Register No : _____

# THE KAVERY ENGINEERING COLLEGE

*(An Autonomous Institution)*

B.E/B.TECH DEGREE END SEMESTER THEORY EXAMINATIONS, NOV/DEC 2025

*Third Semester*

*Electrical and Electronics Engineering*

MA3303 – Probability and Complex Functions

*Statistical Tables can be permitted*

*Regulations - 2021*

*Duration : 3 Hrs* *Maximum : 100 Marks*

*PART – A (ANSWER ALL QUESTIONS) (Marks 10*2=20)*

| *Q.No* | *Questions* | *BLT* | *CO* | *Marks* |
|---|---|---|---|---|
| 1. | In a city 60% people read newspaper A, 40% read newspaper B, 30% read newspaper C, 20% read newspapers A & B, 30% read newspapers A & C, 10% read newspapers B & C, 15% read newspapers A, B & C. Find the percentage of the people who do not read newspaper at all? | L2 | 1 | 2 |
| 2. | If mean of binomial distribution is 3 and its variance is 3/2, then find the probability of success. | L2 | 1 | 2 |
| 3. | The mileage (in 1000s of kilometers) for which a certain type of tyre will last is a continuous random variable with probability density function $f(x) = ke^{-x/1000}$, $x \geq 0$. Compute the parameter k. | L3 | 2 | 2 |
| 4. | State central limit theorem for independent and identically distributed random variable. | L1 | 2 | 2 |
| 5. | Find the image of $\|z-2i\|=2$ under the transformation $w= 1 / z$. | L2 | 3 | 2 |
| 6. | Compute the critical points of $w=z^2$. | L2 | 3 | 2 |
| 7. | Find the nature of the singularity of the function $\frac{z - \sin z}{z^3}$. | L3 | 4 | 2 |
| 8. | State Cauchy's Integral theorem. | L1 | 4 | 2 |
| 9. | Compute the general solution of the differential equation $(D^2 - 2D + 5)^2 y = 0.$ | L2 | 5 | 2 |
| 10. | Find the particular integral of $(D^3 - D)y = e^x + e^{-x}$ and $D = d/dx$. | L1 | 5 | 2 |

*PART – B (ANSWER ALL QUESTIONS) (Marks 5*16 = 80)*

| *Q.No* | | *Questions* | *BLT* | *CO* | *Marks* |
|---|---|---|---|---|---|
| 11. | a i | A factory production line is manufacturing bolts using three machines, A, B and C. Of the total output, machine A is responsible for 25%, machine B for 35% and machine C for the rest. It is known from previous experience with the machines that 5% of the output from machine A is defective, 4% from machine B and 2% from machine C. A bolt is chosen at random from the production line and found to be defective. What is the probability that it came from (a) machine A (b) machine B (c) machine C? | L3 | 1 | 8 |

ii Drug producing companies A, B, C produces a drug for the prevention of a particular disease. The testing committee has planned to test the drug produced by the companies. The drug was injected to sample of people for testing. The committee can choose any of the three drugs produce by A, B and C in injecting the people for testing. Suppose X denotes the random variable in choosing the drug produced by company A in 9 successive orders. The probability distribution that determines the above scenario is: L3 1 8

| x | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|---|
| P(x) | *k* | *2k* | *3k* | *5k* | *5k* | *4k* | *3k* | *2k* | *k* |

Compute the variance of the random variable X.

Or

b i Suppose the heights of men of a certain country are normally distributed with average 68 inches and standard deviation 2.5. Compute the percentage of men who are between 66 and 71 inches' height. L3 1 8

ii An IC production company produces 3 types of microchips A, B and C for the CPU. The company has planned to test microchips. The microchips were distributed to engineers for testing. The engineer can choose any of the four microchips. Suppose X denotes the random variable in choosing the microchip A in 7 successive orders. The probability distribution that determines the above scenario is given below. L3 1 8

| x | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|
| P(x) | k | 2k | 2k | 3k | $K^2$ | $2k^2$ | $7k^2+k$ |

Find the chance of choosing the microchip grater than or equal to 6.

12. a i In car manufacturing plant two assembling tasks are performed by two Robots, named as Robot A for welding two joints of a car part and Robot B for tightening the three bolts in a car part. Let X denote the number of defective welds of a car part, and Y be the number of improper tightening per car. The joint density of X and Y is represented as a function $f(x,y)=\frac{x+2y}{27}, x=0,1,2 \ \& \ y=0,1,2.$ Compute the chance that there is no improperly tightened bolts $P(X \le 2, Y=0)$. L2 2 8

ii In a study of pollution in a water stream, the concentration of pollution is measured at 5 different locations. The locations are at different distances to the pollution source. In the table below, these distances and the average pollution are given: L2 2 8

| Distance to the pollution source (in km) X | 3 | 2 | 1 | 4 | 6 |
|---|---|---|---|---|---|
| Average concentration (mg/L) Y | 4 | 5 | 8 | 4 | 2 |

Find correlation which is happening between the distance to the pollution source and average concentration.

Or

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| b | i | In a study of pollution in a water stream, the concentration of pollution is measured at 5 different locations. The locations are at different distances to the pollution source. In the table below, these distances and the average pollution are given:<br><br>Construct the regression equation of distance to the pollution source on average concentration. (X on Y) and average concentration on the pollution source.<br>(Y on X). | L2 | 2 | 8 |

| Distance to the pollution source (in km) X | 5 | 2 | 1 | 4 | 3 |
|---|---|---|---|---|---|
| Average concentration (mg/L) Y | 4 | 5 | 8 | 4 | 2 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | ii | Suppose a data analyst studying the relationship between the time people spend exercising (X) and the number of calories they burn (Y). He suggested that X and Y follows the joint probability density function is given by $f(x,y)=e^{-(x+y)}$, $x>0$, $y>0$. He wants to find the probability density function of $U=\frac{X+Y}{2}$ which represents the total calories burned during exercise. Compute the total calories burned during exercise (pdf) f(u). | L2 | 2 | 8 |
| 13. | a | i | Find the analytic function w = u+iv if $v=e^{2x}(x\cos 2y - y\sin 2y)$. Hence find its conjugate u. | L2 | 3 | 8 |
| | | ii | Show that the transformation w=1/z transforms in general, circles and straight lines into circles or straight lines. | L2 | 3 | 8 |
| | | | Or | | | |
| | b | i | Find the analytic function w = u+iv if $u=3x^2y + 2x^2 - y^3 - 2y^2$. Hence find its conjugate v. | L2 | 3 | 8 |
| | | ii | Determine the bilinear transformation which maps $z_1=0$, $z_2=-i$, $z_3=-1$ into $w_1=i$, $w_{2=1,}$ $w_3=0$ respectively. | L2 | 3 | 8 |
| 14. | a | i | Evaluate the integral using Cauchy's integral formula for<br>$\int_c \frac{\cos(\pi z^2)}{(z-1)(z-2)}dz$<br>where C is the circle $\lvert z\rvert = 3$ . | L3 | 4 | 8 |
| | | ii | Expand $\int_c \frac{1}{(z-1)(z-2)}dz$ in the region $\lvert z\rvert > 2$ using Laurent's series. | L3 | 4 | 8 |
| | | | Or | | | |
| | b | i | Using Cauchy's Residue theorem evaluate $\int_c \frac{z+2}{(z-1)(z+1)^2}dz$ where 'C ' is the circle in $\lvert z\rvert = 2$. | L3 | 4 | 8 |
| | | ii | Find Taylor's expansion of f(z)=cos z about the point z=π/4. | L3 | 4 | 8 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 15. | a | i | Solve the differential equation: $$\frac{d^2y}{dx^2} - 2\frac{dy}{dx} + 4y = e^x \sin x$$ | L2 | 5 | 8 |
| | | ii | Using method of separation of parameter solve: $$\frac{dy}{dx} - y\cos x = \sin 2x$$ | L2 | 5 | 8 |
| | | | Or | | | |
| | b | | Solve the simultaneous equations: $$\frac{dx}{dt} + y = e^t, \frac{dy}{dt} - x = e^{-t}$$ | L2 | 5 | 16 |