Printed Page:- Subject Code:- AAS0301B

Roll. No:

NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA

(An Autonomous Institute Affiliated to AKTU, Lucknow)

B.Tech.

SEM: III - THEORY EXAMINATION (2021 - 2022) (ONLINE)

Subject: Engineering Mathematics III

Time: 02:00 Hours Max. Marks: 100

General Instructions:

1. *All questions are compulsory. It comprises of two Sections A and B.*

- *Section A - Question No- 1 has 35 objective type questions carrying 2 marks each.*
- *Section B - Question No- 2 has 12 subjective type questions carrying 3 marks each. You have to attempt any 10 out of 12 question.*
- *No sheet should be left blank. Any written material after a Blank sheet will not be evaluated/checked.*

SECTION A 35 x 2 = 70

1. Attempt ALL parts:-

1.1.a Analytic function is also known as [CO1] 1

(a) Regular function

(b) Holomorphic function

(c) Both A & B

(d) None of these

1.1.b *For the circle* $z+2-i=2$, *centre and radius are* [CO1] 1

(a) $-2+i,2$

(b) $-i,2$

(c) $2-i,2$

(d) $2,2$

1.1.c *If* $f(z)=\frac{z}{z^2+9}$ *then* [CO1] 1

(a) $f(z)$ *is continuous*

(b) $f(z)$ *is discontinuous at* $z=\pm 3i$

(c) $\lim_{z\to i}\frac{z}{z^2+9}=\frac{i}{8}$

(d) *Both B & C*

1.1.d There exists no analytic function $f(z)$ if CO-1 1

(a) $real\, f(z)=y-2x$

(b) $real\, f(z)=y^2-2x$

(c) $real\, f(z)=y^2-x^2$

(d) $real\, f(z)=y-x$

1.1.e Which of the following is true? CO-1 1

(a) $z-\bar{z}=|z|^2$, where z is complex number

(b) $z+\bar{z}=|z|^2$, where z is complex number

(c) $z\bar{z}=|z|^2$, where z is complex number

(d) None of These

1.1.f Bilinear Transformation is also known as [CO1] 1

(a) Mobius Transformation
(b) Fractional Linear Transformation
(c) Both A & B
(d) None of these

1.1.g Inversion transformation maps a circle in z-plane [CO1] 1

(a) To circle in w-plane
(b) To circle or straight line in w-plane
(c) To straight line in w-plane
(d) None of these

1.2.a 1

The value of the complex integral $\int_c \frac{\cos z}{z^{2n+1}} dz$, where c is $|z| = 1$ is [CO2[

(a) $2\pi i$
(b) $2\pi i(-1)^n$
(c) $\frac{2\pi i(-1)^n}{n!}$
(d) $\frac{2\pi i(-1)^n}{(2n)!}$

1.2.b Residue at $z = 0$ of the function $f(z) = z^2 \sin(1/z)$ is [CO2] 1

(a) -1/6
(b) 1/6
(c) 0
(d) 2/3

1.2.c 1

The value of $\int_c \frac{zdz}{\sin z}$ where C:$|z| = 4$ is [CO2]

(a) -1
(b) 1
(c) 0
(d) 1/2

1.2.d Residue of $z \cos(1/z)$ at $z = 0$ is [CO2] 1

(a) 0
(b) 1
(c) -1/2
(d) 1/2

1.2.e The region of validity for Taylor's series about $z = 0$ of the function e^z is [CO2] 1

(a) $|z| = 0$
(b) $|z| < 1$
(c) $|z| > 1$
(d) $|z| < \infty$

1.2.f The region of validity for Taylor's series about z = 0 of the function 1/(z+1) is [CO2] 1

(a) $|z| = 1$
(b) $|z| < 1$
(c) $|z| > 1$
(d) None of these

1.2.g If $f(z)$ = 1

$\frac{\sin z}{z}$, then $z = 0$ is [CO2]

(a) Removable singularity

(b) Isolated singularity

(c) Essential singularity

(d) None of these

1.3.a *If two ends of a bar of length l is insulated then what are the conditions to solve* $1-d$ *heat equation*? [CO3] 1

(a) $u_x(0,t) = u_x(l,t) = 0$

(b) $u_t(0,t) = u_t(l,t) = 0$

(c) $u_x(0,t) = u_t(l,t) = 0$

(d) *None of these*

1.3.b *In one dimensional heat flow the condition on temperature is* [CO3] 1

(a) Temperature always increases

(b) Temperature decreases as time increase

(c) Temperature always decreases

(d) Temperature remains same

1.3.c *Which of the following is a two − dimensional wave equation*? [CO3] 1

(a) $\frac{\partial u}{\partial t} = c^2\left(\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2}\right)$

(b) $u = c^2\left(\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2}\right)$

(c) $\frac{\partial^2 u}{\partial t^2} = c^2\left(\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2}\right)$

(d) $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$

1.3.d *The solution of PDE* $(D+4D'+5)^2 z = 0$ *is* [CO3] 1

(a) $z = e^{-5x} f_1(y-4x) + xe^{-5x} f_2(y-4x)$

(b) $z = e^{-5x} f_1(y+4x) + xe^{-5x} f_2(y+4x)$

(c) $z = e^{5x} f_1(y+4x) + xe^{5x} f_2(y+4x)$

(d) *None of these*

1.3.e *The Particular integral of PDE* $(D^2 - DD' + D' - 1)z = \cos(x+2y)$ *is* [CO3] 1

(a) $z = \frac{1}{2}\cos(x+2y)$

(b) $z = \frac{1}{2}\sin(x+2y)$

(c) $z = \frac{x}{2}\sin(x+2y)$

(d) *None of these*

1.3.f *Particular Integral of the PDE* $x^2D^2 - 2xyDD' + y^2D'^2)z = x^m y^n$ *is* [CO3] 1

(a) $P.I. = \frac{x^m y^n}{(m+n)(m+n-1)}$

(b) $P.I. = \frac{x^m y^n}{(m+n)(m+n+1)}$

(c) $P.I. = \dfrac{x^m y^n}{(m-n)(m-n+1)}$

(d) $P.I. = \dfrac{x^m y^n}{(m-n)(m-n-1)}$

1.3.g *Solution of the PDE* $DD'(D+2D'+1)z = 0$ *is* [CO3] 1

(a) $z = f_1(y) + f_2(x) + e^x f_3(y-2x)$

(b) $z = f_1(y) + f_2(x) + e^x f_3(y+2x)$

(c) $z = f_1(y) + f_2(x) + f_3(y+2x)$

(d) $z = f_1(y) + f_2(x) + e^{-x} f_3(y-2x)$

1.4.a *The inverse Fourier Transform of* $f(p) = e^{-2p}u(p)$ *is* [CO4] 1

(a) $\dfrac{1}{2\pi(2+ix)}$

(b) $\dfrac{1}{2\pi(2-ix)}$

(c) $\dfrac{1}{2(2+ix)}$

(d) $\dfrac{1}{\pi(2+ix)}$

1.4.b Which of the following are even functions [CO4] 1

(a) x^3

(b) $x^2 - 6x$

(c) $\cos x + x^3 \sin x$

(d) $x\cos x$

1.4.c *Solve by* $Z-$*Transform:* $y_{k+1} + y_k = 1$ *if* $y_0 = 1$ [CO4] 1

(a) $(-1)^k$

(b) $(-1)^k u(k)$

(c) $\dfrac{1}{2}\{1-(-1)^k\}$

(d) $\dfrac{(-1)^k}{k}$

1.4.d 1

The inverse $Z-$*transform of* $\dfrac{z^2}{(z-a)^2}$ *is* [CO4]

(a) a^k

(b) ka^k

(c) $a^k u(k)$

(d) $(k+1)a^k$

1.4.e *If* $F[F(x)] = f(p)$ *then by Modulation theorem* $F[F(x)\cos ax]$ *is* [CO4] 1

(a) $f(ap)$

(b) $\dfrac{1}{2}[f(p+a) + f(p-a)]$

(c) $\dfrac{1}{2}[f(p+a) - f(p-a)]$

(d) $f(p+a) - f(p-a)$

1.4.f *What is the* $Z-$*transform of* $f(k) = \{2, 4, 5\uparrow, 7, 0, 1\}$ [CO4] 1

(a) $2 + 4z + 5z^2 + 7z^3 + z^4$

(b) $2 + 4z + 5z^2 + 7z^3 + z^5$

(c) $2 + 4z^{-1} + 5z^{-2} + 7z^{-3} + z^{-5}$

(d) $2z^2 + 4z + 5 + 7z^{-1} + z^{-3}$

1.4.g *The Fourier Transform of* $F(x) = e^{-a\,x}$, $a > 0$. [CO4] 1

(a) $\frac{2a}{p^2 - a^2}$

(b) $\frac{2a}{p^2 + a^2}$

(c) $\frac{2a}{a^2 - p^2}$

(d) $\frac{a}{a^2 + p^2}$

1.5.a A and B together can do a piece of work in 30 days. A having worked for 16 days, B finishes the remaining work alone in 44 days. In how many days shall B finish the whole work alone ? (CO 5) 1

(a) 30 days

(b) 40 days

(c) 60 days

(d) 70 days

1.5.b A can finish a work in 18 days and B can do the same work in half the time taken by A. Then, working together, what part of the same work they can finish in a day? (CO 5) 1

(a) 1/6

(b) 1/9

(c) 2/5

(d) 2/7

1.5.c One pipe can fill a tank three times as fast as another pipe. If together the two pipes can fill the tank in 36 minutes, then the slower pipe alone will be able to fill the tank in (CO 5) 1

(a) 81 min

(b) 108 min

(c) 144 min

(d) 192 min

1.5.d Bucket P has thrice the capacity as bucket Q. It takes 60 turns for bucket P to fill the empty drum. How many turns will it take for both the buckets P and Q, having each turn together to fill the empty drum? (CO 5) 1

(a) 30

(b) 40

(c) 45

(d) 90

1.5.e Train A passes a lamp post in 9 seconds and 700 meter long platform in 30 seconds. How much time will the same train take to cross a platform which is 800 meters long? (in seconds) (CO 5) 1

(a) 32

(b) 31

(c) 33

(d) 30

1.5.f A car is driven at the speed of 100 km/hr and stops for 10 minutes at the end of every 150 km. To cover a distance of 1000 km, it will take (CO 5) 1

(a) 9 hours
(b) 10 hours
(c) 11 hours
(d) 12 hours

1.5.g A boat goes 8 km in one hour along the stream and 2 km in one hour against the stream. The speed in km/hr of the stream is (CO 5) 1

(a) 2
(b) 3
(c) 4
(d) 5

SECTION B 10 X 3 = 30

2. Answer any TEN of the following:-

2.1.a Show that the function $f(z)=\overline{z}$ is not differentiable at origin ? [CO1] 2

2.1.b Find the fixed points under the transformation $w=\frac{2z-5}{z+4}$. (CO1) 2

2.2.a *Evaluate*: $\int_0^{2\pi}\frac{d\theta}{5-3\cos\theta}$ [CO2] 2

2.2.b *Find the residue of* $f(z)=\frac{z^3}{z^2-1}$ *at* $z=\infty$.[CO2] 2

2.2.c *Expand* $\frac{1}{(z+1)(z+2)}$ *in the regions* $|z|<1$ [CO2] 2

2.3.a *Find the P.I. of* $2s+t-3q=5\cos(3x-2y)$ [CO3] 2

2.3.b *Find the P.I. of* $(2D^2-3DD'+D'^2)z=e^{x+2y}$ [CO3] 2

2.3.c *Solve the PDE*: $(D-5D'+1)^2z=0$ [CO3] 2

2.4.a *Find* $z-Transformof\{a^k\}, k\geq 0.$ [CO4] 2

2.4.b Find z-transform of unit impulse function. [CO4] 2

2.5.a A tap can fill a tank in 6 hours. After half the tank is filled, three more similar taps are opened. What is the total time taken to fill the tank completely? CO 5 2

2.5.b A boat takes half time in moving a certain distance downstream than upstream. What is the ratio between the rate in still water and the rate of current? CO 5 2