CBCS SCHEME

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BMATEC301/BBM301

Third Semester B.E./B.Tech. Degree Examination, June/July 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. VTU Formula Hand Book and statistical table are permitted.
3. M : Marks , L: Bloom's level , C: Course outcomes.

		Module – 1	**M**	**L**	**C**
Q.1	**a.**	Find the Fourier series for $f(x)=\begin{cases}-K, & \text{in } (-\pi,0)\\ K & \text{in } (0,\pi)\end{cases}$ and hence deduce $\frac{\pi}{4}=1-\frac{1}{3}+\frac{1}{5}-\frac{1}{7}+\ldots\ldots$	6	L2	CO1
	b.	Expand $f(x) = 2x - 1$ as a cosine half range Fourier series in $0 < x < 1$.	7	L2	CO1
	c.	Express y as a Fourier series upto the first harmonics given the following values:	7	L3	CO1

x	0	1	2	3	4	5
y	4	8	15	7	6	2

OR

Q.2	**a.**	Find the Fourier series for $f(x) = x - x^2$ in $-1 < x < 1$.	6	L2	CO1
	b.	Show that half range sine series of $f(x) = \pi x - x^2$ in the interval $(0, \pi)$ is $\frac{8}{\pi}\sum_{h=0}^{\infty}\frac{1}{(2n+1)^3}\sin(2n+1)x$	7	L2	CO1
	c.	Obtain the Fourier series of y upto 2^{nd} harmonics f(x) is given by	7	L3	CO1

x	0	$\pi/3$	$2\pi/3$	π	$4\pi/3$	$5\pi/3$	2π
f(x)	1.98	1.30	1.05	1.30	-0.88	-0.25	1.98

		Module – 2			
Q.3	**a.**	Find the Fourier transform of $f(x)=\begin{cases}1-x^2, & \lvert x\rvert<1\\ 0 & \lvert x\rvert\geq 1\end{cases}$ and hence find the value of $\int_0^{\infty}\frac{x\cos x-\sin x}{x^3}dx$	6	L2	CO2
	b.	Find the Fourier sine and cosine transform of $f(x) = e^{-\alpha x}$, $\alpha > 0$.	7	L2	CO2
	c.	Solve the integral equation $\int_0^{\infty} f(\theta)\cos\alpha\theta\, d\theta=\begin{cases}1-\alpha, & 0\leq\alpha\leq 1\\ 0, & \alpha>1\end{cases}$ and hence evaluate $\int_0^{\infty}\frac{\sin^2 t}{t^2}dt$.	7	L3	CO2

		OR			
Q.4	**a.**	Find the Fourier transform of $e^{-a^2x^2}$, $a > 0$.	6	L2	CO2
	b.	Find the Fourier sine transform of $f(x) = e^{-\|x\|}$ and hence evaluate $\int_0^\infty \frac{x \sin mx}{1+x^2} dx,\ m > 0$	7	L2	CO2
	c.	Find the discrete Fourier transform of the sequence $\{1, 2, 1, 3\}^T$.	7	L3	CO2
		Module – 3			
Q.5	**a.**	Obtain the Z-transform i) $\cos n\theta$ ii) $\sin n\theta$.	6	L2	CO3
	b.	Find the inverse Z-transform of $\frac{3z^2 + 2z}{(5z-1)(5z+2)}$	7	L2	CO3
	c.	Solve by using Z-transforms : $y_{n+2} + 2y_{n+1} + y_n = n$ with $y_0 = 0 = y_1$.	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.	Find the inverse Z-transform of $\frac{4z^2 - 2z}{(z-1)(z-2)^2}$.	7	L2	CO3
	c.	If $\bar{u}(z) = \frac{2z^2 + 3z + 12}{(Z-1)^4}$ find the value of u_0, u_1, u_2.	7	L3	CO3
		Module – 4			
Q.7	**a.**	Solve $(D^4 + 8D^2 + 16)\, y = 0$.	6	L1	CO4
	b.	Solve $\frac{d^2y}{dt^2} - 4\frac{dy}{dt} + 13y = e^{3t} \cosh 2t$.	7	L2	CO4
	c.	Solve $x^3 + x^2y'' + xy' + 8y = 65 \cos(\log x)$.	7	L3	CO4
		OR			
Q.8	**a.**	Solve $y'' + 9y = \cos 2x \cos x$.	6	L2	CO4
	b.	Solve $(2x+1)^2 y'' - 2(2x+1)y' - 12y = 6x + 5$.	7	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 equation for q.	7	L3	CO4

Module – 5

Q.9 **a.** Fit a straight line for the following data: (6, L1, CO5)

x	50	70	100	120
y	12	15	21	25

b. Obtain the lines of regression and hence find the coefficient of correlation for the data: (7, L2, CO5)

x	1	2	3	4	5	6	7
y	9	8	10	12	11	13	14

c. Compute the rank correlation coefficient for the following data: (7, L3, CO5)

x	68	63	75	50	62	80	78	40	55	60
y	62	58	68	45	81	60	68	48	50	70

OR

Q.10 **a.** An experiment on life time 't' of cutting tool at different cutting speeds v(units) are given below (6, L2, CO5)

Speed (v)	350	400	500	600
Life (t)	61	26	7	2.6

Fit a relation of the form $v = at^b$.

b. The following data gives the age of husband (x) and the age of wife (y) in years. Form the 2 regression lines and calculate the age of husband corresponding to 16 years of age of wife. (7, L2, CO5)

x	36	23	27	28	28	29	30	31	33	35
y	29	18	20	22	27	21	29	27	29	28

c. If the coefficient of correlation between the variables x and y is 0.5 and the acute angle between their lines of regression is $\tan^{-1}(3/5)$. Show that $\sigma_y = 2\sigma_x$. (7, L3, CO5)

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