INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad - 500 043

ELECTRICAL AND ELECTRONICS ENGINEERING

DEFINITIONS AND TERMINOLOGY QUESTION BANK

Course Name	:	**COMPLEX ANALYSIS AND PROBABILITY DISTRIBUTION**
Course Code	:	**AHSB06**
Program	:	**B. Tech**
Semester	:	**IV**
Branch	:	**Electrical and Electronics Engineering**
Section	:	**A,B**
Academic Year	:	**2019 – 2020**
Course Faculty	:	**Mr.Ch Soma Shekar , Assistant Professor, FE**

OBJECTIVES:

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.

DEFINITIONS AND TERMINOLOGY QUESTION BANK

S.No	QUESTION	ANSWER	Blooms Level	CO	CLO	CLO Code
			MODULE-I			
1	What do you mean by the term function?	Let S be a non empty subset of C then f maps S tends C is said to be a function if every element of S associates with an element of C	Understand	CO1	CLO1	AHSB06.01
2	What do you mean by the term is a complex number?	The number which can be written as $z = x + iy$ is called a complex number.	Understand	CO1	CLO1	AHSB06.01
3	What is the conjugate of complex number?	The negative sing of imaginary c number $z = x - iy$ is called the conjugate of complex number z.	Understand	CO1	CLO1	AHSB06.01
4	Define the term complex function?	Let D be a nonempty set in C. A single-valued complex function or, simply, a complex function $f : D \to C$ is a map that assigns to each complex argument $z = x + iy$ in D a unique complex number $w = u + iv$. We write $w = f(z)$.	Remember	CO1	CLO1	AHSB06.01

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5	Explain the Limit of Function.	A function w=f(z) is said to have a limit at w_0 as z approaches to z_o when $\in > 0$ in domain then f(z) approaches to w_0 when $\delta > 0$ in codomain when ever modulus of z-z_o less than $\in$then modulus of f(z)- w_0 less than δ We shall use the notation $w_0 = \lim_{z \to z_0} f(z)$.	Understand	CO1	CLO1	AHSB06.01
6	Define the term Continuity of the function.	A function is said to be continuity at a point if limit of the function exit and the limit value is equals to functional value	Remember	CO1	CLO1	AHSB06.01
7	Explain the term Differentiation of complex function.	Let w = f(z) be a given function defined for all z in a neighbourhood of z_0.If $\lim_{\Delta z \to 0} \frac{f(z_0 + \Delta z) - f(z_0)}{\Delta z}$ exists,the function f(z) is said to be derivable at z_0 and the limit is denoted by $f'(z_0)$. $f'(z_0)$ if exists is called the derivative of f(z) at z_0.	Understand	CO1	CLO1	AHSB06.01
8	Define an Analytic function.	A complex function is said to be analytic on a region R if it is complex differentiable at every point in R.	Remember	CO1	CLO1	AHSB06.01
9	Explain the properties of limit.	If the limit of a function f(z) exists as z tends to then it is unique	Understand	CO1	CLO1	AHSB06.01
10	What is the value of $f'(z)$.	$f'(z) = \frac{\partial u}{\partial x} + i\frac{\partial v}{\partial x}$	Understand	CO1	CLO1	AHSB06.01
11	Write the properties of continuous function of f(z)	All polynomials, exponential, logarithmic and trigonometric functions are continuous.	Remember	CO1	CLO1	AHSB06.01
12	Write the properties of derivative of a given function	Every differentiable functions is a continuous but converse need not be true	Remember	CO1	CLO1	AHSB06.01
13	Define the term Singularities.	A complex function may fail to be analytic at one or more points through the presence of singularities.	Remember	CO1	CLO2	AHSB06.02
14	Explain the term Entire function.	A complex function that is analytic at all finite points of the complex plane is said to be entire function.	Understand	CO1	CLO2	AHSB06.02
15	State Cauchy–Riemann equations in Cartesian form	The Cauchy–Riemann equations on a pair of real-valued functions of two real variables $u(x,y)$ and $v(x,y)$ are the two equations:	Understand	CO1	CLO2	AHSB06.02

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		1. $\frac{\partial u}{\partial x} = \frac{\partial v}{\partial y}$ 2. $\frac{\partial u}{\partial y} = -\frac{\partial v}{\partial x}$ Typically *u* and *v* are taken to be the real and imaginary parts respectively of a complex-valued function of a single complex variable z = x + iy, f(x + iy) = u(x,y) + iv(x,y).				
16	State polar form of Cauchy-Riemann equation.	If $f(z) = f(re^{i\theta}) = u(r,\theta) + iv(r,\theta)$ and f(z) is derivable at $z_0 = r_0 e^{i\theta_0}$ then $\frac{\partial u}{\partial r} = \frac{1}{r}\frac{\partial v}{\partial \theta}, \frac{\partial v}{\partial r} = -\frac{1}{r}\frac{\partial u}{\partial \theta}$	Understand	CO1	CLO3	AHSB06.03
17	Define the term Harmonic function.	Analytic functions are intimately related to harmonic functions. We say that a real-valued function h(x, y) on the plane is harmonic if it obeys Laplace's equation: $\frac{\partial^2 h}{\partial^2 x} + \frac{\partial^2 h}{\partial^2 y} = 0$	Remember	CO1	CLO3	AHSB06.03
18	Define the term Conjugate harmonic function.	If two harmonic functions u and v satisfy the Cauchy-Reimann equations in a domain D and they are real and imaginary parts of an analytic function f in D then v is said to be a conjugate harmonic function of u in D.If f(z)=u+iv is an analytic function and if u and v satisfy Laplace's equation ,then u and v are called conjugate harmonic functions.	Remember	CO1	CLO3	AHSB06.03
19	State Milne Thomson method.	$f'(z)$ express completely in terms of z by replacing x by z and y by zero.	Understand	CO1	CLO3	AHSB06.03
20	Define the term Harmonic Conjugate.	Given a function *u*(*x*,*y*) harmonic in an open disk, then we can find another harmonic function *v*(*x*,*y*) so that *u* + *iv* is an analytic function of *z* in the disk. Such a function *v* is called a *harmonic conjugate* of *u*.	Remember	CO1	CLO3	AHSB06.03
MODULE-II						
1	Define the term	A line integral is an integral	Remember	CO2	CLO6	AHSB06.06

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	line integral.	where the function to be integrated is evaluated along a curve. we define $\int_a^b F(t)\,dt = \int_a^b u(t)\,dt + i\int_a^b v(t)\,dt$				
2	What is real part of $\int_a^b F(t)dt$?	The real part of $\int_a^b F(t)dt$ is $\int_a^b u(t)dt$	Understand	CO2	CLO6	AHSB06.06
3	What is imaginary part of $\int_a^b F(t)dt$	The imaginary part of $\int_a^b F(t)dt$ is $\int_a^b v(t)dt$	Understand	CO2	CLO6	AHSB06.06
4	Define the term Indefinite integral.	The integral $\int f(z)dz$ is called indefinite integral.	Remember	CO2	CLO6	AHSB06.06
5	Define the Singular point.	A point at which a function f(z) is not analytic is called a singular point .	Remember	CO2	CLO6	AHSB06.06
6	Define the term Contour.	A continuous arc without multiple point is called contour.	Remember	CO2	CLO6	AHSB06.06
7	Define the term Continuous function.	A function f(z) is said to be continuous at $z=z_0$,if $f(z_0)$ is defined and $\underset{z\to z_0}{Lt}\ f(z) = f(z_0)$	Remember	CO2	CLO6	AHSB06.06
8	Define the Laplace equation.	If f(z) is analytic function in a domain D, then U and v satisfies the equation $\frac{\partial^2}{\partial x^2} + \frac{\partial^2}{\partial y^2}$ =0	Remember	CO2	CLO6	AHSB06.06
9	Define the term Orthogonality.	Two curves intersecting at a point p are said to intersect orthogonally.	Remember	CO2	CLO6	AHSB06.06
10	Express the Laplacian operator.	The operator $\nabla = \frac{\partial^2}{\partial x^2} + \frac{\partial^2}{\partial y^2}$ is called Laplacian operator.	Remember	CO2	CLO6	AHSB06.06
11	Define the term Simple closed curve.	A curve which does not intersect is called a simple closed curve.	Remember	CO2	CLO6	AHSB06.06
12	What do you mean by the term Line integral?	A line integral is just an integral of a function along a path or curve. In this case, the curve is a straight line – a segment of the x-axis that starts at x = a and ends at x = b.	Remember	CO2	CLO6	AHSB06.06
13	What is Path independence?	We say the integral f(z) dz is path independent if it has the same value for any two paths with the same endpoints.	Remember	CO2	CLO6	AHSB06.06

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14	Explain extension statement of Cauchy's theorem?	Cauchy's theorem requires that the function f(z) be analytic on a simply connected region. In cases where it is not, we can extend it in a useful way. Suppose R is the region between the two simple closed curves C1 and C2. Note, both C1 and C2 are oriented in a counterclockwise direction.	Understand	CO2	CLO6	AHSB06.06
15	What is a Domain?	An open and connected subset G ⊆ C is called a domain.	Understand	CO2	CLO6	AHSB06.06
16	State Cauchy Integral theorem.	let F(z)=u(x,y)+iv(x,y) be analytic on and within a simple closed contour (or curve) 'c' and let f '(z) be continuous there,then and if integral f(z)dz is equal to zero	Understand	CO2	CLO7	AHSB06.07
17	State Cauchy Integral formula.	Let f(z) be an analytic function everywhere on and within a closed contour c. If z=a is any point within c then $f(a)=\frac{1}{2\pi i}\int_c \frac{f(z)}{(z-a)}dz$ where the integral is taken in the positive sense around c.	Understand	CO2	CLO7	AHSB06.07
18	State generalization of Cauchy integral formula.	Let f(z) be an analytic function everywhere on and within a closed contour c. If z=a is any point within c then $f^n(a)=\frac{n!}{2\pi i}\int_c \frac{f(z)}{(z-a)^{n+1}}dz$	Understand	CO2	CLO7	AHSB06.07
		MODULE-III				
1	Define the term Power series.	A series of the form $\sum a_n z^n$ is called as power series. That is $\sum a_n z^n = a_1 z + a_2 z^2 + ...+ a_n z^n + ...$	Remember	CO3	CLO8	AHSB06.08
2	State Taylor's series.	The Taylor series is an infinite series, whereas a Taylor polynomial is a polynomial of degree n and has a finite number of terms. The form of a Taylor polynomial of degree n for a function f (z) at x = a is $f(z)=f(a)+f'(a)(z-a)+f''(0)\frac{(z)^2}{2!}+.....$ $........\|z-a\|<r$	Remember	CO3	CLO10	AHSB06.10

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3	State Maclaurine series.	A Maclaurine series is a Taylor series expansion of a function about x=0, $f(z) = f(0) + f^{'}(0)z) + f^{''}(0)\frac{(z)^2}{2!} + f^{'''}(0)\frac{(z)^3}{3!} + ...$	Remember	CO3	CLO10	AHSB06.10
4	State Laurent series.	The Laurent series for a complex function *f*(*z*) about a point *c* is given by: $$f(z) = \sum_{n=-\infty}^{\infty} a_n (z-a)^n$$ $$f(z) = \sum_{n=0}^{\infty} a_n (z-a)^n + \sum_{n=1}^{\infty} b_n \frac{1}{(z-a)^n}$$ where the a_n *and a* are constants.	Remember	CO3	CLO10	AHSB06.10
5	Name the two parts in Laurent series.	Principal part and Analytic part	Remember	CO3	CLO10	AHSB06.10
6	Define Zero's of an analytic function.	A zero of an analytic function f(z) is a value of z such that f(z)=0 .Particularly a point a is called a zero of an analytic function f (z) if f(a) = 0.	Remember	CO3	CLO12	AHSB06.12
7	Define Zero's of m^{th} order.	If an analytic function f(z) can be expressed in the form $f(z) = (z-a)^m \Phi(z)$ where $\Phi(z)$ is analytic function and $\Phi(a) \neq 0$ then z=a is called zero of m^{th} order of the function f(z).	Remember	CO3	CLO12	AHSB06.12
8	Define the term Isolated singular points.	A singular point z_0 is called an isolated singular point of an analytic function f(z) if there exists a deleted ε-spherical neighborhood of z_0 that contains no singularity. If no such neighborhood can be found, z_0 is called a non-isolated singular point.	Remember	CO3	CLO12	AHSB06.12
9	Define the term Non-isolated singular points.	A singular point z_0 is called an isolated singular point of an analytic function f(z) if there exists a deleted ε-spherical neighborhood of z_0 that contains no singularity. If no such neighborhood can be found, z_0 is called a non-isolated singular point.	Remember	CO3	CLO12	AHSB06.12
10	Define the term Simple pole.	A pole of order one is called a simple pole.	Remember	CO3	CLO12	AHSB06.12
11	Define the term Removable singular point.	An isolated singular point z_0 such that f can be defined, or redefined, at z_0 in such a way as to be analytic at z_0. A	Remember	CO3	CLO12	AHSB06.12

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		singular point z_0 is removable if $\lim_{z \to z_0} f(z) exist$.				
12	Define the term Essential singular point.	A singular point that is not a pole or removable singularity is called an essential singular point.	Remember	CO3	CLO12	AHSB06.12
13	Define the term Residues at Poles.	If f(z) has a simple pole at z_0, then $\text{Res}[f, z_0] = \lim_{Z \to Z_0} (z - z_0) f(z)$	Remember	CO3	CLO12	AHSB06.12
14	State Cauchy's Residue Theorem.	$\int_c f(z)dz = 2\pi i \sum_{a \in A} \text{Res}_{z=a_i} f(z)$ Where A is the set of poles contained inside the contour	Understand	CO3	CLO12	AHSB06.12
15	Define the term Residue at infinity.	The residue at infinity is given by: $\text{Res}[f(z)]_{Z=\infty} = -\frac{1}{2\pi i} \int_C f(z)dz$ Where f is an analytic function except at finite number of singular points and C is a closed countour so all singular points lie inside it.	Remember	CO3	CLO12	AHSB06.12
MODULE-IV						
1	What do you mean by the term Exhaustive event?	The total number of events in any random experiment	Remember	CO4	CLO14	AHSB06.14
2	What do you mean by the term Mutually exclusive event?	It two or more events cannot obtain simultaneously in the same random experiment	Remember	CO4	CLO14	AHSB06.14
3	What do you mean by the term Equally likely event?	Two events are said to be equally likely events if they have equal chance of happening.	Remember	CO4	CLO14	AHSB06.14
4	Define the term Dependent event.	If one event is effected by the another event the n the two events are called dependent events	Remember	CO4	CLO14	AHSB06.14
5	What do you mean by the term Random experiment?	An experiment is said to be predictable if the result cannot be predicted	Remember	CO4	CLO14	AHSB06.14
6	Define the term Outcome of an experiment.	The result of the experiment	Remember	CO4	CLO14	AHSB06.14
7	What do you mean by the term sample space?	The collection of all possible outcomes in any random experiment.	Remember	CO4	CLO14	AHSB06.14
8	What do you mean by the term an Event?	A non empty subset of the sample space	Remember	CO4	CLO14	AHSB06.14
9	Define the term Independent event.	If one event is not effected by the another event the n the two	Remember	CO4	CLO14	AHSB06.14

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		events are called independent events				
10	What do you mean by the term is Favorable event?	The events which are favorable to one particular event in any random experiment	Remember	CO4	CLO14	AHSB06.14
11	Define the term Probability.	Consider any random experiment the total number of events are n out of them m events are favorable to a particular event E then P(E)=Favorable events/ total number of events	Understand	CO4	CLO14	AHSB06.14
12	What do you mean by the term Predictable experiment?	An experiment is said to be predictable if the result can be predicted	Remember	CO4	CLO14	AHSB06.14
13	Define the term Probability distribution.	If X is a random variable then P(X=x) is called probability distribution or probability function	Understand	CO4	CLO15	AHSB06.15
14	Define the term Random variable.	In any random experiment the sample space associated with a real number	Remember	CO4	CLO15	AHSB06.15
15	What do you mean by the term Discrete random variable?	A random variable is said to be discrete if the range of the random variable is finite	Remember	CO4	CLO15	AHSB06.15
16	What do you mean by the term Continuous random variable?	A random variable is said to be continuous if the range of the random variable is interval of two real numbers	Remember	CO4	CLO15	AHSB06.15
MODULE-V						
1	What is the mean of Binomial distribution?	The mean of binomial distribution is $\mu = np$	Understand	CO5	CLO17	AHSB06.17
2	What is the variance of Binomial distribution?	The variance of binomial distribution is $\sigma = npq$	Understand	CO5	CLO17	AHSB06.17
3	What is the standard deviation of Binomial distribution?	The standard deviation of binomial distribution is $\sigma = \sqrt{npq}$	Understand	CO5	CLO17	AHSB06.17
4	What do you mean by the term Bernuolli trial.	It is a random experiment having only two possible outcomes. Which are denoted by success and failure	Remember	CO5	CLO17	AHSB06.17
5	Define the term Binomial distribution.	Consider a random experiment having n trials. Let it succeed x times then the probability of getting x success is p^x , and the probability of n-x failures are q^{n-x} Therefore the probability of getting x success out of n trials are b(x,n,p) = P(X=X) = $n_{c_x} p^x q^{n-x}$, x=0,1,2…….n	Understand	CO5	CLO17	AHSB06.17

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6	Express the recurrence relation in Binomial distribution	P(x+1) = $\left\{\frac{n-x}{x+1}.\frac{p}{q}\right\}p(x)$	Remember	CO5	CLO17	AHSB06.17
7	Express the moment generating function of Binomial distribution	If X ~ B(n,p) then $M_X(t)$ = $(q+pe^t)^n$	Remember	CO5	CLO17	AHSB06.17
8	What is the mean of Poisson distribution?	The mean of Poisson distribution is $\mu = np$	Understand	CO5	CLO18	AHSB06.18
9	What is the variance of Poisson distribution?	The variance of Poisson distribution is λ	Understand	CO5	CLO19	AHSB06.18
10	What is the standard deviation of Poisson distribution?	The standard deviation of Poisson distribution is $\sigma = \sqrt{\lambda}$	Understand	CO5	CLO19	AHSB06.18
11	Define the term Poisson distribution.	A random variable X is said to follow a Poisson distribution if it assumes only non-negative values and its probability mass function is given by $f(x,\lambda) = P(X = x) = \frac{e^{-\lambda}.\lambda^x}{x!}, x = 0,1.....\infty$	Understand	CO5	CLO18	AHSB06.18
12	Express the recurrence relation in Poisson distribution	P(x+1) = $\frac{\lambda}{x+1}p(x)$	Remember	CO5	CLO18	AHSB06.18
13	Express the moment generating function of Poisson distribution	If X~ P(λ) then $M_X(t)$ = $e^{\lambda(e^t-1)}$	Remember	CO5	CLO18	AHSB06.18
14	What do you mean by the term mean of Normal distribution?	The mean of Normal distribution is $\mu = b$	Understand	CO5	CLO20	AHSB06.20
15	What do you mean by the term variance of Normal distribution?	The variance of Normal distribution is σ^2	Understand	CO5	CLO20	AHSB06.20
16	What do you mean by the term median of Normal distribution?	The median of Normal distribution is $\mu = M$	Understand	CO5	CLO20	AHSB06.20
17	Define the term Normal distribution.	If X is a continuous random variable μ, σ^2 are any two parameters then the normal distribution is denoted by $N(\mu,\sigma^2) = P(X_1 \le X \le X_2) = \frac{1}{\sigma\sqrt{2\pi}}e^{-\frac{1}{2}\left(\frac{x-m}{\sigma}\right)^2}, -\infty < X < \infty$	Understand	CO5	CLO20	AHSB06.20

S.No	QUESTION	ANSWER	Blooms Level	CO	CLO	CLO Code
18	What do you mean by the term Normal curve?	Normal curve is bell shape. It is symmetric about $x = \mu$ and z = 0. The total area in a normal distribution is unity.	Remember	CO5	CLO20	AHSB06.20
19	Express the point of inflexion in Normal distribution	The points of inflexion of the curve are given by x = $\mu \pm \sigma$, f(x) = $\frac{1}{\sigma\sqrt{2\pi}} e^{-1/2}$	Remember	CO5	CLO20	AHSB06.20
20	Express the area properties of Normal distribution	$P(\mu - \sigma < X < \mu + \sigma) = 0.6826 = P(-1 < Z < 1)$ $P(\mu - 2\sigma < X < \mu + 2\sigma) = 0.9544 = P(-2 < Z < 2)$ $P(\mu - 3\sigma < X < \mu + 3\sigma) = 0.9973 = P(-3 < Z < 3$ $P(\|Z\| > 3) = 0.0027$	Remember	CO5	CLO20	AHSB06.20
21	Express the moment generating function of Normal distribution	If $X \sim N(\mu, \sigma^2)$ then $M_X(t) = e^{\mu t} + t^2\sigma^2/2$	Remember	CO5	CLO20	AHSB06.20

Signature of the Faculty

Signature of HOD