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CS/B.TECH (ECE) (Separate Supple)/SEM-7/EC-704B/2011

2011 ADVANCED MATHEMATICS FOR ELECTRONICS **ENGINEERING**

Time Allotted: 3 Hours Full Marks: 70

The figures in the margin indicate full marks. Candidates are required to give their answers in their own words as far as practicable.

GROUP - A (Multiple Choice Type Questions)

Choose the correct alternatives of the following:

 $10 \times 1 = 10$

i) The solution to the partial differential equation
$$z = px + qy + p^4 + q^5 \text{ is}$$

a)
$$z = ax + by + a^4 + b^5$$

b)
$$z = ax + by$$

c)
$$z = ax + by + a^2 + b^2$$

d)
$$z = ax - by$$

ii)
$$\frac{d}{dx} (x^{-n} J_n)$$
 is equal to

a)
$$x^n J_{n-}$$

a)
$$x^n J_{n-1}$$
 b) $x^{n-1} J_{n-1}$

c)
$$x^{n+1}J_{n-1}$$
 d) $x^{-n}J_{n+1}$

$$d) x^{-n}J_{n+}$$

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- iii) The value of a skew-symmetric determinant of odd order is always
 - a) 1

- b) 0
- perfect square
- d) odd.
- The value of $\int_{-1}^{1} P_m(x) P_n(x) dx$, $m \neq n$ is equal to:
 - a) 0

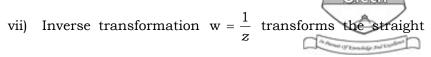
- c) $\frac{n}{2n-1}$
- d) $\frac{2}{2n+1}$
- v) $L(e^{at}t^n)$ is equal to
 - a) $\frac{b}{(s-a)^2 b^2}$ b) $\frac{s-a}{(s-a)^2 + b^2}$

 - c) $\frac{n!}{(s-a)^{n+1}}$ d) $\frac{s}{(s-a)^2-b^2}$
- The Fourier cosine transform of $\frac{1}{x}$ is:

b) $\sqrt{\frac{\pi}{2}}$

c) $\sqrt{\frac{2}{\pi}}$

d) $\sqrt{\frac{1}{2}}$.



line ay + bx + 0 into

- circle a)
- straight line through origin b)
- straight line c)
- d) none of these.

viii) Let
$$L\{f(t)\} = \frac{s^2}{4s+1}$$
, then the Laplace Transform of

the function f(st) is

a)
$$\frac{s^2}{4s+5}$$

a)
$$\frac{s^2}{4s+5}$$
 b) $\frac{s^2}{100s+5}$

c)
$$\frac{s^2}{25(4s+5)}$$
 d) $\frac{s^2}{s+1}$.

d)
$$\frac{s^2}{s+1}$$

For Legendre polynomial of degree n, P_2 (x) is equal to ix)

b)
$$\frac{1}{2}(3x^2-1)$$

c)
$$\frac{1}{2}(x^2-3)$$

c)
$$\frac{1}{2}(x^2-3)$$
 d) $\frac{1}{2}(5x^3-3x)$.

- The value of $\int \frac{dz}{z^2 (z-3)}$, where C: |z| = 2 is
 - a)

c)
$$2\pi i$$

d)
$$-\frac{2\pi i}{9}$$
.

GROUP - B

(Short Answer Type Questions

Answer any three of the following.

$$3 \times 5 = 15$$

2. Find out the eigenvalue and corresponding eigenvectors of the following matrix:

$$A = \begin{pmatrix} 2 & 1 & 1 \\ 2 & 3 & 2 \\ 3 & 3 & 4 \end{pmatrix}_{3 \times 3}$$

3. Solve the following partial differential equation:

$$(x^2 - yz)p + (y^2 - zx)q = (z^2 - xy)$$

4. Prove that the function $f(z) = \begin{cases} \frac{x^3(1+i)-y^3(1-i)}{x^2+u^2} \end{cases}$

if $z \neq 0$

$$= 0 if z = 0$$

satisfies C-R equations at the origin but f'(0) does not exist.

5. Using the properties of the determinant show that

$$\begin{vmatrix} a+b+2c & a & b \\ c & b+c+2a & b \\ c & a & c+a+2b \end{vmatrix} = 2(a+b+c)^3$$

- Prove that : $4J_n^{//}(x) = J_{n-2}(x) 2J_n(x) + J_{n+2}(x)$ Find : $L^{-1}\left\{\frac{2s^2 1}{(s^2 + 1)(s^2 + 4)}\right\}$

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GROUP - C

(Long Answer Type Questions)

Answer any three of the following.

$$3 \times 15 = 45$$

- 8. a) Find the Fourier cosine transform of e^{-x^2}
 - b) Solve completely the equation $\frac{\partial^2 y}{\partial t^2} = C2 \frac{\partial^2 y}{\partial x^2}$, representing the vibration of a string of length L, fixed at both ends, subject to the condition.
 - i) y(o, t) = 0
 - ii) y(l, t) = 0
 - iii) y(x, o) = f(x)

iv)
$$\frac{\partial y(x, o)}{\partial t} = 0$$
, $o < x < l$

7 + 8

9. a) Using residue theorem show that

$$\int_{0}^{2\pi} \frac{d\theta}{1+a\sin\theta} = \frac{2\pi}{\sqrt{1-a^2}}, \left(-1 \langle a \langle 1 \rangle\right)$$

b) Using convolution theorem evaluate:

$$L^{-1} \left\{ \frac{s}{\left(s^2 + a^2\right)^2} \right\}$$

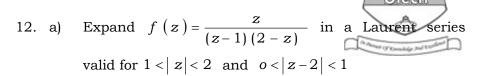
c) If A and B are Hermitian matrices, then show that

$$6 + 5 + 4$$

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- 10. a) Find the Fourier transform of f(x), given by $f(x) = \begin{cases} 1 x^2, & \text{if } |x| < |\\ o, & \text{if } |x| > | \end{cases}$ Hence show that $\int_{0}^{\infty} \left(\frac{x \cos x \sin x}{x^3} \right) \cos \frac{x}{2} \, dx = -\frac{3\pi}{16}$
 - b) Solve the partial differential equation. $\left(D^2 + DD' 6D'^2 \right) z = y \cos x$ where $D = \frac{\partial}{\partial x}$ and $D' = \frac{\partial}{\partial u}$
 - c) Determine and classify the singular points of $f(z) = \frac{z}{e^z 1}$ 6 + 5 + 4
- 11. a) Show that the transformation $w = \frac{5-4z}{4z-2}$ maps the unit circle |z|=1 into a circle of radius unity and centre $\left(-\frac{1}{2},o\right)$
 - b) Given $v(x, y) = x^4 6x^2y^2 + y^4$. Find f(z) = u(x, y) + iv(x, y) such that f(z) is analytic.
 - c) Find out the complete integral of the partial differential equation : $\sqrt{p} + \sqrt{q} = 2x$ where, $p = \frac{\partial z}{\partial x}$ and $q = \frac{\partial z}{\partial y}$ 5 + 5 + 5



- b) Prove the Rodrigues formula : $P_n(x) = \frac{1}{2^n \lfloor n} \frac{d^n}{dx^n} \left[(x^2 1)^n \right]$
- c) Construct Green's function for the boundary value problem

$$u'' - u = x$$
, $u(o) = u(1) = 0$ 5 + 5 + 5