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)**

h Find the angle between the radius vector and the tangent for the curve r''' = a' (cosm0 +sinm0). **(05 Marks)**

c. Show that the radius of curvature at any point 0 on the cycloid x = a **(0 +** sing), y = a(l - cos 0) is 4 acos(0/2) **(06 Marks)**

OR

2 a. If x = sint and y = cosmt, prove that (1- x^2)y,,,2- **(05 Marks)**

b. Find the pedal equation of the curve r = a ¯ sec 20. **(05 Marks)**

c. Prove with usual notation tan 4) - $\frac{rd0}{dr}$. **(06 Marks)**

Module-2

a_ Expand e[l]' using Maclaurin's series upto third degree term. **(05 Marks)**

b. Evaluate liM x —>. 0 [I/X` 1/sin²x] **(05 Marks)**

C. **If** u = e('' ÷by) flax - by), prove that b $\frac{Ai}{ax}$ + a $\frac{au}{ay}$ = 2abu **(06 Marks)**

OR

4 a. Expand sin x **in** ascending power ofit/2 upto the term containing x^4. **(05 Marks)**

b. If u tan' (3 j_ 3 / x y), show that x u_x + y u_y = sin2u. **(05 Marks)**

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

Module-3

5 a. Find the angle between the surfaces x^2 + y¯ + z¯ = 9 and x¯ + y¯ 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 4) such that P = V4). **(05 Marks)**

c. Prove that V - (4)X (l)(V • A) + V4) • A . **(06 Marks)**

OR

6 a. Prove that Curl (4) A) = 4)(Curl A) + grad4) x X. **(05 Marks)**

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

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 $\int$ 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

$$A = \begin{vmatrix} -1 & --3 & -1^1 \\ 1 \quad 2 & 3 & -1 \\ 1 \quad 0 & 1 & 1 \\ 0 \quad 1 & 1 & -1 \end{vmatrix}$$ **(05 Marks)**

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

6 —2 2
A = — 2 3 —1 by power method taking $X^{(")}$ = [1, 1
2 -1 3 **(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, = x, +2x, $+5x_3$
y_2 = 2x, +4x, $+1 lx_3$
y_3 =—x, +2x; **(05 Marks)**

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