USN 8MAT11

First Semester B.E. Degree Examination, Dec.201klae.2020
Calculus and Linear Algebra

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. With usual notations prove that tan c = r $\frac{de'}{dr}$ (06 Marks)

h. Find the angle between the curves r = sine + cos() and r = 2 sin° (06 Marks)

c. Show that the radius of curvature for the catenary of uniform strength

y = a log sec $\frac{x}{a}$ is a sec (x/a). (08 Marks)

OR

2 a. Show that the pairs of curves r = a(1 + cost)) and r = b(1-cos0) intersect each other Orthogonally. (06 Marks)

b. Find the pedal equation of the curve r^n = a" cos ne. (06 Marks)

c. Show that the evolute of $y^2 = 4ax$ is $27ay^2 = 4(x + a)^3$. (08 Marks)

Module-2

3 a. Find the Macluarin's series for tanx upto the term x^4. (06 Marks)

b. Evaluate $\lim_{x} \left| \frac{a' + bx + c'}{3} \right|$ (07 Marks)

c. If = f(x-y, y-z, z-x), prove that - i7u + au + au = O (07 Marks)

OR

4 a. Expand log (sec x) upto the term containing x^4 using Maclaurin's series. (06 Marks)

b. Find the extreme values of the function $f(x, y) = x^3 + y^3 - 3x - 12y + 20$. (07 Marks)

Find $\frac{i)(11, v, w)}{0(x,, y, z)}$ where $u = x^2 + y^2 + z^2$, v = xy + yz + zx, w = x + y + z. (07 Marks)

Module-3

5 a. Evaluate $\int_0^{N1} \int_0^{1-x} \int_0^{1-x} xyz \, dzdydx$ (06 Marks)

b. Evaluate $\int_{-2}^{} \int_{0}^{\sqrt{4x}} (2 - x)dydx$ by changing the order of integration. (07 Marks)

c. Prove that 13(m, n) = $\frac{\overline{(m)} \cdot (n)}{}$ (07 Marks)

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OR

6 a. Evaluate $\int\int$ ydx dy over the region bounded by the first quadrant of the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$. **(06 Marks)**

b. Find by double integration the area enclosed by the curve r = a (1 + CosO) between 0 = 0 and 0 = 1t. **(07 Marks)**

c. Show that $\int^{\pi/2} \frac{}{\sqrt{\sin\theta}}$ x $\int \sqrt{\sin\theta}\, d\theta = \pi$. **(07 Marks)**

Module-4

7 a. Solve $\frac{dy}{dx} + \frac{y\cos x + \sin y + y}{\sin x + x\cos y + x} = 0$ **(06 Marks)**

b. Solve rSinO - Cos() $\frac{dr}{d\theta}$ = r' **(07 Marks)**

C. A series circuit with resistance R, inductance L and electromotive force E is governed by the differential equation L $\frac{di}{dt}$ + Ri = E , where L and R are constants and initially the current i is zero. Find the current at any time t. **(07 Marks)**

OR

8 a. Solve (4xy + 3y^2 – x)dx + x (x + 2y)dy = 0. **(06 Marks)**

b. Find the orthogonal trajectories of the family of parabolas y^1 = 4ax. **(07 Marks)**

c. Solve p" + 2py cotx = y$^{\cdot}$. **(07 Marks)**

9 a. Find the rank of $\begin{bmatrix} 1 & 2 & 3 & 2 \\ 2 & 3 & 5 & 1 \\ 1 & 3 & 4 & 5 \end{bmatrix}$ by elementary row transformations. **(06 Marks)**

b. Apply Gauss-Jordan method to solve the system of equations
$2x_1 + x_2 + 3x_3 = 1$,
4x, + 4x$_2$ + 7X3 = 1,
2x] + 5x2 + 9X3 = 3. **(07 Marks)**

c. Find the largest Eigen value and the corresponding Eigen vector of the matrix $A = \begin{bmatrix} 2 & 0 & 1 \\ 0 & 2 & 0 \\ 1 & 0 & 2 \end{bmatrix}$ by power method. Using initial vector $(100)^T$. **(07 Marks)**

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10 a. Solve by Gauss elimination method
x 2y + 3z --- 2,
3x y + 4z --- 4,
2x F y – 2z = 5 **(06 Marks)**

b. Solve the system of equations by Gauss-Seidal method
20x + y – 2z 17,
3x + 20y – z -18,
2x 3y + 20z 25 **(07 Marks)**

c. Reduce the matrix A = $\begin{bmatrix} -1 & 3 \\ & 4 \end{bmatrix}$ to the diagonal form. **(07 Marks)**