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

Question Paper Code: 51Z25

M.E. DEGREE EXAMINATION, NOV 2018

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 a two point Gauss Hermite Quadrature then the weight is _____ CO2 -R

(a) -0.8862 (b) 0.8862 (c) 0.7071 (d) – 0.7071

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. Write down the One dimensional wave equation and explain the variables involved in it. CO1-U

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

8. Obtain the Euler's equation for the extremals of the functional CO3-App

$\int_{x_0}^{x_1} \left(y^2 - yy' + y'^2 \right) dx$.

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) Evaluate CO2- App (8)

$\int_1^2 \int_1^2 \frac{dxdy}{x + y}$ by Gaussian quadrature formula.

(ii) Evaluate $\int_1^2 \frac{dx}{1+x^3}$ by Gaussian three point formula. CO2- App (8)

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 the conditions

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

14. (a) Using power method find all the Eigen values of CO4 -App (16)

$$A = \begin{bmatrix} 1 & 6 & 1 \\ 1 & 2 & 0 \\ 0 & 0 & 3 \end{bmatrix}$$

Or

(b) Find the resolvent of the matrix CO4 -App (16)

$$A = \begin{pmatrix} -2 & -2 & -4 \\ 2 & 3 & 2 \\ 3 & 2 & 5 \end{pmatrix}$$ by Faddeev-Leverrier method.

15. (a) Find the maximum likelihood estimate for the parameter λ of a 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)