

Name : .....

Roll No. : .....

Invigilator's Signature : .....

**CS/B.Tech (ECE-NEW)/SEM-7/EC-704B/2010-11**

**2010-11**

**ADVANCED ENGINEERING 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 )**

1. Choose the correct alternatives for any *ten* of the following :

$$10 \times 1 = 10$$

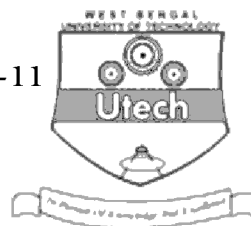
- i) If  $A = (a_{ij})$  be an  $n \times n$  matrix and  $A_{rs}$  be the cofactor  $a_{rs}$  in  $\det A$ , then

a)  $\det (A_{ij}) = [\det (a_{ij})]^{n-1}$

b)  $\det (A_{ij}) = [\det (a_{ij})]^n$

c)  $\det (A_{ij}) = [\det (a_{ij})]^{1-n}$

- d) none of these.



ii) The value of  $J_{1/2}(x)$  is equal to

- a)  $\sqrt{\frac{2}{\pi x}} \sin x$
- b)  $\sqrt{\frac{b}{\pi x}} \tan x$
- c)  $\sqrt{\frac{2}{\pi x}} \cos x$
- d)  $\sqrt{\frac{2}{\pi x}} \sec x.$

iii) The Fourier sine transform of  $\frac{1}{x}$  is

- a) 1
- b)  $\frac{\pi}{2}$
- c) 0
- d)  $\pi.$

iv) Let  $A$  be an orthogonal matrix of order 2 having two eigenvalues  $\lambda_1$  and  $\lambda_2$ . Then the eigenvalues of  $A^{-1}$  are

- a)  $\frac{1}{\lambda_1}, \frac{1}{\lambda_2}$
- b)  $\lambda_1, \lambda_2$
- c)  $\lambda_1 + \lambda_2, \lambda_1 - \lambda_2$
- d)  $\lambda_1^2, \lambda_2^2.$



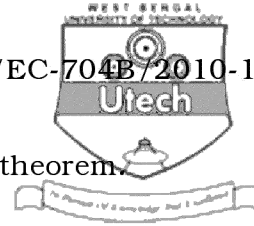
- v) The eigenvalues of a real skew-symmetric matrix are
- purely imaginary or zero
  - real
  - 0
  - none of these.
- vi) The general solution of  $(D^2 - 3DD' + 2D'^2)z = e^{2x-y}$  is given by
- $z(x, y) = f(x + y) + g(2x + y) + \frac{1}{12}e^{2x-y}$
  - $z(x, y) = f(x + y) + g(2x + y) - \frac{1}{12}e^{2x-y}$
  - $z(x, y) = f(x - y) + g(2x - y) - \frac{1}{6}e^{2x-y}$
  - $z(x, y) = f(x - y) + g(2x + y) + \frac{1}{6}e^{2x-y}$
- vii) The function  $f(z) = |z|^2$  is
- continuous nowhere
  - continuous everywhere but nowhere differentiable
  - continuous everywhere but nowhere differentiable except at the origin
  - continuous at origin only.

- GROUP – B**

Answer any *three* of the following.

2. Show that  $\frac{d}{dx} [x^n J_n(x)] = x^n J_{n-1}(x)$ .

3. Solve :  $z^2(x^2p^2 + y^2q^2) = 1$



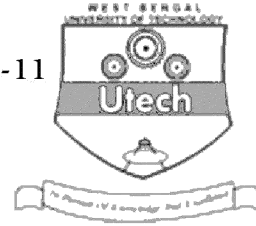
4. Evaluate  $L^{-1} \left\{ \frac{1}{s^2 (s+1)^2} \right\}$  using convolution theorem.
5. Show that for a matrix  $A = \begin{pmatrix} 1 & -3 & 3 \\ 3 & -5 & 3 \\ 6 & -6 & 4 \end{pmatrix}$ , product of eigenvalues of  $A = -|A|$ .
6. Using contour integration evaluate  $\int_0^\pi \frac{1+2 \cos \theta}{5+4 \cos \theta} d\theta$ .

**GROUP - C**

**( Long Answer Type Questions )**

Answer any *three* of the following.  $3 \times 15 = 45$

7. a) Find the Fourier cosine transform of  $e^{-x^2}$ .
- b) Solve completely the equation  $\frac{\partial^2 y}{\partial t^2} = e^2 \frac{\partial^2 y}{\partial x^2}$ , representing the vibration of a string of length  $l$ , fixed at both ends, subject to the condition
- i)  $y(0, t) = 0$
- ii)  $y(l, t) = 0$
- iii)  $y(x, 0) = f(x)$
- iv)  $\frac{\partial y(x, 0)}{\partial t} = 0, 0 < x < l$ . 7 + 8



8. a) Using residue theorem show that

$$\int_0^{2\pi} \frac{d\theta}{1+a \sin \theta} = \frac{2\pi}{\sqrt{1-a^2}}, \quad (-1 < a < 1)$$

- b) Using convolution theorem evaluate :

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

9. a) Expand  $f(z) = \sin z$  in a Taylor series about  $z = \pi/4$  and determine the region of convergence of this series.

- b) Determine the region of  $w$ -plane into which the region bounded by  $x = 1$ ,  $y = 1$  and  $x + y = 1$  is mapped by the transformation  $w = z^2$ . 10 + 5

10. a) State and prove Rodrigue's formula.

- b) Prove that  $\int P_m(x) P_n(x) dx = 0$ , where  $m \neq n$ ,  $P_m(x), P_n(x)$

being Legendre polynomials of order  $m$  &  $n$  respectively.

- c) Prove that  $J_n(x) = \frac{x}{2n} [J_{n-1}(x) + J_{n+1}(x)]$ ,  $J_n(x)$  being

Bessel's function of order  $n$ .

6 + 4 + 5



11. a) Applying elementary row operation find the rank of the

matrix  $\begin{pmatrix} 1 & 2 & 1 & 0 \\ 2 & 4 & 8 & 6 \\ 0 & 0 & 5 & 8 \\ 3 & 6 & 6 & 3 \end{pmatrix}$ .

- b) Diagonalize the matrix  $\begin{pmatrix} 3 & 2 & 1 \\ 2 & 3 & 1 \\ 0 & 0 & 1 \end{pmatrix}$ .

- c) Determine  $\alpha$ ,  $\beta$ ,  $\gamma$  so that the matrix  $\begin{pmatrix} 0 & 2\beta & \gamma \\ \alpha & \beta & -\gamma \\ \alpha & -\beta & \gamma \end{pmatrix}$  is

orthogonal.

5 + 5 + 5

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