



CBCS SCHEME

21MATME41

Fourth Semester B.E./B.Tech. Degree Examination, June/July 2026 Complex Analysis, Probability and Linear Programming

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

- 1 a. With usual notations, derive the Cauchy-Riemann equation in polar form. (06 Marks)
- b. If $f(z)$ is analytic function, show that $\frac{\partial}{\partial x} |f(z)|^2 + \frac{\partial}{\partial y} |f(z)|^2 = |f'(z)|^2$. (07 Marks)
- c. Find the analytical function whose real part is $\frac{x^4 - y^4 - 2x}{x^2 + y^2}$. (07 Marks)

OR

- 2 a. Show that z^n is analytic. Hence, find its derivative. (06 Marks)
- b. If $f(z)$ is analytical function with constant modular, show that $f(z)$ is constant. (07 Marks)
- c. Find the regular function whose imaginary part is $\left[r - \frac{k^2}{r} \right] \sin \theta$, $r \neq 0$. (07 Marks)

Module-2

- 3 a. Discuss the transformation $w = e^z$. (06 Marks)
- b. State and prove the Cauchy integral theorem. (07 Marks)
- c. Find the bilinear transformation which maps $z = 1, i, -1$ into $w = 2, i, -2$. Also find its invariant points. (07 Marks)

OR

- 4 a. Discuss the transformation $w = z + \frac{1}{z}$. (06 Marks)
- b. Verify Cauchy's theorem for the function $f(z) = z^2$ where C is the square having vertices $(0, 0) (1, 0) (1, 1) (0, 1)$. (07 Marks)
- c. Evaluate : $\int_C \frac{\sin \pi z^2 + \cos \pi z^2}{(z-1)^2(z-2)} dz$

Where C is the circle $|z| = 3$.

(07 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and/or equations written eg, 42+8 = 50, will be treated as malpractice.

Module-3

- 5 a. A random variable X has the following probability function :

x	-3	-2	-1	0	1	2	3
P(x)	K	2K	3K	4K	3K	2K	K

Find the value of K and calculate the mean and variance.

(06 Marks)

- b. Find the mean and variance of Poisson distribution. (07 Marks)
- c. In an examination 7% of students score less than 35% marks and 89% of students score less than 60% marks. Find the mean and standard deviation if the marks are normally distributed (Given that $P(1.2263) = 0.39$ and $P(1.4757) = 0.43$). (07 Marks)

OR

- 6 a. A random variable x has the following density function :

$$f(x) = \begin{cases} kx^2, & -3 \leq x \leq 3 \\ 0, & \text{otherwise} \end{cases}$$

Evaluate K and find :

- i) $P(1 \leq x \leq 2)$
 ii) $P(x \leq 2)$
 iii) $P(x > 1)$.

(06 Marks)

- b. The number of telephone lines busy at an instant of time is a binomial variate with probability 0.1 that a line is busy. If 10 lines are chosen at random, what is the probability that :
- i) No line is busy
 ii) All lines are busy
 iii) Atleast one line is busy. (07 Marks)
- c. In a certain town the duration of a shower is exponentially distributed with mean 5 minutes. What is the probability that a shower will last for :
- i) 10 minutes or more
 ii) Less than 10 minutes
 iii) Between 10 and 12 minutes. (07 Marks)

Module-4

- 7 a. Solve the following L.P.P using Simplex Method :

$$\text{Maximize } Z = 4x_1 + 10x_2$$

$$\text{Subject to : } 2x_1 + x_2 \leq 50$$

$$2x_1 + 5x_2 \leq 100$$

$$2x_1 + 3x_2 \leq 90$$

$$x_1, x_2 \geq 0.$$

(10 Marks)

- b. Use Big – M Method to solve the L.P.P

$$\text{Max } Z = 3x_1 + 2x_2$$

$$\text{Subject to : } 2x_1 + x_2 \leq 2$$

$$3x_1 + 4x_2 \geq 12$$

$$x_1, x_2 \geq 0.$$

(10 Marks)

OR

- 8 a. Solve the following L.P.P by Two-Phase Method :

Minimize $Z = x_1 + x_2$

Subject to : $2x_1 + x_2 \geq 4$

$x_1 + 7x_2 \geq 7$

$x_1, x_2 \geq 0.$

(10 Marks)

- b. Find an optimal solution to the following L.P.P by computing all basic solutions and then finding one that maximizes the objective function :

$2x_1 + 3x_2 - x_3 + 4x_4 = 8$

$x_1 - 2x_2 + 6x_3 - 7x_4 = -3$

$x_1, x_2, x_3, x_4 \geq 0$

Maximize $Z = 2x_1 + 3x_2 + 4x_3 + 7x_4.$

(10 Marks)

Module-5

- 9 a. Find optimal solution of the given balanced transportation problem using Vogel's method.

Source	Destination				Availability
		A	B	C	
F ₁		10	9	8	8
F ₂		10	7	10	7
F ₃		11	9	7	9
F ₄		12	14	10	4
Requirements		10	10	8	

(10 Marks)

- b. Four Jobs are to be done on four different machines. The cost (in Rupees) of producing
- i^{th}
- Job on the
- j^{th}
- machine is given below :

		Machines			
		M ₁	M ₂	M ₃	M ₄
Jobs	J ₁	15	11	13	15
	J ₂	17	12	12	13
	J ₃	14	15	10	14
	J ₄	16	13	11	17

Assign the Jobs to different machines so as to minimize the total cost.

(10 Marks)

OR

- 10 a. Solve the following transportation problem by VAM.

Source	Destination					Availability
		A	B	C	D	
I		8	9	6	3	170
II		6	11	5	10	200
III		3	8	7	9	180
Requirements		150	160	110	130	

(10 Marks)

- b. The processing time in hours for the Jobs when allocated to different machines are indicated below. Assign the machines for the Jobs so that the total processing time is minimum.

		Machines				
		M ₁	M ₂	M ₃	M ₄	M ₅
Jobs	J ₁	9	22	58	11	19
	J ₂	43	78	72	50	63
	J ₃	41	28	91	37	45
	J ₄	74	42	27	49	39
	J ₅	36	11	57	22	25

(10 Marks)