CBCS SCHEME

USN | | | | | | | | | |

BMATE301/BEE301

Third Semester B.E./B.Tech. Degree Examination, June/July 2024
Engineering Mathematics for EEE

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.

		Module – 1	M	L	C
Q.1	a.	Solve $(4D^4 - 4D^3 - 23D^2 + 12D + 36)y = 0$.	6	L2	CO1
	b.	Solve $\frac{d^2y}{dx^2} - 6\frac{dy}{dx} + 25y = \sin x + x$.	7	L2	CO1
	c.	Solve $(2x+1)^2 y'' - 6(2x+1)y' + 16y = 8(2x+1)^2$.	7	L3	CO1
		OR			
Q.2	a.	Solve $\frac{d^2y}{dx^2} - 4y = \cosh(2x-1)$.	6	L2	CO1
	b.	Solve $x^3\frac{d^3y}{dx^3} + 3x^2\frac{d^2y}{dx^2} + x\frac{dy}{dx} + 8y = 65\cos(\log x)$.	7	L2	CO1
	c.	In an L-C-R circuit the charge q on a plate of a condenser is given by $L\frac{d^2q}{dt^2} + R\frac{dq}{dt} + \frac{q}{c} = E\sin pt$ the circuit is tuned to resonance so that $P^2 = \frac{1}{LC}$, if initially the current i and the charge q be zero show that, for small values of R/L the current in the circuit at time t is given by (Et/2L) sin pt.	7	L3	CO1
		Module – 2			
Q.3	a.	Fit a straight line of the form y = ax + b to the following data : x: 1, 3, 4, 6, 8, 9, 11, 14 y: 1, 2, 4, 4, 5, 7, 8, 9	6	L1	CO2
	b.	Find the coefficient of correlation and obtain the equation of the lines of regression for the data : x: 6, 2, 10, 4, 8 y: 9, 11, 5, 8, 7	7	L2	CO2
	c.	Test students got the following percentage of marks in two subjects x and y compute their rank correlation coefficient. 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	7	L2	CO2
		OR			

Q.3 a. data:

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

Q.3 b. data:

x	6	2	10	4	8
y	9	11	5	8	7

Q.3 c. data:

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

Q.4

a. Fit a parabola $y = ax^2 + bx + c$ in least square sense to the data : (6, L1, CO2)

x	10	12	15	23	20
y	14	17	23	25	21

b. In a partially destroyed lab record only the lines of regression of y on x and x on y are available as $4x - 5y + 33 = 0$ and $20x - 9y = 107$ respectively. Calculate $\bar{x}$, $\bar{y}$ and coefficient correlation between x and y. (7, L2, CO2)

c. Ten competitors in music contest are ranked by three judges A, B and C in the following order. (7, L2, CO2)

A	1	6	5	10	3	2	4	9	7	8
B	3	5	8	4	7	10	2	1	6	9
C	6	4	9	8	1	2	3	10	5	7

Use rank correlation coefficient to decide which pair of judges have the nearest approach to common taste of music.

Module – 3

Q.5

a. Find the Fourier series of the function $f(x) = |x|$ in $-\pi \le x \le \pi$ hence deduce that $\frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2} + \ldots\ldots = \frac{\pi^2}{8}$. (6, L2, CO3)

b. Find the cosine half range series for $f(x) = 2x - 1$ over the interval $0 \le x \le 1$. (7, L2, CO3)

c. Given the following table : (7, L2, CO3)

x	0	60°	120°	180°	240°	300°
y	7.9	7.2	3.6	0.5	0.9	6.8

Obtain the Fourier series upto First Harmonics.

OR

Q.6

a. Find the Fourier series of $f(x) = x\,(2\pi - x)$ over the interval $0 \le x \le 2\pi$. (6, L3, CO3)

b. Find the Fourier series for $f(x) = 2x - x^2$ in $0 \le x \le 2$. (7, L2, CO3)

c. Obtain the Fourier series of y up to the first Harmonics for the given data: (7, L2, CO3)

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

Module – 4

Q.7

a. Find the Fourier transform of $f(x) = \begin{bmatrix} 1-|x| & \text{for } |x| \le 1 \\ 0 & |x| > 1 \end{bmatrix}$ (6, L3, CO4)

b. Obtain the Fourier cosine transform of the function (7, L2, CO4)

$$f(x) = \begin{cases} 4x & 0 < x < 1 \\ 4 - x & 1 < x < 4 \\ 0 & x > 4 \end{cases}$$

c. Find the z-transform of $2n + \sin\left(\frac{n\pi}{4}\right) + 1$ (7, L3, CO4)

OR

Q.8	a.	Obtain the Fourier sine transform of $e^{-\|x\|}$ and hence evaluate $\int_0^\infty \frac{x \sin mx}{1+x^2} dx \quad m > 0.$	6	L3	CO4
	b.	Obtain the inverse z-transform of $\frac{3z^2+2z}{(5z-1)(5z+2)}$.	7	L2	CO4
	c.	Solve the difference equation $y_{n+2}+6y_{n+1}+9y_n = 2^n$ with $y_0 = y_1 = 0$ using z-transforms.	7	L3	CO4
		Module – 5			
Q.9	a.	A random variable X has the following probability function for various values of x. x: 0, 1, 2, 3, 4, 5, 6, 7 P(x): 0, K, 2K, 2K, 3K, K^2, $2K^2$, $7K^2+K$ (i) Find K (ii) Evaluate $P(x<6)$, $P(x \geq 6)$ and $P(3 < x \leq 6)$.	6	L2	CO5
	b.	In 800 families with 5 children each how many families would be expected to have (i) 3 boys (ii) 5 girls (iii) either 2 or 3 boys (iv) atmost 2 girls, by assuming probabilities for boys and girls to be equal.	7	L3	CO5
	c.	A communication channel receives independent pulses at the rate of 12 pulses per micro second the probability of transmission error is 0.001 for each microsecond compute the probabilities of : (i) no error during a microsecond (ii) one error per microsecond (iii) atleast one error per microsecond (iv) two errors (v) atmost two errors	7	L3	CO5
		OR			
Q.10	a.	Explain the following terms: (i) Null hypothesis (ii) Type I and Type II error (iii) Confidence limits (iv) Alternative hypothesis (v) Significance level	6	L1	CO5
	b.	Ten individuals are chosen at random from a population and their heights in inches are found to be 63, 63, 66, 67, 68, 69, 70, 70, 71, 71 test the hypothesis that the mean height of the universe is 66 inches [$t_{0.05} = 2.262$ for 9 d.f.]	7	L3	CO5
	c.	In experiments on pea breeding the following frequencies of seeds were obtained Round and Yellow: 315; Wrinkled and Yellow: 101; Round and Green: 108; Wrinkled and Green: 32; Total: 556 Theory predicts that the frequencies should be in proportions 9:3:3:1. Examine the correspondence between theory and experiment. [$\chi^2_{0.05} = 7.815$ for 3 d.f.]	7	L3	CO5

Q.9 a. table:

x	0	1	2	3	4	5	6	7
P(x)	0	K	2K	2K	3K	K^2	$2K^2$	$7K^2+K$

Q.10 c. table:

Round and Yellow	Wrinkled and Yellow	Round and Green	Wrinkled and Green	Total
315	101	108	32	556

* * * * *