CBCS SCHEME

USN

15MAT11

First Semester B.E. Degree Examination, June/July 2019

Engineering Mathematics - I

Time: 3 hrs. Max. Marks: 80

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. Find the n^{th} derivative of $\frac{7x+6}{2x^2+7x+6}$ (05 Marks)

b. Find the angle between the radius vector and the tangent for the curve $r^m = a^m(\cos m\theta + \sin m\theta)$. (05 Marks)

c. Show that the radius of curvature at any point θ on the cycloid x = a (θ + sinθ), y = a(1 - cos θ) is 4 acos(θ/2) (06 Marks)

OR

2 a. If x = sint and y = cosmt, prove that $(1-x^2)y_{n+2}$- (05 Marks)

b. Find the pedal equation of the curve $r = a^{-}$ sec 2θ. (05 Marks)

c. Prove with usual notation tan ϕ = $\frac{rd\theta}{dr}$. (06 Marks)

Module-2

3 a. Expand $e^{\sin x}$ using Maclaurin's series upto third degree term. (05 Marks)

b. Evaluate $\lim_{x \to 0} \left[\frac{1}{x^2} - \frac{1}{\sin^2 x} \right]$ (05 Marks)

c. If $u = e^{(ax+by)} f(ax - by)$, prove that $b\frac{\partial u}{\partial x} + a\frac{\partial u}{\partial y} = 2abu$ (06 Marks)

OR

4 a. Expand sin x in ascending power of $(x - \pi/2)$ upto the term containing x^4. (05 Marks)

b. If u = tan' (...) $\frac{}{x-y}$, show that $x u_x + y u_y$ = sin2u. (05 Marks)

c. If $u = \frac{yz}{x}$, $v = \frac{zx}{y}$, $w = \frac{xy}{z}$. Find $\frac{\partial(u,v,w)}{\partial(x,y,z)}$ (06 Marks)

Module-3

5 a. Find the angle between the surfaces $x^2 + y^2 + z^2 = 9$ and $x^2 + y^2 - z = 3$ at the point (2, -1, 2). (05 Marks)

b. **Show that F = (y + z)i +(x + z)j+(x +** y)k is irrotational. Also find a scalar function ϕ such that F = ∇ϕ. (05 Marks)

c. Prove that ∇ - (ϕ)X (ϕ(∇ • A) + ∇ϕ) • A. (06 Marks)

OR

6 a. Prove that Curl (ϕ A) = ϕ(Curl A) + gradϕ x A. (05 Marks)

b. A particle moves along the curve C : $x = t^3 - 4t$, $y = t^2 + 4t$, $z = 8t^2 - 3t^3$ where t denotes the time. Find the component of acceleration at t = 2 along the tangent. (05 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

c. Show that F = $(2xy^2 + yz)i + (2x^2y + xz + 2yz^2)j + (2y^2z + xy)k$ is a conservative force field. Find its scalar potential. **(06 Marks)**

Module-4

7 a. Obtain the reduction formula for $\int$ sing' x dx **(05 Marks)**

b. Solve $(y^2 ex''' + 4x^3)dx + (2xye'''' — 3y^2)dy = 0$. **(05 Marks)**

c. Find the orthogonal trajectories of r = a (l+sin0). **(06 Marks)**

OR

8 a. Evaluate $\int_{j}^{2}$ x-si2x — x^2 dx **(05 Marks)**

b. Solve $(y^3 — 3x^2y)dx — (x^3 — 3xy^2)dy = 0$. **(05 Marks)**

c. A bottle of mineral water at a room temperature of 72°F is kept in a refrigerator where the temperature is 44°F. After half an hour, water cooled to 61°F

i) What is the temperature of the mineral water in another half an hour?

ii) How long will it take to cool to 50°F? **(06 Marks)**

Module-5

9 a. Find the rank of the matrix

$$A = \begin{vmatrix} -1 & -3 & -1 \\ 1 & 2 & 3 & -1 \\ 1 & 0 & 1 & 1 \\ 0 & 1 & 1 & -1 \end{vmatrix}$$

(05 Marks)

b. Find the largest eigen value and corresponding eigenvector of the matrix

$$A = \begin{matrix} 6 & —2 & 2 \\ —2 & 3 & —1 \\ 2 & -1 & 3 \end{matrix}$$ by power method taking $X^{(n)}$ = [1, 1 **(05 Marks)**

c. Reduce the matrix $A = \begin{vmatrix} -1 & 3 \\ -2 & 4 \end{vmatrix}$ to the diagonal form. **(06 Marks)**

10 a. Use Gauss elimination method to solve

2x+y+4z=12

4x+11y—z=33

8x —3y + 2z = 20 **(05 Marks)**

b. Find the inverse transformation of the following lin ear transformation.

$y_1 = x_1 + 2x_2 + 5x_3$

$y_2 = 2x_1 + 4x_2 + 11x_3$

$y_3 = —x_2 + 2x_3$ **(05 Marks)**

c. Reduce the quadratic form 2x; + 2x + 2x + 2x ; x. to the Cannonical form. **(06 Marks)**