

Time: 90 minutes

MATHEMATICS-II (15A54201)

Date: 08/05/2017

(COMMON TO CE&ME)

Max.Marks:30

PART-A (5 X 2 = 10M)

ANSWER ALL QUESTIONS.EACH QUESTION CARRY EQUAL MARKS

	Marks	Unit	CO	Cognitive level
1 a State and prove Linearity Property of <i>Fourier transform</i>	2	III	C110.4	Remember
b Find the Fourier cosine transforms of $e^{-ax} \cos ax, a > 0$	2	III	C110.4	Apply
c Find $Z(n^p)$	2	V	C110.6	Apply
d Find $Z[(\cos \theta + i \sin \theta)^n]$. Hence evaluate $Z(\cos n\theta)$ and $Z(\sin n\theta)$	2	V	C110.6	Apply
e Form the P.D.E by eliminating arbitrary constants a & b from $z = ax + by + \frac{a}{b} - b^2$	2	IV	C110.5	Apply

PART-B (2 X 10= 20M)

ANSWER ALL QUESTIONS

2. A) Express $f(x) = \begin{cases} \frac{\pi}{2}, & \text{for } 0 \leq x \leq \pi \\ 0, & \text{for } x > \pi \end{cases}$ as a Fourier Sine integral and hence evaluate $\int_0^{\infty} \frac{1-\cos(\pi\lambda)}{\lambda} \sin(x\lambda) d\lambda$

Marks	Unit	CO	Cognitive level
5	III	C110.4	Analyze

B) Find the F.T of $f(x)$ defined by $f(x) = e^{-\frac{x^2}{2}}, -\infty < x < \infty$ and show that $f(x)$ is a self-reciprocal function

Marks	Unit	CO	Cognitive level
5	III	C110.4	Apply

(OR)

3. A) Find $Z^{-1} \left[\frac{z}{z^2+11z+24} \right]$

Marks	Unit	CO	Cognitive level
5	V	C110.6	Apply

B) Use Convolution theorem to evaluate $Z^{-1} \left[\left(\frac{z}{z-a} \right)^3 \right]$

Marks	Unit	CO	Cognitive level
5	V	C110.6	Evaluate

4.A) Using the Z –transform, Solve $4u_n - u_{n+2} = 0$ given that $u_0 = 0, u_1 = 2$

Marks	Unit	CO	Cognitive level
5	V	C110.6	Evaluate

B) Find $Z \left(\frac{1}{n(n+1)} \right)$

Marks	Unit	CO	Cognitive level
5	V	C110.6	Apply

(OR)

5. Solve by the method of Separation of variables $u_x = 2u_t + u$, where $u(x, 0) = 6e^{-3x}$

Marks	Unit	CO	Cognitive level
5	IV	C110.5	Apply

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ANSWER ALL QUESTIONS.EACH QUESTION CARRY EQUAL MARKS

	Marks	Unit	CO	Cognitive level
1 a State and prove Shifting Property of Fourier Transform	2	III	C110.4	Remember
b State and prove Change of Scale property of z -transforms	2	V	C110.6	Remember
c Use Convolution theorem to evaluate $Z^{-1} \left[\frac{z^2}{(z-4)(z-5)} \right]$	2	V	C110.6	Evaluate
d Form the P.D.E by eliminating arbitrary constants from $z = (x-a)^2 + (y-b)^2 = z^2 \cot^2 \alpha$ where α is a parameter	2	IV	C110.5	Apply
e Form the P.D.E by eliminating arbitrary functions from $xyz = f(x^2 + y^2 + z^2)$	2	IV	C110.5	Apply

PART-B (2 X 10 = 20M)

ANSWER ALL QUESTIONS

2. Find the Fourier sine and cosine transforms of $f(x) = \frac{e^{-x}}{x}$ and hence deduce that

$$\int_0^{\infty} \frac{e^{-ax} - e^{-bx}}{x} \sin x \, dx = \tan^{-1} \left(\frac{s}{a} \right) - \tan^{-1} \left(\frac{s}{b} \right)$$

Marks	Unit	CO	Cognitive level
10	III	C110.4	Apply

(OR)

3. Show that the Fourier transform of $f(x) = \begin{cases} 1-x^2 & \text{if } |x| < 1 \\ 0 & \text{if } |x| > 1 \end{cases}$ is $\frac{4}{p^3} (\sin p - p \cos p)$. Using

Parseval's identity prove that $\int_0^{\infty} \left(\frac{\sin x - x \cos x}{d^3} \right) dx = \frac{\pi}{15}$

Marks	Unit	CO	Cognitive level
10	III	C110.4	Analyze

4. A) Find $Z^{-1} \left[\frac{3z^2+z}{(5z-1)(5z+2)} \right]$

Marks	Unit	CO	Cognitive level
5	V	C110.6	Apply

B) Solve the difference equation, using Z -transform $u_{n+2} - 3u_{n+1} + 2u_n = 0$ given that $u_0 = 0, u_1 = 1$

Marks	Unit	CO	Cognitive level
5	V	C110.6	Apply

(OR)

5. Solve $\frac{\partial^2 u}{\partial x \partial t} = e^{-t} \cos x$, given that $u = 0$ when $t = 0$ and $\frac{\partial u}{\partial t} = 0$, when $x = 0$

Marks	Unit	CO	Cognitive level
5	V	C110.5	Apply

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PART-A (5 X 2 = 10M)

ANSWER ALL QUESTIONS.EACH QUESTION CARRY EQUAL MARKS

	Marks	Unit	CO	Cognitive level
1 a State and prove Modulation Theorem of Fourier Transform	2	III	C110.4	Remember
b Find the Fourier cosine transforms of $e^{-ax}, a > 0$	2	III	C110.4	Apply
c Find (i) $Z(na^n)$ (ii) $Z\left(\frac{1}{n}\right)$	2	V	C110.6	Apply
d Find $Z(a^n \cos nt)$	2	V	C110.6	Apply
e Form the P.D.E by eliminating arbitrary constants a & b from $\log(az - 1) = x + ay + b$	2	IV	C110.5	Apply

PART-B (2 X 10 = 20M)

ANSWER ALL QUESTIONS

2. A) Using Fourier integral, Show that $e^{-ax} - e^{-bx} = \frac{2(b^2 - a^2)}{\pi} \int_0^\infty \frac{\lambda \sin \lambda x d\lambda}{(\lambda^2 + a^2)(\lambda^2 + b^2)}, a, b > 0$

Marks	Unit	CO	Cognitive level
5	III	C110.4	Evaluate

B) Evaluate the following using Parseval's identity a) $\int_0^\infty \frac{x^2}{(a^2 + x^2)^2} dx (a > 0)$ (b) $\int_0^\infty \frac{dx}{(a^2 + x^2)^2} (a > 0)$

Marks	Unit	CO	Cognitive level
5	III	C110.4	Evaluate

OR

3. A) State and prove Shifting property of z –transforms

Marks	Unit	CO	Cognitive level
5	V	C110.6	Remember

B) Find i) $Z(n^3)$ ii) $Z(n^4)$

Marks	Unit	CO	Cognitive level
5	V	C110.6	Apply

4. A) Find $Z^{-1} \left[\frac{8z - z^3}{(4 - z)^3} \right]$

Marks	Unit	CO	Cognitive level
5	V	C110.6	Apply

B) Using the Z –transform, Solve $y_{n+2} + 2y_{n-1} + y_n = n$ given that $y_0 = y_1 = 0$

Marks	Unit	CO	Cognitive level
5	V	C110.6	Apply

OR

5. Solve by the method of separation of variables $u_x = 4u_y$ with $u(0, y) = 8e^{-3y}$

Marks	Unit	CO	Cognitive level
10	IV	C110.5	Apply

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ANSWER ALL QUESTIONS.EACH QUESTION CARRY EQUAL MARKS

	Marks	Unit	CO	Cognitive level
1 a Find the Fourier Sine Transforms of $f(x) = e^{-ax} \sin ax, a > 0$	2	III	C110.4	Apply
b Find $Z^{-1} \left[\frac{z^2}{(z-a)(z-b)} \right]$ using Convolution theorem	2	V	C110.6	Apply
c Find $Z[e^{-an} \cos n\theta]$	2	V	C110.6	Apply
d Form the P.D.E by eliminating arbitrary functions $f(x)$ & $g(x)$ from $z = f(x) + e^y g(x)$	2	IV	C110.5	Apply
e Form the P.D.E by eliminating arbitrary constants a & b from $2z = (x + a)^{1/2} + (y - a)^{1/2} + b$	2	IV	C110.5	Apply

PART-B (2 X 10 = 20M)

ANSWER ALL QUESTIONS

2. Find the Fourier transform of $f(x) = \begin{cases} a^2 - x^2, & \text{for } |x| < a \\ 0, & \text{for } |x| > a > 0 \end{cases}$. Hence show that $\int_0^\infty \frac{\sin x - x \cos x}{x^3} dx = \frac{\pi}{4}$

Marks	Unit	CO	Cognitive level
5	III	C110.4	Evaluate

(OR)

3. A) Find $Z^{-1} \left[\frac{2z^2 + 3z}{(z+2)(z-4)} \right]$

Marks	Unit	CO	Cognitive level
5	V	C110.4	Apply

B) Find $Z^{-1} \left[\frac{4z^2 - 2z}{z^3 - 5z^2 + 8z - 4} \right]$

Marks	Unit	CO	Cognitive level
5	V	C110.4	Apply

4. A) Form the P.D.E by eliminating arbitrary constants a, b, c from $\frac{x^2}{a^2} + \frac{y^2}{b^2} + \frac{z^2}{c^2} = 1$

Marks	Unit	CO	Cognitive level
5	IV	C110.6	Apply

B) Solve by the method of Separation of variables $2x z_x - 3y z_y = 0$

Marks	Unit	CO	Cognitive level
5	IV	C110.5	Apply

(OR)

5. A tightly stretched string of length l has its ends fastened at $x = 0, x = l$ the midpoint of the string is then taken to height ' h ' and then released from rest in that position. Find the lateral displacement of a point of the string at time ' t ' from the instant of release.

Marks	Unit	CO	Cognitive level
5	IV	C110.5	Apply