INSTITUTEOFAERONAUTICALENGINEERING

(Autonomous)

Dundigal, Hyderabad - 500043

ELECTRICAL AND ELECTRONICS ENGINEERING

TUTORIAL QUESTION BANK

Course Title	**COMPLEX ANALYSIS AND PROBABILITY DISTRIBUTIONS**				
Course Code	AHSB06				
Programme	B.Tech				
Semester	IV	EEE			
Course Type	Foundation				
Regulation	IARE - R18				
Course Structure	**Theory**			**Practical**	
	Lectures	**Tutorials**	**Credits**	**Laboratory**	**Credits**
	3	-	3	-	-
Chief Coordinator	Mr. Ch Soma Shekar, Assistant Professor				
Course Faculty	Mr. Ch Soma Shekar, Assistant Professor				

COURSE OBJECTIVES:

The course should enable the students to:	
I	Understand the basic theory of complex functions to express the power series.
II	Evaluate the contour integration using Cauchy residue theorem.
III	Enrich the knowledge of probability on single random variables and probability distributions

COURSE OUTCOMES (COs):

CO 1	Discuss about continuity/differentiability/analyticity of a Complex function using Cauchy-Riemann Equations. Estimate complex conjugate using Milne Thomson method and understand the concept of Bilinear transformation.
CO 2	Recognize and apply the Cauchy's integral formula and the generalized Cauchy's integral formula. Evaluate complex functions as power series and radius of convergence of power series
CO 3	Establish the contour integral with an integrand which has singularities lying inside or outside the simple closed contour. Expand complex function as power series using Taylor's and Laurent series.
CO 4	Enrich the knowledge of Probability to discrete and continuous random variables.
CO 5	Analyze probability distributions for Binomial, Poisson and Normal distributions and study its properties

COURSE LEARNING OUTCOMES (CLOs):

Students, who complete the course, will have demonstrated the asking to do the following:

AHSB06.01	Recall continuity, differentiability, analyticity of a function using limits.
AHSB06.02	Interpret the conditions for a complex variable to be analytic and/or entire function.
AHSB06.03	Interpret the concepts of Cauchy-Riemann relations and harmonic functions.
AHSB06.04	Analyze the Bilinear transformation by cross ratio property.
AHSB06.05	Identify the conditions of fixed and critical point of Bilinear Transformation.
AHSB06.06	Demonstrate the area under a curve using the concepts of indefinite integration.
AHSB06.07	Interpret the concepts of the Cauchy's integral formula and the generalized Cauchy's integral formula.
AHSB06.08	Demonstrate complex functions as power series and radius of convergence of power series.
AHSB06.09	Interpret the concept of complex integration to the real-world problems of flow with circulation around a cylinder.
AHSB06.10	Asses the Taylor's and Laurent series expansion of complex functions.
AHSB06.11	Interpret the concept of different types of singularities for analytic function.
AHSB06.12	Identify the poles, residues and solve integrals using Cauchy's residue theorem.
AHSB06.13	Interpret the concept of Cauchy's residue theorem to the real-world problems of Quantum Mechanical scattering and Quantum theory of atomic collisions.
AHSB06.14	Demonstrate an understanding of the basic concepts of probability and random variables.
AHSB06.15	Classify the types of random variables and calculate mean, variance.
AHSB06.16	Estimate moment about origin, central moments, moment generating function of probability distribution.
AHSB06.17	Recognize where the Binomial distribution could be appropriate model of the distributions.
AHSB06.18	Recognize where the Poisson distribution could be appropriate model of the distributions.
AHSB06.19	Recognize where the Binomial distribution and Poisson distribution could be appropriate to find mean, variance of the distributions.
AHSB06.20	Apply the inferential methods relating to the means of normal distributions.
AHSB06.21	Interpret Binomial distribution to the phenomena of real-world problem like sick versus healthy.
AHSB06.22	Identify the mapping of Normal distribution in real-world problem to analyze the stock market.
AHSB06.23	Use Poisson distribution in real-world problem to predict soccer scores.
AHSB06.24	Possess the knowledge and skills for employability and to succeed in national and international level competitive examinations.

TUTORIAL QUESTION BANK

MODULE-I					
COMPLEX FUNCTIONS AND DIFFERENTIATION					
Part - A(Short Answer Questions)					
S No	**QUESTIONS**	**Blooms Taxonomy Level**	**CO**	**CLO**	**Course Learning Outcomes (CLOs)**
1	Define the term Analyticity of a complex variable function f (z).	Remember	CO1	CLO 1	AHSB06.1
2	Define the term Continuity of a complex variable function f (z).	Remember	CO1	CLO 1	AHSB06.1
3	Define the term Differentiability of a complex variable function f (z).	Remember	CO1	CLO 1	AHSB06.1
4	Examine the complex variable function f (z) = z^3 to analyticity for all values of z in Cartesian form.	Understand	CO1	CLO 2	AHSB06.2
5	Verify whether the function $v = x^3y - xy^3 + xy + x + y$ can be imaginary part of an analytic function f (z) where z= x+ iy.	Understand	CO1	CLO 2	AHSB06.2
6	Show that the function f(z) = $\|z\|^2$ does not satisfy Cauchy-Riemann equations in Cartesian form.	Understand	CO1	CLO 3	AHSB06.3
7	Examine the complex variable function f (z) = $\frac{x-iy}{x^2+y^2}$ for analyticity in Cartesian form.	Understand	CO1	CLO 2	AHSB06.2
8	Interpret whether the function f (z) = sinx siny – i cosx cosy is an analytic function or not in Cartesian form.	Understand	CO1	CLO 2	AHSB06.2
9	Calculate the value of k such that f(x, y) = $x^3 + 3kxy^2$ may be harmonic function.	Understand	CO1	CLO 3	AHSB06.3
10	Determine the most general analytic function f (z) whose real part of the analytic function is u = $x^2 - y^2 - x$.	Understand	CO1	CLO 2	AHSB06.2
11	Obtain an analytic function f (z) whose imaginary part of the analytic function is v = $e^x(xsiny + ycosy)$.	Understand	CO1	CLO 2	AHSB06.2
12	Show that the real part of an analytic function f(z) where u = 2log ($x^2 + y^2$) is harmonic.	Understand	CO1	CLO 3	AHSB06.3
13	Show that the function f (z) = $\|z\|^2$ is continuous at all points of z but not differentiable at any $z \neq 0$.	Understand	CO1	CLO 1	AHSB06.1
14	Calculate all the values of k such that f (z) = $e^x(cosky + isinky)$ is an analytic function.	Understand	CO1	CLO 2	AHSB06.2
15	Determine the values of a, b, c such that f (z) = x+ ay- i(ax+by) is differentiable function at every point.	Understand	CO1	CLO 1	AHSB06.1
16	Justify whether every differentiable function is continuous or not. Give a valid example.	Remember	CO1	CLO 1	AHSB06.1
17	Determine the Bilinear transformation whose fixed points are i,-i.	Understand	CO1	CLO 4	AHSB06.4
18	Discover the Bilinear transformation which maps the points (0,-i,-1) into the points (i,1, 0)	Understand	CO1	CLO 4	AHSB06.4
19	Discover the points at which w = coshz is not conformal.	Understand	CO1	CLO 4	AHSB06.4
20	Discuss the fixed points of the transformation $w = \frac{2i-6z}{iz-3}$	Understand	CO1	CLO 4	AHSB06.4
Part - B (Long Answer Questions)					
1	Show that the real part of an analytic function f (z) where u = $e^{-2xy}\sin(x^2 - y^2)$ is a harmonic function. Hence find its harmonic conjugate.	Understand	CO1	CLO 3	AHSB06.3
2	Prove that the real part of analytic function f (z) where u = $\log\|z\|^2$ is harmonic function. If so find the analytic function by Milne Thompson method.	Understand	CO1	CLO 3	AHSB06.3
3	Determine the imaginary part of an analytic function f (z) whose	Understand	CO1	CLO 2	AHSB06.2

	real part of an analytic function is $e^x(xcosy - ysiny)$.				
4	Prove that $\left(\frac{\partial^2}{\partial x^2}+\frac{\partial^2}{\partial y^2}\right)\|Realf(z)\|^2 = 2\|f'(z)\|^2$ where w = f (z) is an analytic function.	Understand	CO1	CLO 2	AHSB06.2
5	Find an analytic function f (z) whose real part of an analytic function is u = $\frac{sin2x}{cosh2y-cos2x}$ by Milne-Thompson method.	Understand	CO1	CLO 3	AHSB06.3
6	If f (z) is a regular function of z, then prove that $\left(\frac{\partial^2}{\partial x^2}+\frac{\partial^2}{\partial y^2}\right)\|f(z)\|^2 = 4\|f'(z)\|^2$.	Understand	CO1	CLO 2	AHSB06.2
7	Show that the function defined by f(z)= $\begin{cases}\frac{xy^2\,(x+iy)}{x^2+y^4}, & z \neq 0\\ 0, & z = 0\end{cases}$ is not analytic function even though Cauchy Riemann equations are satisfied at origin.	Understand	CO1	CLO 3	AHSB06.3
8	Show that real part u = $x^3 - 3xy^2$ of an analytic function f (z) is harmonic. Hence find the conjugate harmonic function and the analytic function.	Understand	CO1	CLO 3	AHSB06.3
9	Find an analytic function f (z) = u +iv if the real part of an analytic function is u = a (1+cosθ) using Cauchy-Riemann equations in polar form.	Understand	CO1	CLO 3	AHSB06.3
10	Derive Cauchy-Riemann equations in polar form of an analytic function f (z).	Remember	CO1	CLO 3	AHSB06.3
11	Prove that the real and imaginary parts of an analytic function f (z) are harmonic.	Remember	CO1	CLO 3	AHSB06.3
12	Find the analytic function f (z) whose imaginary part of an analytic function is $r^2cos2\theta + r\,sin\theta$ by Cauchy Riemann equations in polar form.	Understand	CO1	CLO 3	AHSB06.3
13	Prove that the function f (z) = $\|z\|$ is continuous everywhere but nowhere differentiable.	Remember	CO1	CLO 1	AHSB06.1
14	Show that the real part of an analytic function f (z) where u = $e^{-x}(xsiny - ycosy)$ is a harmonic function.	Understand	CO1	CLO 3	AHSB06.3
15	Prove that an analytic function f (z) with constant real part is always constant.	Remember	CO1	CLO 2	AHSB06.2
16	Prove that an analytic function f (z) with constant modulus is always constant.	Remember	CO1	CLO 2	AHSB06.2
17	If u and v are conjugate harmonic functions then show that uv is also a harmonic function.	Remember	CO1	CLO 3	AHSB06.3
18	Determine the Bilinear transformation that maps the points (1-2i, 2+i,2+3i) into the points (2+i,1+3i,4).	Understand	CO1	CLO 4	AHSB06.4
19	Determine the Bilinear transformation that maps the points (1, i,-1) into the points (2,i,-2).	Understand	CO1	CLO 4	AHSB06.4
20	Determine the Bilinear transformation that maps the points ($\infty, i, 0$) into the points (0,i, ∞).	Remember	CO1	CLO 4	AHSB06.4
Part - C (Problem Solving and Critical Thinking Questions)					
1	If f (z) is an analytic function of z such that u + v = $\frac{sin2x}{cosh2y-cos2x}$ then determine the analytic function f(z) in terms of z.	Understand	CO1	CLO 1	AHSB06.1
2	Prove that if $u = x^2 - y^2, v = -\frac{y}{x^2+y^2}$ both u and v satisfy Laplace's equation, but u + iv is not a regular (analytic) function of z.	Understand	CO1	CLO3	AHSB06.3
3	If f(z) is an analytic function and u - v = $\frac{cosx+sinx-e^{-y}}{2cosx-e^{y}-e^{-y}}$ then determine the analytic function f(z) subjected to the condition f ($\frac{\pi}{2}$) = 0.	Understand	CO1	CLO 2	AHSB06.2
4	Find an analytic function f(z) whose real part of it is u = $e^x[(x^2 - y^2)cosy - 2xy\,siny)]$.	Understand	CO1	CLO 2	AHSB06.2
5	Prove that $\left(\frac{\partial^2}{\partial x^2}+\frac{\partial^2}{\partial y^2}\right) log\|f'(z)\| = 0$ where w = f (z) is an	Understand	CO1	CLO 2	AHSB06.2

	analytic function.				
6	Find the analytic function $f(z) = u(r,\theta) + i\, v\,(r,\theta)$ such that $v\,(r,\theta) = \left(r - \frac{1}{r}\right) sin\theta$, r≠ 0 using Cauchy-Riemann equations in polar form.	Understand	CO1	CLO 3	AHSB06.3
7	Find an analytic function f (z) such that $\text{Re}[f'(z)] = 3x^2 - 4y - 3y^2$ and $f(1+i) = 0$.	Understand	CO1	CLO 2	AHSB06.2
8	Show that the function f (z) = $\sqrt{\lvert xy \rvert}$ is not analytic at the origin although Cauchy –Riemann equations are satisfied at origin.	Remember	CO1	CLO 3	AHSB06.3
9	If $w = \emptyset + i\varphi$ represents the complex potential for an electric field where $\varphi = x^2 - y^2 + \frac{x}{x^2+y^2}$ then determine the function φ.	Understand	CO1	CLO 3	AHSB06.3
10	Determine the Bilinear transformation that maps the points $(\infty, i, 0)$ in the z-plane into the points $(0, i, \infty)$ in the w-plane.	Understand	CO1	CLO 4	AHSB06.4
	MODULE-II				
	COMPLEX INTEGRATION				
	Part - A (Short Answer Questions)				
1	Write the Cauchy's integral formula.	Remember	CO 2	CLO 7	AHSB06.7
2	Write the Cauchy's General integral formula.	Remember	CO 2	CLO 7	AHSB06.7
3	Define the term Radius of convergence.	Remember	CO 2	CLO 8	AHSB06.8
4	Define the term Power series expansions of complex functions.	Remember	CO 2	CLO 8	AHSB06.8
5	Define the term Line Integral of complex variable function w = f (z).	Remember	CO 2	CLO 6	AHSB06.6
6	Define the term Contour Integration of a given curve in complex function.	Remember	CO 2	CLO 6	AHSB06.6
7	State Cauchy's integral theorem for multiple connected region.	Remember	CO 2	CLO 7	AHSB06.7
8	Estimate the value of $\int_0^{1+i} z^2 dz$.	Understand	CO 2	CLO 6	AHSB06.6
9	Estimate the value of $\int_C \frac{3z^2+7z+1}{(z+1)} dz$ with C:$\lvert z+i \rvert = 1$ by Cauchy integral formulae.	Understand	CO 2	CLO 7	AHSB06.7
10	Determine the value of line integral to $\int_0^{2+i} z^2\, dz$ along the real axis to 2 and then vertically to (2+i).	Understand	CO 2	CLO 6	AHSB06.7
11	Determine the value of line integral to $\int_0^{3+i} z^2\, dz$ along the straight line y = x/3.	Understand	CO 2	CLO 7	AHSB06.7
12	Examine the value of $\int_C e^{-z} dz$ with C:$\lvert z-1 \rvert = 1$ by Cauchy integral formulae.	Understand	CO 2	CLO 7	AHSB06.7
13	Determine the value of line integral to $\int_0^{2+i} (x - y^2 + ix^3)\, dz$ along the real axis from z=0 to z=1.	Understand	CO 2	CLO 6	AHSB06.6
14	Determine the value of the line integral $\int_C \bar{z} dz$ from z = o to 2i and then from 2i to z = 4+2i.	Understand	CO 2	CLO 6	AHSB06.6
15	Estimate the radius of convergence of an infinite series f (z) = sinz.	Understand	CO 2	CLO 8	AHSB06.8
16	Estimate the radius of convergence of an infinite series f (z) =$\frac{1}{1-z}$.	Understand	CO 2	CLO 8	AHSB06.8
17	Estimate the radius of convergence of an infinite series $1 + 2^2 z + 3^2 z^2 + 4^2 z^3 + \ldots\ldots..$	Understand	CO 2	CLO 8	AHSB06.8
18	Evaluate $\int_0^{1+i} (x^2 - iy) dz$ along the path $y = x$.	Remember	CO 2	CLO 6	AHSB06.6
19	Estimate the value of $\int_C \frac{1}{z-2} dz$ around the circle $\lvert z-1 \rvert = 5$ by Cauchy integral formulae.	Understand	CO 2	CLO 7	AHSB06.7

20	Prove that by using line integral, $\int_C \frac{1}{(z-a)} dz = 2\pi i$ where c is the curve $\|z-a\| = r$.	Remember	CO 2	CLO 7	AHSB06.7
Part - B (Long Answer Questions)					
1	Estimate the value of line integral to $\int_c \frac{z^3 - \sin 3z}{(z-\pi/2)^3}$ dz where c is the circle $\|z\|$=2 using Cauchy's integral formula.	Understand	CO 2	CLO 7	AHSB06.7
2	Verify Cauchy's theorem for the integral of z^3 taken over the boundary of the rectangle formed with the vertices -1 ,1,1+i ,-1+i.	Understand	CO 2	CLO 6	AHSB06.6
3	Determine the value of line integral to $\int_c \frac{e^{2z}}{(z-1)(z-2)}$ dz where c is the circle $\|z\|$=3 using Cauchy's integral formula.	Understand	CO 2	CLO 7	AHSB06.7
4	Determine the value of line integral to $\int_c \frac{z^3 e^{-z}}{(z-1)^3}$ dz where c is $\|z-1\| = \frac{1}{2}$ using Cauchy's integral formula.	Understand	CO 2	CLO 7	AHSB06.7
5	Determine the value of line integral to $\int_c \frac{5z^2 - 3z + 2}{(z-1)^3} dz$ where c is any simple closed curve enclosing $\|z\|$=1 using Cauchy's integral formula.	Understand	CO 2	CLO 7	AHSB06.7
6	Estimate the value of line integral to $\int_{z=0}^{z=1+i} [x^2 + 2xy + i(y^2 - z)]\ dz$ along the curve $y = x^2$.	Understand	CO 2	CLO 6	AHSB06.6
7	Evaluate $\int_c (3z^2 + 2z - 4) dz$ around the square with vertices at (0,0), (1,0), (1,1) and (0,1).	Remember	CO 2	CLO 6	AHSB06.6
8	Verify Cauchy's theorem for the function $f(z) = 5\ sin2z$ if c is the square with vertices at $1 \pm i\ and\ -1 \pm i$.	Understand	CO 2	CLO 6	AHSB06.6
9	Determine the value of line integral to $\int_C \frac{(\sin z)^6}{\left(z - \frac{\pi}{6}\right)^3} dz$ around the unit circle using Cauchy's integral formula.	Understand	CO 2	CLO 7	AHSB06.7
10	Determine the value of to $\int_c \frac{e^{2z}}{(z+1)^4}$ dz where c is $\|z-1\| = 3$ using Cauchy's general integral formulae.	Understand	CO 2	CLO 7	AHSB06.7
11	Evaluate using Cauchy's integral formula $\int_c \frac{z+1}{z^2 + 2z + 4} dz$ Where $c: \|z+1+i\| = 2$.	Understand	CO 2	CLO 7	AHSB06.7
12	Determine the value of line integral to $\int_C (y^2 + z^2) dx + (z^2 + x^2) dy + (x^2 + y^2) dz$ from (0,0,0) to (1,1,1) where C is the curve x= t, y = t^2, z = t^3 in the parametric form.	Understand	CO 2	CLO 6	AHSB06.6
13	Estimate the value of $\int_c \frac{e^z}{z^2 (z+1)^3} dz$ with C:$\|z\| = 2$ by Cauchy	Understand	CO 2	CLO 7	AHSB06.7

	general integral formulae.				
14	Prove that if f(z) is analytic function then $\int_A^B f(z)dz$ is independent of path followed.	Remember	CO 2	CLO 6	AHSB06.6
15	Determine the value of line integral to $\int_0^{3+i} z^2\, dz$ along the parabola x=3y^2.	Understand	CO 2	CLO 6	AHSB06.6
16	Estimate the value of $\int_C \frac{1}{e^z(z-1)^3}dz$ with C:$\|z\| = 2$ by Cauchy general integral formulae.	Understand	CO 2	CLO 7	AHSB06.7
17	Determine the value of $\int_C \frac{e^z \sin 2z - 1}{z^2(z+2)^2}dz$ where c is $\|z\| = \frac{1}{2}$ using Cauchy integral formulae.	Understand	CO 2	CLO 7	AHSB06.7
18	Evaluate $\int_c \left[\frac{e^z}{z^3} + \frac{z^4}{(z-i)^2}\right]dz \quad ,c:\|z\| = 2$ using Cauchy's integral formulae.	Remember	CO 2	CLO 7	AHSB06.7
19	Determine the value of line integral to $\int_C (z^2+3z)dz$ along the straight line from (2,0) to (2,2) and then from (2,2) to (0,2).	Understand	CO 2	CLO 6	AHSB06.6
20	Let C denote the boundary of a square whose sides lie along the lines x= ± 2 and y= ± 2 where C is described in positive sense. Then determine the value of line integral to $\int_C \frac{\cos hz}{z^4}dz$.	Understand	CO 2	CLO 7	AHSB06.7
Part - C (Problem Solving and Critical Thinking Questions)					
1	Determine the value of line integral to $\int_c \frac{z}{(z-1)(z-2)^2}$ dz where c is the circle $\|z-2\|$=1/2 using Cauchy's integral formula.	Understand	CO 2	CLO 7	AHSB06.7
2	Estimate the value of line integral to $\int_c \frac{z^4}{(z+1)(z-i)^2}$ dz where c is the ellipse 9x^2+4y^2=36 using Cauchy's integral formula.	Understand	CO 2	CLO 7	AHSB06.7
3	Estimate the value of line integral to $\int_c \frac{z^4-3z^2+6}{(z+1)^3}$dz where c is the circle $\|z\| = 2$ using Cauchy's integral formula.	Understand	CO 2	CLO 7	AHSB06.7
4	Estimate the value of line integral to $\int_c \frac{z^2-2z-2}{(z^2+1)^2}$ dz where c is the circle $\|z-i\|$ = 1/2 using Cauchy's integral formula.	Understand	CO 2	CLO 7	AHSB06.7
5	Estimate the value of line integral to $\int_c \frac{e^z}{(z^2+\pi^2)^2}dz$ where c is $\|z\|$=4 using Cauchy's integral formula.	Understand	CO 2	CLO 7	AHSB06.7
6	Estimate the value of line integral to $\int_c \frac{\cos \pi z^2}{(z-1)(z-2)^3}$ dz where c is the circle $\|z\|$=3 using Cauchy's integral formula.	Understand	CO 2	CLO 7	AHSB06.7
7	Determine the value of line integral to $\int_0^{1+i}(x-y+ix^2)$ dz i) Along the straight line from z = 0 to z = 1+i.	Understand	CO 2	CLO 6	AHSB06.6

	ii) Along the real axis from z = 0 to z = 1 and then along a line parallel to imaginary axis from z = 1 to z = 1+i iii) Along the imaginary axis from z = 0 to z = i and then along a line parallel to real axis z = i to z = 1+ i.				
8	Verify Cauchy's theorem for the integral of $3z^2 + iz - 4$ taken over the boundary of the square with vertices -1+i ,-1-i,1+i ,-1-i.	Understand	CO 2	CLO 6	AHSB06.6
9	Derive the Cauchy general integral formulae of an analytic function f(z) within a closed contour c.	Remember	CO 2	CLO 7	AHSB06.7
10	Estimate the value of line integral to $\int_C (y^2+2xy)dx + (y^2-2xy)dy$ where C is the boundary of the region $y = x^2$ and $x = y^2$.	Understand	CO 2	CLO 6	AHSB06.6
MODULE-III					
POWER SERIES EXPANSION OF COMPLEX FUNCTION					
Part - A (Short Answer Questions)					
1	State Taylor's theorem of complex power series.	Remember	CO 3	CLO 10	AHSB06.10
2	State Laurent's theorem of complex power series.	Remember	CO 3	CLO 10	AHSB06.10
3	Define the term pole of order m of an analytic function f(z).	Remember	CO 3	CLO 12	AHSB06.12
4	Define the terms Essential and Removable singularity of an analytic function f(z).	Remember	CO 3	CLO 11	AHSB06.11
5	Expand f(z) = $\frac{1}{z^2}$ in powers of z+1 as a Taylor's series.	Understand	CO 3	CLO 10	AHSB06.10
6	Expand f(z) = e^z as Taylor's series about z = 1.	Understand	CO 3	CLO 10	AHSB06.10
7	Estimate the Poles of $\frac{1}{z^2-1}$.	Understand	CO 3	CLO 12	AHSB06.12
8	Obtain the Taylor series expansion of f(z) = e^z about the point z = 1.	Understand	CO 3	CLO 10	AHSB06.10
9	Determine the Poles of the function $f(z) = \frac{ze^z}{(z+2)^4(z-1)}$.	Understand	CO 3	CLO 12	AHSB06.12
10	Define the Isolated singularity of an analytic function f(z).	Understand	CO 3	CLO 11	AHSB06.11
11	State Cauchy's Residue theorem of an analytic function f(z) within and on the closed curve.	Remember	CO 3	CLO 12	AHSB06.12
12	Determine the Residue by Laurent's expansion to $f(z) = \frac{e^z}{(z-1)^2}$ about z = 1.	Understand	CO 3	CLO 12	AHSB06.12
13	Estimate the Residues of the function $f(z) = \frac{1}{(z-\sin z)}$ about z = 0 by Laurent's expansion.	Understand	CO 3	CLO 12	AHSB06.12
14	Estimate the Residues of the function $f(z) = \frac{z}{(z+1)(z+2)}$ as a Laurent's series about z = -2.	Understand	CO 3	CLO 12	AHSB06.12
15	Estimate the value of $\oint_C \frac{1-2z}{z(z-1)(z-2)} dz$ by Cauchy's Residue theorem.	Understand	CO 3	CLO 12	AHSB06.12
16	State Residue formulae for simple pole.	Remember	CO 3	CLO 11	AHSB06.11
17	Explain the types of evaluation of integrals by Cauchy's Residue theorem.	Remember	CO 3	CLO 12	AHSB06.12
18	Estimate the Residues of the function $f(z) = \frac{z}{(z-1)(z-2)}$ as a Laurent's series about z = -1.	Understand	CO 3	CLO 12	AHSB06.12
19	Define the radius and region of convergence of a power series.	Remember	CO 3	CLO 11	AHSB06.11
20	Define the residue of a function by Laurent series expansion	Remember	CO 3	CLO 12	AHSB06.12

Part - B (Long Answer Questions)					
1	Expand f(z) = $\frac{z-1}{z+1}$ in Taylor's series about the point $z = 1$.	Understand	CO 3	CLO 10	AHSB06.10
2	Expand f(z) = $\frac{z-1}{z^2}$ in Taylor's series in powers of z -1. Also determine the region of convergence about the point z = 1.	Understand	CO 3	CLO 10	AHSB06.10
3	Obtain Laurent's series expansion of f (z) = $\frac{z^2-4}{z^2+5z+4}$ valid in 1< z < 4.	Understand	CO 3	CLO 10	AHSB06.10
4	Expand $f(z)=\frac{e^{2z}}{(z-1)^3}$ about z = 1 as Laurent's series. Also find the region of convergence about z = 1.	Understand	CO 3	CLO 10	AHSB06.10
5	Expand f(z) = $\frac{7z-2}{z(z+1)(z-2)}$ about z=-1 in the region $1<\|z+1\|<3$ as Laurent's series.	Understand	CO 3	CLO 10	AHSB06.10
6	Expand $f(z)=\frac{2z^3+1}{z(z+1)}$ in Taylor's series about the point $z = 1$	Understand	CO 3	CLO 10	AHSB06.10
7	Find Taylor's expansion of $f(z)=\frac{z+1}{(z-3)(z-4)}$ about the point z=2.Determine the region of convergence.	Understand	CO 3	CLO 10	AHSB06.10
8	Expand $f(z)=\cos z$ in Taylor's series about $z=\pi i$.	Understand	CO 3	CLO 10	AHSB06.10
9	Obtain the Laurent's series expansion of $f(z) = \frac{e^z}{z(1-3z)}$ about z = 1.	Understand	CO 3	CLO 10	AHSB06.10
10	Express $f(z) = \frac{1+2z}{z^2+z^3}$ in a series of positive and negative powers of z.	Understand	CO 3	CLO 10	AHSB06.10
11	Estimate the value of $\int_c \frac{2z-1}{z(2z+1)(z+2)}dz$ where c is the circle $\|z\| = 1$.	Understand	CO 3	CLO 12	AHSB06.12
12	Assess the value of $\oint_c \tan z dz$ where c is circle $\|z\| = 2$.	Understand	CO 3	CLO 12	AHSB06.12
13	Estimate the value of $\oint_c \frac{dz}{(z^2+4)^2}$ where c is $\|z-i\| = 2$.	Understand	CO 3	CLO 12	AHSB06.12
14	Calculate the value of $\oint_c \frac{\coth z}{z-i}dz$ where c is $\|z\| = 2$.	Understand	CO 3	CLO 12	AHSB06.12
15	Calculate the value of $\int_{-\infty}^{\infty} \frac{x^2dx}{(x^2+1)(x^2+4)}$ using Residue theorem. .	Understand	CO 3	CLO 12	AHSB06.12
16	Estimate the value of $\int_0^{\pi} \frac{d\theta}{(a+b\cos\theta)}$ using Residue theorem. .	Remember	CO 3	CLO 12	AHSB06.12
17	Assess the value of $\frac{\sin z}{z\cos z}dz$ where c is circle $\|z\| = \pi$.	Understand	CO 3	CLO 12	AHSB06.12

18	Assess the value of $\oint_c \frac{1}{\sinh z} dz$ where c is circle |z| = 4 using Residue theorem.	Understand	CO 3	CLO 12	AHSB06.12
19	Assess the value of $\oint_c \frac{2e^z}{z(z-3)} dz$ where c is circle |z| = 2 using Residue theorem. .	Understand	CO 3	CLO 12	AHSB06.12
20	Calculate the value of $\int_{-\infty}^{\infty} \frac{dx}{(x^2+a^2)^2}$ using Residue theorem. .	Understand	CO 3	CLO 12	AHSB06.12
Part - C (Problem Solving and Critical Thinking Questions)					
1	Obtain the Laurent expansion of f(z) = $\frac{1}{z^2-4z+3}$ for 1 < |z| < 3 (ii) |z| < 1 (iii) |z| > 3.	Understand	CO 3	CLO 10	AHSB06.10
2	Expand f(z) = $\frac{(z-2)(z+2)}{(z+1)(z+4)}$ in the region where $(i)\|z\| < 1$ (ii)1< |z| < 4 .	Understand	CO 3	CLO 10	AHSB06.10
3	Expand $\frac{1}{z^2(z-3)^2}$ as Laurent's series in the region $(i)\|z\| < 1$ $(ii)\|z\| > 3$.	Understand	CO 3	CLO 10	AHSB06.10
4	Expand f(z) = $\frac{2}{(2z+1)^3}$ in Taylor's series about z=0 and z=2.	Understand	CO 3	CLO 10	AHSB06.10
5	Expand f(z) = $\frac{e^z}{z(z+1)}$ in Taylor's series about z=2.	Understand	CO 3	CLO 10	AHSB06.10
6	Determine the value of $\oint_c \frac{z-3}{(z^2+2z+5)} dz$ where c is circle |z| = 1.	Understand	CO 3	CLO 12	AHSB06.12
7	Estimate the value of $\int_0^{2\pi} \frac{d\theta}{a+b\cos\theta}$ using Residue theorem.	Remember	CO 3	CLO 12	AHSB06.12
8	Calculate the value of $\int_0^{\infty} \frac{dx}{(x^6+1)}$ using Residue theorem.	Understand	CO 3	CLO 12	AHSB06.12
9	Calculate the value of $\int_{-\infty}^{\infty} \frac{x^2 dx}{(x^2+a^2)(x^2+b^2)}$ using Residue theorem (a>0, b>0 and a $\neq$ b)	Understand	CO 3	CLO 12	AHSB06.12
10	Estimate the value of $\int_0^{2\pi} \frac{\cos 2\theta d\theta}{5+4\cos\theta}$ using Residue theorem	Understand	CO 3	CLO 12	AHSB06.12
MODULE-IV					
SINGLE RANDOM VARIABLES					
Part - A (Short Answer Questions)					
1	Define the discrete and continuous random variables with a suitable example.	Remember	CO 4	CLO 14	AHSB06.14
2	List the important Properties of probability density function.	Remember	CO 4	CLO 14	AHSB06.14
3	Obtain the probability distribution of getting number tails if we toss three coins.	Remember	CO 4	CLO 14	AHSB06.14
4	Define the term mathematical expectation of a probability distribution function.	Remember	CO 4	CLO 14	AHSB06.14
5	If X is discrete random variable then Prove that Variance of (aX + b) = a^2 Variance of (X).	Remember	CO 4	CLO 14	AHSB06.14

6	Define the term probability mass function of a probability distribution.	Remember	CO 4	CLO 15	AHSB06.15
7	If X denote random variable, prove that E[X-K} = E{X] - K where 'K' is a constant.	Remember	CO 4	CLO 14	AHSB06.14
8	List the important properties of probability mass function.	Remember	CO 4	CLO 14	AHSB06.14
9	Explain the term Moment generating function of a probability distribution.	Remember	CO 4	CLO 14	AHSB06.14
10	Express the relation between the probability density and cumulative density function of a random variable.	Remember	CO 4	CLO 14	AHSB06.14
11	Define the term Mean and Variance of a probability mass function.	Remember	CO 4	CLO 14	AHSB06.14
12	Define the term Mean and Variance of a probability density function.	Remember	CO 4	CLO 14	AHSB06.14
13	Define the term probability density function of a probability distribution.	Understand	CO 4	CLO 14	AHSB06.14
14	Define the moments for distribution.	Understand	CO 4	CLO 14	AHSB06.14
15	Obtain the first 4 moments for the set of numbers 2, 4, 6 and 8.	Understand	CO 4	CLO 14	AHSB06.14
16	A die is thrown at random. What is the expectation of a number on it.	Understand	CO 4	CLO 15	AHSB06.15
17	The probability density function of a random variable x is $f(x) = e^{\|-x/2\|}$, $x > 0$. Estimate the value of the probability of $1 < x < 2$.	Understand	CO 4	CLO 14	AHSB06.14
18	Probability density function of a random variable X $f(x) = \begin{cases} \frac{\sin x}{2}, & 0 \le x \le \pi \\ 0, & \text{otherwise} \end{cases}$ Find the mean of the random variable X.	Understand	CO 4	CLO 14	AHSB06.14
19	A continuous random variable has the probability density function $f(x) = \begin{cases} kxe^{-\lambda x}, & for\ x \ge 0, \lambda > 0 \\ 0, & otherwise \end{cases}$ Determine the value of k.	Remember	CO 4	CLO 14	AHSB06.14
20	Obtain the value of $P(0 < x < 2)$ to the Probability density function of a random variable X where	Understand	CO 4	CLO 14	AHSB06.14

Part - B (Long Answer Questions)

<table>
<tr><td>1</td><td>A random variable x has the following probability function:
<table>
<tr><td>X</td><td>0</td><td>1</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td></tr>
<tr><td>P(x)</td><td>0</td><td>k</td><td>2k</td><td>2k</td><td>3k</td><td>k^2</td><td>$7k^2+k$</td></tr>
</table>
Find (i) k (ii) P(x<6) (iii) p(x>6)</td><td>Understand</td><td>CO 4</td><td>CLO 15</td><td>AHSB06.15</td></tr>
<tr><td>2</td><td>Let X denotes the minimum of the two numbers that appear when a pair of fair dice is thrown once. Find
(i)Discrete probability distribution (ii) Expectation (iii) Variance</td><td>Understand</td><td>CO 4</td><td>CLO 15</td><td>AHSB06.15</td></tr>
<tr><td>3</td><td>A random variable X has the following probability function
<table>
<tr><td>X</td><td>-2</td><td>-1</td><td>0</td><td>1</td><td>2</td><td>3</td></tr>
<tr><td>P(x)</td><td>0.1</td><td>K</td><td>0.2</td><td>2K</td><td>0.3</td><td>K</td></tr>
</table>
Calculate (i) k (ii) mean (iii) variance (iv) $P(0 < x < 3)$</td><td>Understand</td><td>CO 4</td><td>CLO 15</td><td>AHSB06.15</td></tr>
<tr><td>4</td><td>A continuous random variable has the probability density function
$f(x) = \begin{cases} kxe^{-\lambda x}, & for\ x \ge 0, \lambda > 0 \end{cases}$</td><td>Understand</td><td>CO 4</td><td>CLO 15</td><td>AHSB06.15</td></tr>
</table>

<table>
<tr><td></td><td>⎩0, otherwise
Determine(i) k (ii) Mean (iii) Variance</td><td></td><td></td><td></td><td></td></tr>
<tr><td>5</td><td>If the Probability density function of random variable is
$f(x)=k(1-x^2),0<x<1$ then Calculate
(i) k (ii) p(0.1 < x< 0.2) (iii) P(x > 0.5)</td><td>Understand</td><td>CO 4</td><td>CLO 14</td><td>AHSB06.14</td></tr>
<tr><td>6</td><td>Two coins are simultaneously ,Let X denotes the number of heads then find expectation of X and variance of X.</td><td>Understand</td><td>CO 4</td><td>CLO 14</td><td>AHSB06.14</td></tr>
<tr><td>7</td><td>If the Probability density function of a random variable is
f(x) = $k\left(1+x^2\right),0<x<2$ then Calculate
(i) k (ii) P(0.2 < x< 0.3) (iii) P(x > 0.7)</td><td>Understand</td><td>CO 4</td><td>CLO 14</td><td>AHSB06.14</td></tr>
<tr><td>8</td><td>If a random variable X has the moment generating function is given by M(t) = 2/(2-t), find the variance of X.</td><td>Understand</td><td>CO 4</td><td>CLO 16</td><td>AHSB06.16</td></tr>
<tr><td>9</td><td>Let X be the random variable of the following values x=1,2,3 if f(x) =x/6.Then find mean and variance.</td><td>Understand</td><td>CO 4</td><td>CLO 15</td><td>AHSB06.15</td></tr>
<tr><td>10</td><td>Obtain the moment generating function of a random variable X having the
probability density function $f(x)=\begin{cases} x, 0\le x<1 \\ 2-x, 1\le x<2 \\ 0, elsewhere \end{cases}$</td><td>Understand</td><td>CO 4</td><td>CLO 16</td><td>AHSB06.16</td></tr>
<tr><td>11</td><td>List the relation between moment about mean and moment about origin.</td><td>Understand</td><td>CO 4</td><td>CLO 16</td><td>AHSB06.16</td></tr>
<tr><td>12</td><td>Is the function defined by
$\boldsymbol{f(x)}=\begin{cases} \mathbf{0}, \boldsymbol{x}<2 \\ \frac{\mathbf{1}}{\mathbf{2x+3}}, \mathbf{2}\le \boldsymbol{x}\le \mathbf{4} \\ \mathbf{0}, \boldsymbol{x}>4 \end{cases}$
a probability density function? Find the probability that a variate having f(x) as density
function will fall in the interval $2<x<3$.</td><td>Remember</td><td>CO 4</td><td>CLO 15</td><td>AHSB06.15</td></tr>
<tr><td>13</td><td>If E(X) = 10 ,v(x)=1 then find E[2x (x+20)].</td><td>Remember</td><td>CO 4</td><td>CLO 14</td><td>AHSB06.14</td></tr>
<tr><td>14</td><td>Find the probability distribution for sum of scores on dice if we throw two dice simultaneously.</td><td>Understand</td><td>CO 4</td><td>CLO 14</td><td>AHSB06.14</td></tr>
<tr><td>15</td><td>A discrete random variable X has the following probability distribution
<table><tr><td>X</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td></tr><tr><td>P (X=x)</td><td>2k</td><td>4k</td><td>6k</td><td>8k</td><td>10k</td><td>12k</td><td>14k</td><td>4k</td></tr></table>Find (i) k (ii) p(X<3) (iii) p(X □ 5)</td><td>Understand</td><td>CO 4</td><td>CLO 14</td><td>AHSB06.14</td></tr>
<tr><td>16</td><td>Let X be a random variable which can take on the values 1, 2 and 3with probabilities 1/3, 1/6 and 1/2. Calculate the third moment about mean.</td><td>Understand</td><td>CO 4</td><td>CLO 15</td><td>AHSB06.15</td></tr>
<tr><td>17</td><td>A random variable has the probability density function
$f(x)=x^2, 1\le x\le 2$ Find its moment generating function.</td><td>Understand</td><td>CO 4</td><td>CLO 16</td><td>AHSB06.16</td></tr>
<tr><td>18</td><td>The density function of a random variable X is
$\mathrm{f(x)}=\begin{cases} e^{-x}, x\ge 0 \\ 0.\ \text{otherwise} \end{cases}$
Find E(X), E(X^2), V(X).</td><td>Understand</td><td>CO 4</td><td>CLO 14</td><td>AHSB06.14</td></tr>
</table>

<table>
<tr><td>19</td><td>Compute the first four moments about the mean for the following distribution
<table><tr><td>Marks</td><td>0-10</td><td>10-20</td><td>20-30</td><td>30-40</td><td>40-50</td><td>50-60</td><td>60-70</td></tr><tr><td>No. of students</td><td>8</td><td>12</td><td>20</td><td>30</td><td>15</td><td>10</td><td>5</td></tr></table>Also find the values of β_1 and β_2</td><td>Understand</td><td>CO 4</td><td>CLO 16</td><td>AHSB06.16</td></tr>
<tr><td>20</td><td>Determine the value of A to the probability density function f(x) = Ax^2 in 0 < x < 1</td><td>Understand</td><td>CO 4</td><td>CLO 15</td><td>AHSB06.15</td></tr>
<tr><td colspan="6">Part - C (Problem Solving and Critical Thinking Questions)</td></tr>
<tr><td>1</td><td>Find the Mean and Variance to the following discrete distribution
<table><tr><td>X</td><td>8</td><td>12</td><td>16</td><td>20</td><td>24</td></tr><tr><td>P(X)</td><td>1/8</td><td>1/6</td><td>3/8</td><td>1/4</td><td>1/2</td></tr></table></td><td>Understand</td><td>CO 4</td><td>CLO 15</td><td>AHSB06.15</td></tr>
<tr><td>2</td><td>A random variable X has the following probability function.
<table><tr><td>X</td><td>4</td><td>5</td><td>6</td><td>8</td></tr><tr><td>P(X)</td><td>0.1</td><td>0.3</td><td>0.4</td><td>0.2</td></tr></table>Determine (i) Expectation (ii) variance (iii)Standard deviation.</td><td>Understand</td><td>CO 4</td><td>CLO 15</td><td>AHSB06.15</td></tr>
<tr><td>3</td><td>Out of 24 mangoes, 6 mangoes are rotten. If we draw two mangoes, then obtain probability distribution of number of rotten mangoes that can be drawn.</td><td>Remember</td><td>CO 4</td><td>CLO 15</td><td>AHSB06.15</td></tr>
<tr><td>4</td><td>If X is a Continuous random variable whose density function is
$f(x) = \begin{cases} x & if\ 0 < x < 1 \\ 2 - x & if\ 1 \le x < 2 \\ 0 & elsewhere \end{cases}$
Find ($25X^2 + 30X - 5$).</td><td>Understand</td><td>CO 4</td><td>CLO 14</td><td>AHSB06.14</td></tr>
<tr><td>5</td><td>The probability density function of a random variable X is $f(x) = \frac{k}{x^2+1}, -\infty < x < \infty$. Find K and the distribution function F(x).</td><td>Understand</td><td>CO 4</td><td>CLO 14</td><td>AHSB06.14</td></tr>
<tr><td>6</td><td>If the probability density of a random variable X is given by $f(x) = \begin{cases} k(1-x^2), 0 < x < 1 \\ 0, otherwise \end{cases}$
Find (i) k (ii) The cumulative distribution function of X.</td><td>Understand</td><td>CO 4</td><td>CLO 14</td><td>AHSB06.14</td></tr>
<tr><td>7</td><td>The first three moments of a distribution about the value 2 of the variable are1, 16, and -40. Show that the mean = 3, the variance = 15 and μ_3 = - 86.</td><td>Understand</td><td>CO 4</td><td>CLO 16</td><td>AHSB06.16</td></tr>
<tr><td>8</td><td>Explain moments at origin of a probability distribution function.</td><td>Remember</td><td>CO 4</td><td>CLO 16</td><td>AHSB06.16</td></tr>
<tr><td>9</td><td>Explain the moment generating function of a probability distribution function.</td><td>Remember</td><td>CO 4</td><td>CLO 16</td><td>AHSB06.16</td></tr>
<tr><td>10</td><td>Explain the relation between the moments about mean in terms of moments about arbitrary origin.</td><td>Remember</td><td>CO 4</td><td>CLO 16</td><td>AHSB06.16</td></tr>
<tr><td colspan="6">MODULE-V</td></tr>
<tr><td colspan="6">PROBABILITY DISTRIBUTIONS</td></tr>
<tr><td colspan="6">Part - A (Short Answer Questions)</td></tr>
<tr><td>1</td><td>Define the terms mean, variance of Binomial distribution.</td><td>Remember</td><td>CO 5</td><td>CLO 17</td><td>AHSB06.17</td></tr>
<tr><td>2</td><td>Draft the recurrence relation for the Binomial distribution.</td><td>Remember</td><td>CO 5</td><td>CLO 17</td><td>AHSB06.17</td></tr>
<tr><td>3</td><td>Define the term mode of a Binomial distribution.</td><td>Remember</td><td>CO 5</td><td>CLO 17</td><td>AHSB06.17</td></tr>
<tr><td>4</td><td>Determine the value of n if the mean and variance of a Binomial distribution are 3 and 9/4.</td><td>Understand</td><td>CO 5</td><td>CLO 17</td><td>AHSB06.17</td></tr>
<tr><td>5</td><td>Determine the Binomial distribution for which the mean is 4 and variance 3</td><td>Understand</td><td>CO 5</td><td>CLO 17</td><td>AHSB06.17</td></tr>
</table>

6	The mean and variance of a binomial variable X with parameters n and p are 16 and 24.Determine the value of P(X=1).	Remember	CO 5	CLO 17	AHSB06.17
7	If a bank received on the average 6 bad cheques per day,Find the probability that it will receive 4 bad cheques on any given day.	Understand	CO 5	CLO 17	AHSB06.17
8	Define the terms Mean, Variance of Poisson distribution	Remember	CO 5	CLO 17	AHSB06.17
9	If X is a Poisson variate with P(x=2) = 2/3P(x = 1) Compute the value of P(x=0).	Understand	CO 5	CLO 18	AHSB06.18
10	Draft the recurrence relation for the Poisson distribution.	Remember	CO 5	CLO 18	AHSB06.18
11	The mean and variance of binomial distribution are 4 and 4/3 respectively. Find $p(X \geq 1)$.	Remember	CO 5	CLO 19	AHSB06.19
12	If a bank received on the average 6 bad apples per day then estimate the probability that it will receive 4 bad cheques on any given day.	Understand	CO 5	CLO 18	AHSB06.18
13	If 2% of light bulbs are defective in a sample of 100.Find at least one is defective.	Remember	CO 5	CLO 17	AHSB06.17
14	If a random variable has Poisson distribution such that p (1) = p (2).Determine the value of p (1< x < 4).	Understand	CO 5	CLO 18	AHSB06.18
15	Define Poisson distribution.	Remember	CO 5	CLO 18	AHSB06.18
16	Define the term Normal Distribution.	Remember	CO 5	CLO 20	AHSB06.20
17	Define Binomial distribution.	Remember	CO 5	CLO 20	AHSB06.20
18	Define Normal curve.	Remember	CO 5	CLO 20	AHSB06.20
19	Draft the applications of Normal distribution.	Remember	CO 5	CLO 20	AHSB06.20
20	If X is Normally distributed with mean 2 and variance 0.1, then Estimate the value of P($x - 2 \geq 0.01$)	Understand	CO 5	CLO 20	AHSB06.20
Part - B (Long Answer Questions)					
1	Derive the Variance of a Binomial Distribution.	Remember	CO 5	CLO 17	AHSB06.17
2	Estimate the probability that at most 5 defective components will be found in a lot of 200. Experience shows that 2% of such components are defective. Also find the probability of more than 5 defective components.	Understand	CO 5	CLO 17	AHSB06.17
3	The probability that a man hitting a target is 1/3. If he fires 5 times ,Determine the probability that he fires (i) At most 5 times (ii) At least 2 times	Understand	CO 5	CLO 17	AHSB06.17
4	Find the variance of a Poisson Distribution.	Remember	CO 5	CLO 18	AHSB06.18
5	Poisson variate has a double mode at x=2 and x=3, Determine the maximum probability and also find p($x \geq 2$)	Understand	CO 5	CLO 18	AHSB06.18
6	Average number of accidents on any day on a national highway is 1.8. Determine the probability that the number of accidents is (i) at least one (ii) at most one	Understand	CO 5	CLO 18	AHSB06.18
7	A car hire firm has two cars which it hires out day by day. The number of demands for a car on each day is distributed to Poisson distribution with mean 1.5. Find the proportion of days (i)on which there is no demand (ii)on which demand is refused.	Understand	CO 5	CLO 18	AHSB06.18
8	If x is a poisson variate such that p(x=2)=45p(x=6)-3p(x=4).Find (i) p($x \geq 1$) (ii) p(x<2)	Remember	CO 5	CLO 18	AHSB06.18
9	Derive median of the Normal distribution.	Remember	CO 5	CLO 20	AHSB06.20
10	Explain the variance of a Normal Distribution.	Remember	CO 5	CLO 20	AHSB06.20
11	Explain the mode of Normal distribution.	Remember	CO 5	CLO 20	AHSB06.20
12	Prove that mean deviation from the mean for Normal distribution is $4\sigma/5$ approximately.	Remember	CO 5	CLO 20	AHSB06.20
13	Prove that poisson distribution is limiting case of binomial distribution .	Remember	CO 5	CLO 18	AHSB06.18
14	If the masses of 300 students are normally distributed with mean 68 kg and standard deviation3 kg how many number of students have masses: greater than 72 kg (ii) less than or equal to 64 kg (iii) between 65 and 71 kg inclusive	Understand	CO 5	CLO 20	AHSB06.20
15	In a Normal distribution, 7% of the item are under 35 and 89%	Understand	CO 5	CLO 20	AHSB06.20

<table>
<tr><td></td><td>are under 63.Compute the mean and standard deviation of the distribution</td><td></td><td></td><td></td><td></td></tr>
<tr><td>16</td><td>It has been found that 2% of the tools produced by a certain machine are defective. Estimate the probability that in a shipment of 400 such tools, i) 3% or more ii) 2% are less will prove defective.</td><td>Understand</td><td>CO 5</td><td>CLO 20</td><td>AHSB06.20</td></tr>
<tr><td>17</td><td>In a Normal distribution, 31% of the items are under 45 and 8% are over 64. Estimate the mean and variance of the distribution.</td><td>Understand</td><td>CO 5</td><td>CLO 20</td><td>AHSB06.20</td></tr>
<tr><td>18</td><td>If X is a Normal variate then determine the area A.
i) to the left of $z = -1.78$ ii) to the right of $z = -1.45$ iii) corresponding to $-0.8 \leq z \leq 1.53$ iv) to the left of $z = -2.52$ and the right of 1.83. Show the above by graphs.</td><td>Understand</td><td>CO 5</td><td>CLO 20</td><td>AHSB06.20</td></tr>
<tr><td>19</td><td>1000 students have written an examination with the mean of test is 35 and standard deviation is 5. Assuming the distribution to be normal find i) How many students marks like between 25 and 40? ii) How many students get more than 40? iii) How many students get below 20? iv) How many students get more than 50.</td><td>Understand</td><td>CO 5</td><td>CLO 20</td><td>AHSB06.20</td></tr>
<tr><td>20</td><td>The mean height of students in a college is 155cm and standard deviation is 15. Estimate the probability that mean height of 36 students is less than 157cm.</td><td>Understand</td><td>CO 5</td><td>CLO 20</td><td>AHSB06.20</td></tr>
<tr><td colspan="6">Part - C (Problem Solving and Critical Thinking Questions)</td></tr>
<tr><td>1</td><td>Fit a Binomial Distribution to the following data
<table><tr><td>x</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td></tr><tr><td>f</td><td>305</td><td>365</td><td>210</td><td>80</td><td>28</td><td>9</td><td>2</td><td>1</td></tr></table></td><td>Remember</td><td>CO 5</td><td>CLO 17</td><td>AHSB06.17</td></tr>
<tr><td>2</td><td>It has been claimed that in 60%of all solar heat installations that utility bill is reduced by atleast one –third .Accordingly, What are the probabilities that the utility bill will be reduced by at least one –third in (i) four or five instalations (ii) at least four of five instalations.</td><td>Understand</td><td>CO 5</td><td>CLO 20</td><td>AHSB06.20</td></tr>
<tr><td>3</td><td>Fit a Binomial Distribution to the following data
<table><tr><td>x</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td></tr><tr><td>f</td><td>2</td><td>14</td><td>20</td><td>34</td><td>22</td><td>8</td></tr></table></td><td>Understand</td><td>CO 5</td><td>CLO 17</td><td>AHSB06.17</td></tr>
<tr><td>4</td><td>Show that the mean, mode and median are equal in poisson distribution.</td><td>Remember</td><td>CO 5</td><td>CLO 18</td><td>AHSB06.18</td></tr>
<tr><td>5</td><td>Derive mean of the Normal distribution.</td><td>Understand</td><td>CO 5</td><td>CLO 20</td><td>AHSB06.20</td></tr>
<tr><td>6</td><td>Show that the recurrence relation for the Poisson distribution is
$$\boldsymbol{p(x) = \frac{\lambda}{x}.p(x-1)}$$</td><td>Understand</td><td>CO 5</td><td>CLO 18</td><td>AHSB06.18</td></tr>
<tr><td>7</td><td>The marks obtained in statistics in a certain examination found to be normally distributed. If 15% of the students greater than or equal to 60 marks ,40% less than 30 marks. Find the mean and standard deviation.</td><td>Understand</td><td>CO 5</td><td>CLO 20</td><td>AHSB06.20</td></tr>
<tr><td>8</td><td>The life of electronic tubes of a certain types may be assumed to be normal distributed with mean 155 hours and standard deviation 19 hours. Determine the probability that the life of a randomly chosen tube
(i) is between 136 hours and 174 hours.
(ii) less than 117 hours
(iii)will be more than 395 hours</td><td>Understand</td><td>CO 5</td><td>CLO 20</td><td>AHSB06.20</td></tr>
<tr><td>9</td><td>Derive the mean of the Binomial Distribution.</td><td>Remember</td><td>CO 5</td><td>CLO 17</td><td>AHSB06.17</td></tr>
</table>

10	The marks obtained in mathematics by 1000 students are Normally distributed with mean 78% and standard deviation 11%. Determine (i)How many students got marks above 90% marks (ii)What was the highest mark obtained by the lowest 10% of the students (iii)Within what limits did the middle of 90% of the student lie.	Understand	CO 5	CLO 20	AHSB06.20

Prepared By:

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