C **Reg. No. :** | | | | | | | | | | |

Question Paper Code: 51025

M.E. DEGREE EXAMINATION, APRIL 2019

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. $F(e^{-x^2/2}) =$ CO1- R

   (a) $e^{s^2/2}$ (b) $e^{-x^2/2}$ (c) $e^{-s^2/2}$ (d) $e^{x^2/2}$

2. For one point Gaussian Quadrature the sampling point is at _________ CO2 -R

   (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 _________ CO3- R

   (a) $\frac{\partial F}{\partial y^1} = c$ (b) $\frac{\partial F}{\partial y} = c$ (c) $\frac{\partial F}{\partial x^1} = c$ (d) $\frac{\partial F}{\partial x} = c$

4. To find the smallest eigen values of the matrix then use _______ CO4 -R

   (a) Faddeev-Leverrier Method (b) Power Method

   (c) Rayley- Ritz Method (d) Approximation Method

5. Angle between the regression lines are parallel then ___________ CO5- R

   (a) $\theta = 0$ (b) $\theta = \frac{\pi}{2}$ (c) $\theta = \frac{\pi}{4}$ (d) $\theta = \pi$

PART – B (5 x 3= 15 Marks)

6. Define laplace transform of unit step function and find its Laplace transform. CO1-U

7. Define Rayleigh quotient of a Hermitian matrix. CO2-U

8. If y is independent of y, then give the reduced form of the Euler's equation. CO3-U

9. Define principle of least square. CO4-U

10. What are maximum likelihood estimators? CO5-U

PART – C (5 x 16= 80 Marks)

11. (a) Using the Laplace transform method, solve the IBVP described as CO1- App (16)

PDE: $u_{xx} = \frac{1}{c^2} u_{tt} - \cos \omega t, \quad 0 \le x < \infty, \quad 0 \le t < \infty$

BCs: $u(0, t) = 0$, u is bounded as x tends to ∞

ICs: $u_t(x, 0) = u(x, 0) = 0.$

Or

(b) 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 CO1- App (16)

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.

12. (a) (i) By relaxation method, solve CO2- App (8)

$12x + y + z = 31,\ 2x + 8y - z = 24,\ 3x + 4y + 10z = 58.$

(ii) Solve the equation by Choleski method CO2- App (8)

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

Or

(b) (i) Using Gaussian three point formula evaluate CO2- App (8)

$\int_{-1}^{1} \frac{x^2}{1+x^2}\, dx$ and compare with exact solution.

(ii) Evaluate $\int_{1}^{2} \frac{dx}{1+x^3}$ by Gaussian three point formula. CO2- App (8)

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13. (a) Find the external of the functional , CO3-App (16)

$$\int_0^{\pi/2}\left[2xy+\left(\frac{dx}{dt}\right)^2+\left(\frac{dy}{dt}\right)^2\right]dt,$$ given x(0)=0, x(π/2)= -1, y(0)=0 ,y(π/2)=1 .

Or

(b) Show that the curve which extremizes the functional CO3-App (16)

$$I=\int_0^{\frac{\pi}{4}}(y''^2-y^2+x^2)\,dx$$ under conditions

$y(0) = 0$, $y'(0) = 1$, $y(\frac{\pi}{4}) = y'(\frac{\pi}{4}) = \frac{1}{\sqrt{2}}$.

14. (a) Use Faddeev-Leverrier method to find the characteristic polynomial and inverse of the matrix CO4 -App (16)

$$A=\begin{bmatrix}2 & -1 & 1\\ -1 & 2 & 1\\ 1 & -1 & 2\end{bmatrix}.$$

Or

(b) Use Faddeev-Leverrier method to find the characteristic polynomial and inverse of the matrix. CO4 -App (16)

$$A=\begin{bmatrix}2 & -1 & 1\\ -1 & 2 & 1\\ 1 & -1 & 2\end{bmatrix}.$$

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. CO5-App (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 $R_{1.23}$. CO5-App (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. CO5-App (8)