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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 $r^{a} = a^{n} \cos n\theta$. **(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 $\frac{\partial u}{\partial x} + \frac{\partial u}{\partial y} + \frac{\partial u}{\partial z} = 0$ **(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 $\frac{\partial(u, v, w)}{\partial(x, y, z)}$ where $u = x^2 + y^2 + z^2$, $v = xy + yz + zx$, $w = x + y + z$. **(07 Marks)**

Module-3

5 a. Evaluate $\int_0^{\log 2} \int_0^{x} \int_0^{x+y} xyz \, dz dy dx$ **(06 Marks)**

b. Evaluate $\int_{-2}^{2} \int_{0}^{x^2} (2 - x) dy dx$ by changing the order of integration. **(07 Marks)**

c. Prove that $\beta(m, n) = \frac{\Gamma(m) \cdot \Gamma(n)}{\Gamma(m+n)}$ **(07 Marks)**

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OR

6 a. Evaluate $\iint y\,dx\,dy$ 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 $r = a(1 + \cos\theta)$ between $\theta = 0$ and $\theta = \pi$. **(07 Marks)**

c. Show that $\int_{0}^{\pi/2} \frac{d\theta}{\sqrt{\sin\theta}} \times \int_{0}^{\pi/2} \sin^{6}\theta\, d\theta = \pi$. **(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 $r\sin\theta - \cos\theta\frac{dr}{d\theta} = r^2$ **(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 $y^2 = 4ax$. **(07 Marks)**

c. Solve $p^2 + 2py\cot x = y^2$. **(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
$2x_1 + x_2 + 3x_3 = 1$,
$4x_1 + 4x_2 + 7x_3 = 1$,
$2x_1 + 5x_2 + 9x_3 = 3$. **(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
$x + 2y + 3z = 2$,
$3x + y + 4z = 4$,
$2x + y - 2z = 5$ **(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)**

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