KHAIRA COLLEGE, KHAIRA, BALASORE

DEPARTMENT OF PHYSICS

QUESTION BANK

UG 4th Sem - CC – VIII

Answer all questions

1- Answer the following : [1mark]

a) The value of $(i)^{30}$ = ________ .

b) The point at which a function is not analytic is called _____ .

c) Write the complex form of Fourier integral representation.

d) The Fourier transform of $e^{-x^2/2}$ simply repeats itself. (True/ False)

e) If f(k) is the Fourier transform of f(t) the Fourier transform of f(t$\pm$a) is ________ .

f) Write heat flow equation in ID.

g) L$\{t^5\}$= ______ .

h) Define Laplace transform.

i) Write Polar form of Cauchy – Riemann equations.

j) Find Laurent series of $f(z) = \frac{1}{1-z}$.

k) Find the residue of $f(z) = z\cos\left(\frac{1}{z}\right)$ at singular points.

l) Find Fourier sine Transform of e^{-at}.

m) What is the value of A(W) if $f(x) = e^{-kx}$?

n) One dimension Heat conduction is given by $\frac{\partial u}{\partial t} = c^2 \frac{\partial^2 u}{\partial x^2}$. (True/ false)

o) What is the value of L{cosat}?

p) The value of $L^{-1}\left\{\frac{3}{S-2}\right\}$ is ______ .

2- Answer the following (Very short type) :- [1.5 marks]

a) Prove that $\overline{z_1 + z_2} = \overline{z_1} + \overline{z_2}$.

b) Find Polar form of $z = \sqrt{2} - i$.

c) Obtain Taylor series of $\frac{1}{1+z}$ about z = 0.

d) State convolution theorems of Laplace transform.

e) Find cube roots of -11 -2i.

f) Define Laplace transform.

g) Find Laplace transform of e^{3t}.

h) Find Fourier sine transform of $\frac{1}{x}$.

i) Find the complex Fourier transform of $e^{-|x|}$.

j) Write second shifting theorem of inverse Laplace theorem.

k) Find the complex conjugate of $\frac{1+2i}{1-i}$.

l) State Cauchy's Integral theorem.

m) Find $\oint \frac{e^2}{z^2+9}dz$ inside C if |z| = 2 is C.

n) Find the Taylor's series expansion of f(z)=sin z about z = 0.

o) Find Fourier sine transform of a^{-at}.

p) State convolution theorem.

q) Prove change of scale property of Fourier transform.

r) Find Laplace's transform of $e^{3t} + e^{-2t}$.

s) Find the Laplace's transform of f(t) = t.

t) Write Linearity property of Inverse Laplace's transform.

3- Answer the following (Sort type) :- [2 marks]

a) Find the location of inverse of 4 – 3i in the argand diagram.

b) State necessary and sufficient condition for a function to be analytic.

c) Find the analytic function f(z) – u+iv, if $v(x,y) = y^2 - x^2$.

d) Define zeroes and singular point of a complex function.

e) Find the Fourier cosine integral representation of

$$f(x) = \begin{cases} \sin x\,, & 0 \le x \le \pi \\ 0, & x > \pi \end{cases}$$

f) Prove shifting property of Fourier transform.

g) Write down the properties if Dirac delta function.

h) Find the value of $\int xe^{-3x} \sin x \ dx$.

i) Find Laplace transform of first derivative of f(t).

j) Find f(t) whose Laplace transform is $F(s) = \frac{1}{s(s-a)}$.

k) Find the roots of $z^{1/3}$ if z = 4 +3i.

l) Write Euler's formula.

m) Explain the Fourier transform of change of scale property.

n) Separate log e^7 into real and imaginary part.

o) Find the residue of $f(z) = \frac{1}{z^2+1}$.

p) Find the expression of Fourier transform of its derivatives.

q) Find inverse Laplace transform of $\frac{1}{(S+2)^3}$.

r) State and prove second shifting property of Laplace transform.

s) Find Fourier transform of Dirac delta Fourier zero.

t) State Cauchy's integral formula.

4- Answer the followings (Long type) :- [6marks]

a) State and prove Cauchy Riemann condition for analytic function.

b) State and prove Laurent series expansion.

c) i) Using Fourier integral. Find the expression for Fourier transform.

ii) Find the Fourier consine transform of

$$f(x) \begin{matrix} = 1 \\ = 0 \end{matrix} \left.\right\} \begin{matrix} if\ |x| < 1 \\ if\ |x| > 1 \end{matrix}$$

d) State and prove Fourier integral theore.

e) Find the Fourier transform of nth derivative of f(x).

f) State and prove convolution theorem for Fourier transform.

g) What is the Periodic function. Find the Laplace's transform of periodic function.

h) Give a solution of differential equation of an electric circuit 'D' containing R and L in series connected with emf E using Laplace's transform.

i) Define Cauchy-Reimann conditions in polar form.

j) State and prove Cauchy's Residue theorem in multiply connected region.

k) Find the Fourier transform of Gaussian distribution function f(x) = Ne^{-ax^2}.

l) Derive expression for Fourier sine and cosine transform of 1st derivatives.

m) Find a solution of heat flow equation in ID using Fourier transform.

n) Find Laplace transform f(t) = t^n, n= 0,1,2,…….

o) Using Laplace's transform solve the differential equation $y'' + 2y' + 5y = e^{-x}\sin x$.

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