Reg. No. : [ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ]

Question Paper Code : 40673

M.E./M.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2017
First Semester
Control and Instrumentation Engineering
MA7163 – APPLIED MATHEMATICS FOR ELECTRICAL ENGINEERS
(Common to M.E. Electrical Drives and Embedded Control/M.E. Embedded System Technologies/M.E. Power Electronics and Drives and M.E. Power Systems Engineering)
(Regulations 2013)

Time : Three Hours

Maximum : 100 Marks

Answer ALL questions
Use of statistical table is permitted

PART – A

(10×2=20 Marks)

1. Find a canonical basis for $A = \begin{pmatrix} 3 & 5 \\ -2 & -4 \end{pmatrix}$.

2. Obtain the Cholesky decomposition of the matrix $A = \begin{pmatrix} 9 & -3 \\ -3 & 2 \end{pmatrix}$.

3. Find the Euler-Ostrogradsky equation for the functional

$$I\left[u(x,y)\right] = \iint_D \left[\left(\frac{\partial u}{\partial x}\right)^2 + \left(\frac{\partial u}{\partial x}\right)^2\right] dxdy, \text{ where D is some closed region.}$$

4. On what curve can the functional $\int_0^1 \left[(y')^2 + 12xy\right] dx$, $y(0) = 0$ and $y(1) = 1$ be extremised ?

5. X is a continuous random variable uniformly distributed in the interval (0, 2). Let $Y = 4X + 3$. Find $f_Y(y)$ and $E(Y)$.

6. The probability of a bomb hitting a target is $\frac{1}{5}$. Two bombs are enough to destroy a bridge. If six bombs are aimed at the bridge, then find the probability that the bridge is destroyed.

7. What are slack and surplus variables ?

8. Write down the mathematical formulation of an assignment problem.

9. Find the average power of the periodic signal $f(t) = 2\cos 5\pi t + \sin 6\pi t$.

10. Write down self adjoint form of the following differential equation
$x^2y'' + 3xy' + \lambda y = 0$.

PART – B **(5×16=80 Marks)**

11. a) Construct a QR decomposition for the matrix $A = \begin{pmatrix} 4 & 2 & 2 \\ 3 & -3 & 3 \\ 6 & 6 & 0 \end{pmatrix}$. **(16)**

(OR)

b) Find the singular value decomposition of the matrix $A = \begin{pmatrix} 2 & -1 \\ -2 & 1 \\ 4 & -2 \end{pmatrix}$ and hence find its inverse. **(16)**

12. a) Find the shortest distance from the point A (–1, 5) to the parabola $y^2 = x$. **(16)**

(OR)

b) Solve the boundary value problem using Rayleigh-Ritz method (up to one term approximation); $y'' + y + x = 0$ with the boundary conditions $y(0) = 0 = y(1)$. **(16)**

13. a) i) A component has an exponential time to failure distribution with mean of 10,000 hours. The component has already been in operation for its mean life. What is the probability that it will fail by 15,000 hours ? At 15,000 hours the component is still in operation. What is the probability that it will operate for another 5000 hours ? **(10)**

ii) The number of accidents occurring in a city in a day is a Poisson variate with mean 0.8. Find the probability that on a randomly selected day
a) There are no accidents
b) There are 5 accidents. **(6)**

(OR)

b) i) Let X be a geometric random variable. Prove that X is memoryless. Find its moment generating function and hence its mean and variance. **(10)**

ii) If a random variable X follows Gamma distribution with variance 3, then find $P(|X|<1)$. **(6)**

14. a) Solve the following linear programming problem by simplex method : **(16)**

$$\text{Min } u = x - 3y + 2z$$

Subject to

$$3x - y + 2z \leq 7$$
$$-4x + 3y + 8z \leq 10$$
$$2x - 4y \geq -12$$
$$x, y, z \geq 0.$$

(OR)

b) Solve the transportation problem when the unit transportation costs, demands and supplies are as follows : **(16)**

	D_1	D_2	D_3	D_4	Supply
S_1	6	1	9	3	70
S_2	11	5	2	8	55
S_3	10	12	4	7	70
Demand	85	35	50	45	

15. a) Find the Fourier series for $f(x) = x^2$ in $-\pi < x < \pi$ and hence find the sum of the following series **(16)**

i) $\frac{1}{1^2} + \frac{1}{2^2} + \frac{1}{3^2} + \ldots$

ii) $\frac{1}{1^4} + \frac{1}{2^4} + \frac{1}{3^4} + \ldots$

(OR)

b) Find a generalized Fourier series for the function $f(x) = 1$ in terms of the eigen functions of $y'' + 4y' + (4 + 9\lambda)y = 0$, $y(0) = 0$, $y(2) = 0$. **(16)**