GANDHI INSTITUTE OF ENGINEERING AND TECHNOLOGY, ODISHA, GUNUPUR (GIET UNIVERSITY)

B. Tech (Third Semester - Regular) Examinations, November – 2024

23BBSBS23001– Engineering Mathematics-III

(Electronics and Communication Engineering)

Time: 3 hrs Maximum: 60 Marks

Answer ALL questions

(The figures in the right hand margin indicate marks)

PART – A **(2 x 5 = 10 Marks)**

Q.1. Answer ***ALL*** questions

	Question	CO #	Blooms Level
a.	Determine whether the function $2xy+i(x^2-y^2)$ is analytic or not.	CO1	K1
b.	Find the zeros of $f(z)=\dfrac{z^2+1}{1-z^2}$.	CO2	K1
c.	Find the divided difference of $f(x)=x^3+x+2$ for the arguments 1,3,6 and 11.	CO3	K2
d.	In a particular manufacturing process, it is found that, on the average 1% of the items is defective. What is the probability that the fifth item inspected is the first defective item?	CO4	K2
e.	Consider a Markov chain with state {0,1} and transition probability matrix $P=\begin{bmatrix}0 & 1\\ 1 & 0\end{bmatrix}$. Is the state 0 periodic? If so what is the period?	CO5	K2

PART – B **(10 x 5 = 50 Marks)**

Answer ***ALL*** the questions

	Question	Marks	CO #	Blooms Level
2. a.	If $f(z)=e^z$ then show that u and v are harmonic functions. $[z=x+iy$ and $f(z)=u+iv]$.	5	CO1	K3
b.	Determine the region D of the *w*-plane into which the triangular region D enclosed by the lines $x = 0$, $y = 0$ and $x + y = 1$ is transformed under the transformation $w=2z$.	5	CO1	K4
	(OR)			
c.	Find the bilinear transformation that maps the points z = 0, -1, i into the points w = i, 0, ∞ respectively.	5	CO1	K3
d.	Prove that an analytic function with constant modulus is constant.	5	CO1	K4
3.a.	Using Cauchy's integral formula, evaluate $\int_C \dfrac{z+1}{(z-3)(z-1)}dz$ where C is the circle $\lvert z\rvert=2$.	5	CO2	K3
b.	Find the Laurent's series expansion of the function $\dfrac{z-1}{(z+2)(z+3)}$, valid in the region $2<\lvert z\rvert<3$.	5	CO2	K4
	(OR)			
c.	Find the Taylor's series for $\dfrac{1}{z-2}$ about z =1 up to first four terms.	5	CO2	K3
d.	Evaluate using Cauchy's Residue theorem, $\int_C \dfrac{\sin\pi z^2+\cos\pi z^2}{(z-1)(z-2)}dz$ where $C:\lvert z\rvert=3$.	5	CO2	K4

4.a.	Find the real root of $x^3 - 2x - 5 = 0$ using Newton Raphson's method.[up to three decimal places]	5	CO3	K3
b.	Using Lagrange's interpolation, find $f(3)$ from the following data.	5	CO3	K3

x	0	1	2	5
$f(x)$	2	3	12	147

(OR)

c.	Find the first derivative of $(x)^{\frac{1}{3}}$ at x = 50 and x = 56 given the table below:	5	CO3	K3

x	50	51	52	53	54	55	56
$y = (x)^{\frac{1}{3}}$	3.6840	3.7084	3.7325	3.7563	3.7798	3.8030	3.8259

d.	Solve for a positive root of $x^3 - 4x + 1 = 0$ by Regula Falsi method.[up to three decimal places]	5	CO3	K3
5.a.	The incidence of occupational disease in an industry is such that the workers have a 20% chance of suffering from it. What is the probability that out of six workers 4 or more will contract disease?	5	CO4	K4
b.	If X is uniformly distributed over (0,10), find i) P (X < 4) ii) P (X > 6) iii) P (2 < X < 5)	5	CO4	K4

(OR)

c.	By the method of least squares find the best fitting straight line to the data given below:	5	CO4	K3

x	5	10	15	20	25
y	15	19	23	26	30

d.	A company keeps records of accidents. During a recent safety review, a random sample of 60 accidents was selected and classified by the day of the week on which they occurred.	5	CO4	K4

Day	Mon	Tues	Wed	Thurs	Fri
Number of accidents	8	12	9	14	17

Test whether there is any evidence that accidents are more likely on some days than others.

6.a.	Prove that the random process $X(t) = A\cos(\omega t + \theta)$, where A, ω are constants and θ is uniformly distributed over $(0, 2\pi)$ is a wide sense stationary process.	5	CO5	K4
b.	Suppose that customers arrive at a bank according to a Poisson process with a mean rate of 3 per minute, find the probability that during a time interval of 2 minute (i) more than 4 customers arrive (ii) exactly 4 customers arrive	5	CO5	K4

(OR)

c.	The transition probability matrix of a Markov chain $\{X_n\}$, n = 1, 2 ,… having 3 states1,2 and 3 is $P = \begin{bmatrix} 0.1 & 0.5 & 0.4 \\ 0.6 & 0.2 & 0.2 \\ 0.3 & 0.4 & 0.3 \end{bmatrix}$ and the initial distribution is $P^{(0)} = (0.7 \quad 0.2 \quad 0.1)$. Find $P = (X_3 = 2, X_2 = 3, X_1 = 3, X_0 = 2)$.	5	CO5	K3
d.	If {X(t)} is a wide-sense stationary process with autocorrelation $R(\tau) = Ae^{-\alpha\lvert\tau\rvert}$, determine the second-order moment of the random variable X(8) - X(5).	5	CO5	K4

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