NMAM INSTITUTE OF TECHNOLOGY, NITTE
(An Autonomous Institution affiliated to VTU, Belagavi)
I Sem B.E. (Credit System) Mid Semester Examinations - II, October 2017
17MA101 – ENGINEERING MATHEMATICS – I

Max. Marks: 20

Duration: 1 Hour

Note: Answer any One full question from each Unit.

Marks   BT*

Unit – I

1. a) Using the power method, find the dominant eigen values and corresponding eigen vectors of the matrix $\begin{bmatrix} 1 & 3 & -1 \\ 3 & 2 & 4 \\ -1 & 4 & 10 \end{bmatrix}$ starting with the initial value $[1 \ 0 \ 0]^T$. Carry out 5 iterations   6   L3

   b) Reduce the quadratic form $3x^2 - 2y^2 - z^2 + 12yz + 8zx - 4xy$ to canonical form.   4   L2

2. a) Diagonalize the matrix $A = \begin{bmatrix} 3 & 1 \\ 1 & 3 \end{bmatrix}$. Hence find A^5.   6   L3

   b) i) Define an orthogonal linear transformation.

   ii) If $Y = AX$ is an orthogonal transformation with matrix A as follows $\begin{bmatrix} -2/3 & 1/3 & a/3 \\ 2/3 & 2/3 & b/3 \\ 1/3 & -2/3 & c/3 \end{bmatrix}$ find a,b,c   4   L2

Unit – II

3. a) With usual notation prove that $\tan\varphi = r\dfrac{d\theta}{dr}$.   5   L4

   b) In the ellipse $\dfrac{x^2}{a^2} + \dfrac{y^2}{b^2} = 1$, show that the radius of curvature at the end of the major axis is equal to the semi latus rectum.   5   L4

4. a) Find the angle between the curves $r = a(1 + \sin\theta), r = a(1 - \sin\theta)$.   4   L3

   b) Verify Cauchy's mean value theorem for the functions $f(x) = \log x, g(x) = \dfrac{1}{x}$ in [1,e].   3   L3

   c) For the curve $\theta = \cos^{-1}\left(\dfrac{r}{k}\right) - \dfrac{\sqrt{k^2 - r^2}}{r}$, prove that $r\dfrac{ds}{dr}$ is a constant.   3   L4

BT* Bloom's Taxonomy, L* Level

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Unit – I

1. a) Find the spectral and modal matrix of $\begin{bmatrix} 1 & 0 & 0 \\ 0 & 3 & -1 \\ 0 & -1 & 3 \end{bmatrix}$

   6   L*3

   b) i) Define a regular linear transformation.
   ii) Show that $y_1 = \cos\theta x_1 - \sin\theta x_2$, $y_2 = \sin\theta x_1 + \cos\theta x_2$ is a regular linear transformation. Hence find the inverse of this transformation.

   4   L2

2. a) Using the power method, find the dominant eigen values and corresponding eigen vectors of the matrix $\begin{bmatrix} 2 & -1 & 0 \\ -1 & 2 & -1 \\ 0 & -1 & 2 \end{bmatrix}$ starting with the initial value

   6   L3

   $[1 \ 0 \ 0]^T$. Carry out 5 iterations

   b) Reduce the quadratic form $8x^2 + 7y^2 + 3z^2 - 12xy - 8yz + 4zx$ to canonical form.

   4   L2

Unit – II

3. a) With usual notation prove that $\tan\varphi = r\dfrac{d\theta}{dr}$

   5   L3

   b) Show that the radius of curvature at $(a,0)$ on the curve $y^2 = \dfrac{a^2(a-x)}{x}$ is $\dfrac{a}{2}$.

   5   L4

   4   L3

4. a) State and prove Lagrange's mean value theorem.
   b) Find the angle of intersection of the cardioids
   $r = a(1+\cos\theta), r = b(1-\cos\theta)$

   4   L2

   c) Find $\dfrac{ds}{dr}$ for the curve $r^n = a^n \cos n\theta$.

   2   L2

BT* Bloom's Taxonomy, L* Level

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