Register Number……………………

M.E. DEGREE EXAMINATIONS: DECEMBER 2009

First Semester

MAT506: APPLIED MATHEMATICS FOR ELECTRONICS ENGINEERS

(Common to All M.E. Applied Electronics & M.E. Communication Systems)

Time: Three Hours **Maximum Marks: 100**

Answer ALL Questions:-

PART A (10 x 2 = 20 Marks)

1. Solve: $x - 2y = 0$; $2x+y = 5$ by Gauss elimination method.
2. Solve: $e^x = 3x$, correct to four decimal places, by the method of false position.
3. What are the solutions of one dimensional wave equation?
4. State D' Alemberts wave equation.
5. Prove that $2J_n' = J_{n-1} - J_{n+1}$
6. Express $f(x) = 2x^2 + x + 3$ in terms of Legendre polynomials.
7. Let x be a random variable with E(x) = 1 and E(X(X-1) = 4. Find var(x) and Var (2-3x).
8. The first four moments of a distribution about 4 are 1,4,10 and 45 respectively.
   Find μ_1, μ_2, μ_3.
9. In M / M / 1 queuing system. Find the probability that at least 'n'customers in the system.
10. State the characteristic of queuing theory.

PART B (5 x 16 = 80 Marks)

11. a) i) Solve: $e^{-x} = \sin x$ the roots lying between 0 and 1 by Newton – Raphson method. (8)

ii) Solve: $28x + 4y - z = 32$, $x + 3y + 10z = 24$, $2x + 17y + 4z = 35$ by Gauss – Jacobi method. (8)

(OR)

b) i) Solve: $2x + y + 4z = 12$, $8x - 3y + 2z = 20$, $4x + 11y - z = 33$ by Gauss elimination method (8)

ii). Find the dominant eigen value and the corresponding eigen vector of the matrix

$$A = \begin{bmatrix} 1 & 3 & -1 \\ 3 & 2 & 4 \\ -1 & 4 & 10 \end{bmatrix}$$ (8)

12. a) Solve $u_{tt} = c^2 u_{xx}$, $x > 0$, $t > 0$ subject to

$u(0, t) = A_0 \sin \omega t$, $t > 0$

$u(x, 0) = 0$

$u_t(x, 0) = 0$, $x > 0$ using by Laplace transform method.

(OR)

b) Given $u_{xx} = \frac{1}{C^2} u_{tt} + k$,

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

$u(x, 0) = u_t(x, 0) = 0$, $0 \le x \le l)$ $t > 0$

13. a) i) Prove that $J_{5/2}(x) = \sqrt{\left(\frac{2}{\pi x}\right)}\left\{\frac{3-x^2}{x^2}\sin x - \frac{3}{x}\cos x\right\}$ (6)

ii) Prove that $\int_{-1}^{1} P_m(x)P_n(x)dx = \begin{cases} 0, & m \ne n \\ \frac{2}{2n+1}, & m = n \end{cases}$ (10)

(OR)

b) i) Prove that $(2n+1)P_n(x) = P'_{n+1}(x) - P'_{n-1}(x)$. (8)

ii) If $f(x) = 0$, $-1 < x \le 0$

$= x$, $0 < x < 1$,

Show that $f(x) = \frac{1}{4}P_0(x) + \frac{1}{2}P_1(x) + \frac{5}{16}P_2(x) - \frac{3}{32}P_4(x) + \ldots\ldots$ (8)

14. a) i)A discrete random variable X has the probability function given below: (8)

Values of X	0	1	2	3	4	5	6	7
P(x)	0	k	2k	2k	3k	k^2	$2k^2$	$7k^2+k$

Find (i) the value of K

(ii) $P(X < 6)$, $P(X \ge 6)$ and $P(0) < X < 4)$

(iii) The distribution function of X.

ii) A continuous R.V X that can assume any value between x = 2 and x = 5 has the density function given by $f(x) = k(1+x)$. Find $P[X < 4]$ and $P[3 < X < 4]$. (8)

(OR)

b) i) A random variable X has probability function $p(x) = \frac{1}{2^x}, x = 1,2,3,...$ Find the M.G.F, Mean and Variance. (8)

ii) The first four moments of a distribution about the value 4 of the variables are -1.5, 17, -30, and 08. Find the mean, moments about the mean. Hence find the first four moments about x =2. (8)

15. a) Arrivals at a telephone booth are considered to be Poisson with an average time of 10 minutes between one arrival and the next. The length of phone call is assumed to be distributed exponentially with mean 3 minutes.

i) What is the probability that a person arriving at the booth will have to wait?

ii) The telephone department will install a second booth when convinced that an arrival would expect waiting for atleast 3 minutes for a phone call. Bu how much should the flow of arrivals increase in order to justify a second booth?

iii) What is the average length of the queue that form time to time?

iv) What is the probability that it will take him more than 10 minutes altogether to wait for the phone and complete his call?

(OR)

b) State and Prove Pollaczek – Khintchine formula.

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