Reg. No. : | | | | | | | | | | |

Question Paper Code: 52164

M.E. DEGREE EXAMINATION, NOV 2016

First Semester

Structural Engineering

15PMA125 - APPLIED MATHEMATICS FOR STRUCTURAL ENGINEERING

(Regulation 2015)

Duration: Three hours Maximum: 100 Marks

Answer ALL Questions

PART A - (5 x 1 = 5 Marks)

1. $F\left[\frac{\partial^2 u}{\partial x^2}\right]$

   (a) $\alpha\ u(\alpha,t)$ (b) $\alpha^2\ u(\alpha,t)$ (c) $-\alpha\ u(\alpha,t)$ (d) $-\alpha^2\ u(\alpha,t)$

2. For one point Gaussian Quadrature the sampling point is at

   (a) $\xi = 0$ (b) $\xi = 2$ (c) $\xi = 3$ (d) $\xi = 1$

3. Suppose 'f' is independent of 'y' then the solution of Euler's equation is

   (a) $\frac{\partial F}{\partial y'} = c$ (b) $\frac{\partial F}{\partial y} = c$ (c) $\frac{\partial F}{\partial x} = c$ (d) $\frac{\partial F}{\partial x'} = c$

4. To find the smallest eigen values of the matrix then use

   (a) Faddeev-Leverrier Method (b) Power method
   (c) Rayley-Ritz method (d) Approximation Method

5. The maximum likelihood estimate are

   (a) Inconsistent (b) consistent
   (c) not biased (d) none of these

PART - B (5 x 3 = 15 Marks)

6. Define laplace transform of unit step function and find its Laplace transform.

7. Define Monte method.

8. If y is independent of y, then give the reduced form of the Euler's equation.

9. Find the largest eigen value of $\begin{bmatrix} 4 & 1 \\ 1 & 3 \end{bmatrix}$ by Power method.

10. Define un-biasedness of a good estimator.

PART - C (5 x 16 = 80 Marks)

11. (a) A string is stretched and fixed between two fixed points (0, 0) and (l, 0). Motion is initiated by displacing the string in the form u = $\sin\left(\frac{\pi x}{l}\right)$ and released from rest at time t=0.Find the displacement of any point on the string at any time t. (16)

Or

(b) Solve the following IBVP using the Laplace transform technique

PDE : $u_t = u_{xx}, \quad 0 < x < 1, \quad t > 0$

BCs : $u(0, t) = 1, \; u(1, t) = 1, \; t > 0$

ICs : $u(x, 0) = 1 + \sin \pi x, \; 0 < x < 1.$ (16)

12. (a) (i) Solve the equations by successive over relaxation method by assuming β = 1.2 with Starting vector is (1.5 , 0 , 3.5), $2x_1 - x_2 = 3$, $-x_1 + 2x_2 - x_3 = 0$, $-x_2 + 2x_3 = 7$. (8)

(ii) Solve the equation by Choleski method:

$4x + 6y + 8z = 0, \; 6x + 34y + 52z = -160, \; 8x + 52y + 129z = -452.$ (8)

Or

(b) (i) Using Gaussian three point formula evaluate $\int_{-1}^{1} \frac{x^2}{1+x^2}\,dx$ and compare with exact solution. (8)

(ii) Evaluate $\int_1^2 \int_1^2 \frac{dxdy}{x+y}$ by Gaussian quadrature formula. (8)

52164

13. (a) (i) By applying Ritz method, find the extremal of $I[y(x)] = \int_0^1 (y'^2 + y^2)\,dx$ with $y(0) = 0, y(1) = 1$. (8)

(ii) Find the plane curve of a fixed perimeter and maximum area. (8)

Or

(b) Show that the curve which extremizes the functional I = $\int_0^{\frac{\pi}{4}} (y''^2 - y^2 + x^2)\,dx$ under the conditions y(0) = 0 , y'(0) = 1 , $y(\frac{\pi}{4}) = y'(\frac{\pi}{4}) = \frac{1}{\sqrt{2}}$. (16)

14. (a) Find the resolvent of the matrix $A = \begin{pmatrix} -2 & -2 & -4 \\ 2 & 3 & 2 \\ 3 & 2 & 5 \end{pmatrix}$ by Faddeev-Leverrier method. (16)

Or

(b) Using Power method find all the Eigen values of $A = \begin{pmatrix} 1 & -3 & -2 \\ 4 & 4 & -1 \\ 6 & 3 & 5 \end{pmatrix}$. (16)

15. (a) Find the maximum likelihood estimate for the parameter λ of a Poisson distribution on the basis of a sample of size n. Also find its variance. Show that the sample mean $\bar{x}$ is sufficient for estimating the parameter λ of the Poisson distribution. (16)

Or

(b) (i) In a trivariate distribution $r_{12} = 0.7$, $r_{13} = r_{23} = 0.5$. Find the partial correlation coefficient $r_{12.3}$ and multiple correlation coefficients $R_{1.23}$. (8)

(ii) In a random sampling from normal population $N(\mu, \sigma^2)$, find the maximum likelihood estimators for μ when σ^2 is known. (8)
