51	91	60	68	62	86	58	53	47	07	L3	CO5
Marks in x	78	36	98	25	75	82	90	62	65	39																	
Marks in y	84	51	91	60	68	62	86	58	53	47																	

OR

Q.10	a.	Fit a parabola $y = a + bx + cx^2$ for the data <table><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 following table gives the heights of father (x) and Sons (y) <table><tr><td>x</td><td>65</td><td>66</td><td>67</td><td>67</td><td>68</td><td>69</td><td>70</td><td>72</td></tr><tr><td>y</td><td>67</td><td>68</td><td>65</td><td>68</td><td>72</td><td>72</td><td>69</td><td>71</td></tr></table> Find the lines of regression and hence calculate the co-efficient of correlation.	x	65	66	67	67	68	69	70	72	y	67	68	65	68	72	72	69	71	07	L3	CO5				
x	65	66	67	67	68	69	70	72																			
y	67	68	65	68	72	72	69	71																			
	c.	Compute the rank correlation coefficient for the following ranks of ten candidates in two subjects. <table><tr><td>Sub – 1</td><td>4</td><td>8</td><td>7</td><td>6</td><td>5</td><td>9</td><td>10</td><td>3</td><td>2</td><td>1</td></tr><tr><td>Sub – 2</td><td>6</td><td>7</td><td>8</td><td>1</td><td>5</td><td>10</td><td>9</td><td>2</td><td>3</td><td>4</td></tr></table>	Sub – 1	4	8	7	6	5	9	10	3	2	1	Sub – 2	6	7	8	1	5	10	9	2	3	4	07	L2	CO5
Sub – 1	4	8	7	6	5	9	10	3	2	1																	
Sub – 2	6	7	8	1	5	10	9	2	3	4																	
