CBCS SCHEME

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BMATEC301/BEC/BBM301

Third Semester B.E./B.Tech. Degree Examination, Dec.2023/Jan.2024
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. Statistical table and handbook permitted.
4. Use of VTU Mathematics handbook is permitted.

		Module – 1	M	L	C
Q.1	a.	Obtain the Fourier series of $f(x) = \frac{\pi - x}{2}$ in $0 < x < 2\pi$. Hence deduce that $1 - \frac{1}{3} + \frac{1}{5} - \frac{1}{7} + \ldots\ldots = \frac{\pi}{4}$	6	L2	CO1
	b.	Expand $f(x) = 2x - 1$ as a Cosine half range Fourier series in $0 < x < 1$.	7	L2	CO1
	c.	Compute the First harmonics of the Fourier series of f(x). Given the table	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

Q.2	a.	Obtain the Fourier series of $f(x) = \lvert x \rvert$ in $(-\ell, \ell)$.	6	L2	CO1
	b.	Obtain the Cosine half range Fourier series of $f(x) = x^2$ in $0 < x < \pi$.	7	L3	CO1
	c.	Express Y as a Fourier Cosine series upto second harmonics. Given the table :	7	L3	CO1

x	0	2	4	6	8	10	12
y	9.0	18.2	24.4	27.8	27.5	22.0	9.0

		Module – 2			
Q.3	a.	Find the Fourier transform of $f(x) = e^{-\lvert x \rvert}$.	6	L2	CO2
	b.	Find the Fourier Cosine and Sine transform of $f(x) = e^{-\alpha x}$, $\alpha > 0$.	7	L3	CO2
	c.	i) Find a Discrete Fourier transform of the single $f = [3, 4, 5, 5]^T$. ii) Find the Inverse Discrete Fourier transform of the single obtained in part (i).	7	L3	CO2

OR

Q.4	a.	Find the Fourier transform of $f(x) = \begin{cases} 1 - \lvert x \rvert & \text{for } \lvert x \rvert \le 1 \\ 0 & \text{for } \lvert x \rvert > 1 \end{cases}$ and hence deduce that $\int_0^\infty \frac{\sin^2 t}{t^2}\, dt = \frac{\pi}{2}$.	6	L2	CO2

	b.	Obtain the Fourier Cosine transform of $f(x) = \begin{cases} 4x & , \ 0 < x < 1 \\ 4-x & , \ 1 < x < 4 \\ 0 & , \ x > 4 \end{cases}$	7	L3	CO2
	c.	Solve the Integral equation $\int_0^\infty f(\theta)\cos\alpha\theta\, d\theta = \begin{cases} 1-\alpha & , \ 0 \le \alpha \le 1 \\ 0 & , \ \alpha > 1 \end{cases}$ and hence evaluate $\int_0^\infty \frac{\sin^2 t}{t^2} dt$.	7	L3	CO2
		Module – 3			
Q.5	a.	Find the Z -- transform of i) Cos n θ ii) Sin n θ.	6	L2	CO3
	b.	Find the Inverse Z – transform of $\frac{z^2 - 8z}{(z-4)^2}$.	7	L3	CO3
	c.	Solve the difference equation $y_{n+2} - 4y_n = 0$. Given that $y_0 = 0$ and $y_1 = 2$.	7	L3	CO3
		OR			
Q.6	a.	Find the Z – transform of $2n + \sin\left(\frac{n\pi}{4}\right) + 1$.	6	L2	CO3
	b.	Compute the Inverse Z – transform of $\frac{3z^2 + 2z}{(5z-1)(5z+2)}$.	7	L3	CO3
	c.	Solve the difference equation $u_{n+2} + 6u_{n+1} + 9u_n = 2^n$ with $u_0 = u_1 = 0$, using Z – transforms.	7	L3	CO3
		Module – 4			
Q.7	a.	Solve $(D^4 - m^4)y = 0$.	6	L2	CO4
	b.	Solve $(D^2 - 2D + 1)y = \text{Sin } x + e^x$.	7	L3	CO4
	c.	Solve $x\frac{d^3y}{dx^3} + \frac{d^2y}{dx^2} = \frac{1}{x}$.	7	L3	CO4
		OR			
Q.8	a.	Solve $\frac{d^3y}{dx^3} + 8y = x^4 + 2x + 1$.	6	L2	CO4
	b.	Solve the Legendre's form of Linear equation. $(1+x)^2\frac{d^2y}{dx^2} + (1+x)\frac{dy}{dx} + y = \text{Sin } 2\,[\log(1+x0]$.	7	L3	CO4
	c.	In the LCR circuit the charge q on a plate of condenser is given by $L\frac{d^2q}{dt^2} + R\frac{dq}{dt} + \frac{q}{C} = E \sin p\,t$. Solve the above equation.	7	L3	CO4

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Module – 5

Q.9	a.	Find a Least square straight line for the following data : x: 1 2 3 4 5 6 y: 6 4 3 5 4 2	6	L2	CO5
	b.	In a partially destroyed laboratory record, the lines of regression of y on x and x on y are available as $4x - 5y + 33 = 0$ and $20x - 9y = 107$. Calculate $\bar{x}$, $\bar{y}$ and coefficient of correlation between x and y.	7	L3	CO5
	c.	Ten competition in a beauty contest are ranked by two judges A and B in the following order. Calculate the rank correlation coefficient. ID No. of competition: 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	7	L3	CO5
		OR			
Q.10	a.	Fit a parabola for the data in the form $y = ax^2 + bx + c$. x: 1 2 3 4 5 y: 10 12 13 16 19	6	L2	CO5
	b.	The following table gives the heights of Father (x) and Sons (y) : x: 65 66 67 67 68 69 70 72 y: 67 68 65 68 72 72 69 71 Find the lines of regression and hence calculate the co-efficient of correlation.	7	L3	CO5
	c.	Determine the rank correlation for the following data which shows the marks obtained in two quizzes in mathematics. Marks in first quiz X: 6 5 8 8 7 6 10 4 9 7 Marks in first quiz Y: 8 7 7 10 5 8 10 6 8 6	7	L3	CO5

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