USN | | | | | | | | | | 14MAT11

First Semester B.E. Degree Examination, Dec.2014/Jan.2015
Engineering Mathematics - I

Time: 3 hrs. Max. Marks:100

Note: *Answer any FIVE full questions, selecting ONE full question from each part,*

PART – 1

1 a. If Y = cos(m log x) , prove that $x^2 y_{n+2} + (2n+1)xy_{n+1} + (m^2+n^2)y_n = 0$. (07 Marks)

b. Find the angle of intersection between the curves r = a log 0 and r = $\frac{a}{\log e}$ - (06 Marks)

c. Derive an expression to find radius of curvature in Cartesian form. (07 Marks)

2 a. If $\sin^{-1} y = 2\log(x+1)$ prove that $(x^2 +1)y_{n+2} \pm (2n+1)(x+1)y_{n+1} + (n^2+4)y_n = 0$. (07 Marks)

b. Find the pedal equation $r^n = \sec h n\theta$. (06 Marks)

c. 3 _ –3 2 2 8112 (07 Marks)

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PART – 2

3 a. Find the first four non zero terms in the expansion of f)= e . (07 Marks)

b. If $\cos u = \frac{x+y}{\sqrt{x}+\sqrt{y}}$ show that $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} = -\frac{\cot u}{2}$. (06 Marks)

c. Find $\frac{\partial(u, v, w)}{\partial(x, y, z)}$ where $u = x^2 + y^2 + z^2$, v = xy + yz + zx and w=x+y+z. Hence interpret the result. (07 Marks)

4 a. If w = f(x, y) , x = rcos0 , y = r sin 0 show that

$\left(\frac{\partial w}{\partial x}\right)^2 + \left(\frac{\partial w}{\partial y}\right)^2 = \left(\frac{\partial w}{\partial r}\right)^2 + \frac{1}{r^2}\left(\frac{\partial w}{\partial \theta}\right)^2$ (07 Marks)

b. Evaluate $\lim_{x\to 0} \left(\frac{\sin x}{x}\right)$; . (06 Marks)

c. Examine the function $f(x, y) = 1+\sin(x^2+y^2)$ for extremum. (07 Marks)

PART – 3

5 a. A particle moves along the curve $x = 2t^2$, $y = t^2 - 4t$, z = 3t -5 . Find the components of velocity and acceleration at t = 1 in the direction i -23+2k . (07 Marks)

b. Using differentiation under integral sign, evaluate $\int_0 \frac{e^{-ax}\sin x}{x}dx$. (07 Marks)

c. Use general rules to trace the curve $y^2(a-x) = x^3$, a > 0 (06 Marks)

Important Note : 1. On completing your answers, compulso... 2. Any revealing of identification, appeal t...

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6 a- If v = wx r , prove that | curly = 2w where w is | a constant vector. (07 Marks)

b. Show that div(curlA)= o . (06 Marks)

c. If r + yj + zk and | r | = r . Find grad div[— r/] . (07 Marks)

PART 4

Obtain the reduction formula for 'cos' ^{2} xdx . (07 Marks)

b Solve $(xy^3 + y)dx + 2(x^2y^2 + x + y^4)dy = 0$. (06 Marks)

c. Show that the orthogonal trajectories of the family of cardioids $r = a\cos^2(\frac{\theta}{2})$ is another family of cardio ids $r = b\sin^2(\frac{\theta}{2})$ (07 Marks)

8 a. Evaluate $\int_0^{\pi} x\sin^2 x \cos xdx$. (07 Marks)

b. Solve $\frac{dy}{dx}$ y tan x = y^2 sec x . (06 Marks)

c. If the temperature of the air is 30°C and t subs e cools from 100°C to 70°C in 15 minutes, find when the temperature will be 40° . (07 Marks)

PART—5

9 a. Solve — y + 2z =12 x +2,y +3z =11, 2x — 2y z = 2 by Gauss elimination method. (06 Marks)

b. Diagonalize the matrix, $A = \begin{bmatrix} -1 & 1 & 2 \\ 0 & -2 & -1 \\ 0 & 0 & -3 \end{bmatrix}$ (07 Marks)

c. Determine the largest eigen value and the corresponding eigen vector of

$A = \begin{bmatrix} 1 & 3 & -1 \\ 3 & 2 & 4 \\ -1 & 4 & 10 \end{bmatrix}$.

Starting with $[0, 0, 1]^T$ as the initial eigenvector. Perform 5 iterations. (07 Marks)

10 a. Show that the transformation $y_1 = x_1 + 2x_2 + 5x_3$, $y_2 = 2x_1 + 4x_2 + 11x_3$, $y_3 = -x_2 + 2x_3$ is regular and find the inverse transformation. (06 Marks)

b. Solve by LU decomposition method 2x + y + 4z =12 , 8x-3y + 2z = 20 , 4x +11y z =33. (07 Marks)

c. Reduce the quadratic form $2x^2 + 2y^2 - 2xy - 2yz - 2zx$ into canonical form. Hence indicate its nature, rank, index and signature. (07 Marks)