M.E. DEGREE EXAMINATIONS: DECEMBER – 2008

First Semester

P07MA105 APPLIED MATHEMATICS FOR ELECTRONICS ENGINEERS

(Common to Applied Electronics and Communication Systems Branches)

Time: Three Hours

Maximum Marks: 100

Answer ALL Questions:-

PART A (20 x 1 = 20 Marks)

1. In Gauss elimination method, the coefficient matrix is transformed to

 a) Singular matrix
 b) Unit matrix

 c) Upper triangular matrix
 d) Lower triangular matrix.

2. In Gauss- seidal method the coefficient matrix should be

 a) Diagonally dominant
 b Diagonally not dominant

 c) Symmetric
 d) Skew-symmetric

3. Using Jacobi's method for finding eigen values of the matrix if the matrix is

 a) Singular
 b) Symmetric

 c) Non-symmetric
 d) Skew-symmetric

4. By the use of power method we can find

 a) All the eigen values
 b) Least eigen value

 c) Largest eigen value
 d) No eigen values

5. The type of partial differential equation $\dfrac{\partial^2 f}{\partial x^2} + 2\dfrac{\partial^2 f}{\partial x \partial y} + 4\dfrac{\partial^2 f}{\partial y^2} = 0$ is

 a) Parabolic
 b) Elliptic

 c) Hyperbolic
 d) Non-elliptic

6. The D'Alembert's solution of one dimensional wave equation

 a) $\dfrac{1}{2}[f(x+at)+f(x-at)]$
 b) $\dfrac{1}{4}[(f(x+at)+f(x-at)]$

 c) $\dfrac{1}{2}[f'(x+at)+f'(x-at)]$
 d) $\dfrac{1}{4}[f'(x+at)+f'(x-at]$

7. If $L[u(x,t),s] = U(x,s)$ then $L\left[\dfrac{\partial^2 u}{\partial x^2}, s\right] =$

 a) $\dfrac{d}{dx}[U(x,s)]$
 b) $\dfrac{d^2}{dx^2}[U(x,s)]$

 c) $sU(x,s) - u(x,0)$
 d) $s^2\, U(x,s) - s\, u(x,0) - u_t(x,0)$

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8. In one dimensional wave equation $\frac{\partial^2 u}{\partial t^2} = c^2 \frac{\partial^2 u}{\partial x^2}$, c^2 stands for

    a) $\frac{T}{m}$ b) $\frac{m}{T}$ c) Tm   d) $\frac{T^2}{m}$

9. In Bessel function the value of $J_0(x)$ is

    a) 0   b) 1   c) ½   d) 2

10. $\frac{d}{dx}\left[x^{-n} J_n(x)\right] =$

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

11. In Legendre polynomial the value of $P_1(x)$ is

    a) 1   b) x   c) 1/x   d) x^2

12. $P'_{n+1}(x) - P'_{n-1}(x) =$

    a) $(2n-1)P_n(x)$ b) $(1-2n)P_n(x)$ c) $(2n+1)P_n(x)$ d) $(n+2)P_n(x)$

13. A continuous random variable X has a pdf $f(x) = kx^2 e^{-x}$, $x \geq 0$ then value of k is

    a) 3/2   b) 1/3   c) 2   d) 1/2

14. In a binomial distribution the value of the mean is

    a) npq   b) pq   c) np   d) nq

15. The value of moment generating function in exponential distribution is

    a) $\frac{\lambda}{t-\lambda}$ b) $\frac{t}{\lambda-t}$ c) $\frac{t}{t-\lambda}$ d) $\frac{\lambda}{\lambda-t}$.

16. If X and Y are independent then cov (X,Y) is

    a) 1   b) -1 c) 0   d) ± 1

17. In Queuing model the traffic intensity ρ is

    a) $\frac{\mu}{\lambda}$ b) $\frac{\lambda}{\mu}$ c) $\lambda \mu$ d) $\frac{1}{\lambda}$

18. In the Pollazak- Khinchin formula the value of L_s is

    a) $\frac{\lambda^2 \sigma^2 + \rho^2}{2(1-\rho)} + \rho$ b) $\frac{\lambda^2 \sigma^2 + \rho^2}{2(1+\rho)} + \rho$

    c) $\frac{\lambda^2 \sigma^2 + \rho^2}{2(1-\rho)} - \rho$ d) $\frac{\lambda^2 \sigma^2 - \rho^2}{2(1+\rho)} + \rho$.

19. In M/M/1 model if the arrival rate is 4/min and the service rate is 6 per min, then the expected number of customers in the system is

    a) 2   b) 3   c) 4   d) 1

20. In Kandal's Notation (a/b/c): (d/e) 'b' denotes

    a) arrival time   b) service time

    c) queue discipline   d) Number of service stations.

PART B (5 x 16 = 80 Marks)

21. a. i) Using Jacobi method, find eigen values and vectors of $\begin{pmatrix} 1 & \sqrt{2} & 2 \\ \sqrt{2} & 3 & \sqrt{2} \\ 2 & \sqrt{2} & 1 \end{pmatrix}$. (8)

    ii) Solve $x + y + 54z = 110$; $27x + 6y - z = 85$; $6x + 15y + 2z = 72$ by Gauss Seidel method. (8)

(OR)

b. i) Using Power method, find the eigen value of $\begin{pmatrix} 5 & 0 & 1 \\ 0 & -2 & 0 \\ 1 & 0 & 5 \end{pmatrix}$ (8)

    ii) By Gauss Jordan method solve $10x+y+z=12$; $2x+10y+z=13$; $x+y+5z=7$. (8)

22. a. Using Laplace transforms solve the IBVP described by

    $u_{tt} = u_{xx}$, $0<x<1$, $t>0$.

    $u(0,t) = u(1,t) = 0$ $t>0$

    $u(x,0) = \sin\pi x$, $u_t(x,0) = -\sin\pi x$, $0<x<1$

    (16)

(OR)

b. Using the Laplace Transform method, solve the IBVP $\dfrac{\partial^2 u}{\partial x^2} = \dfrac{1}{c^2} \dfrac{\partial^2 u}{\partial t^2} - \cos wt$,

$0 \leq x \leq \infty$, $0 \leq t \leq \infty$ subject to the initial and boundary conditions u is bounded as

$x \to \infty$, $u(0,t)=0$, $\dfrac{\partial u}{\partial t}(x,0) = u(x,0) = 0$.

    (16)

23. a. i) Prove that $\pi J_n(x) = \int_0^\pi Cos(n\theta - xSin\theta) \, d\theta$

    (8)

    ii) Prove that $\int_{-1}^{1} P_n(x) P_m(x) dx = 0$.

    (8)

(OR)

b. i) Express $4X^3 - 2X^2 - 3X + 8$ in terms of Legendre polynomials. (8)

    ii) Prove that $\dfrac{d}{dx}\left[X^n J_n(x)\right] = X^n J_{n-1}(x)$ (8)

24. a. i) If $f(x,y) = \dfrac{6-x-y}{8}$, $0 \leq x \leq 2$, $2 \leq y \leq 4$. Find the correlation coefficient. (8)

ii) Assume that the current I and the resistance R are independent continuous random variables with the following p.d.f's.

$$I : g(i) = 2i, \quad 0 \leq i \leq 1 \text{ and } 0 \text{ elsewhere}$$

$$R: h(r) = \frac{r^2}{9}, \quad 0 \leq r \leq 3 \text{ and } 0 \text{ elsewhere.}$$

Find the p.d.f. of the random variable E defined by E=IR. (8)

(OR)

b. i) Suppose that the two-dimensional continuous random variable (X,Y) has the joint p.d.f given by

$$f(x,y) = \begin{cases} x^2 + kxy & , \ 0 \leq x \leq 1, \ 0 \leq y \leq 2 \\ 0, & \text{Otherwise.} \quad \text{Find } P(x+y \geq 1) \end{cases}$$ (8)

ii) Derive moment generating function about the origin of Normal distribution. (8)

25. a. A telephone exchange has two long distance operators. The telephone company finds that during the peak load, long distance calls arrive in Poisson fashion at an average of 15 per hour. The length of service on these calls in approximately exponentially distributed with mean length 5 minutes.

    i. What is the probability that a subscriber will have to wait his long distance call during the peak hours of the day?

    ii. If the subscribers will wait and are serviced in turn, what is the expected waiting time? (16)

(OR)

b. Automatic car wash facility operates with only one bay. Cars arrive according to a Poisson distribution, with a mean of 3 cars per hour and may wait in facility's parking lot if the bay is busy. If the service time for all cars is constant and equal to 15 minutes, determine Ls, Lq, Ws and Wq. (16)

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