

# KERALA AGRICULTURAL UNIVERSITY

B.Tech (Food. Engg) 2014 Admission  
I<sup>st</sup> Semester Final Examination- January -2015

Cat No: Basc.1102

Title: Engineering Mathematics -I (3+0)

Marks: 50  
Time: 2 hours

## PART I

10 × 1 = 10

Answer all Questions

1. What is the determinant of the matrix  $A = \begin{pmatrix} 1 & 2 & 3 \\ 4 & 6 & 1 \\ 3 & 6 & 9 \end{pmatrix}$
2. Define the inverse of a matrix.
3. Is it true that a homogeneous system of equations is always consistent.
4. What is the formula for the radius of curvature of the curve  $y = f(x)$  at any point.
5. Find  $\frac{\partial^2 z}{\partial x^2}$  where  $z = x^3 + y^3 - 3axy$
6. Find  $\int_0^{\frac{\pi}{2}} \cos^6 x dx$
7. What is the formula for the volume of the solid generated by the revolution about the x- axis of the area bounded by the curve  $y = f(x)$ , the x-axis and the ordinates  $x=a$ ,  $x=b$ .
8. What is  $\Gamma(\frac{1}{2})$
9. Find  $\lim_{x \rightarrow a} \frac{x^2 - a^2}{x - a}$
10. What are the diagonal elements of a skew symmetric matrix

## PART II

(5 x 2=10)

Answer any five questions

1. Find the asymptotes of the curve  $x^2y^2 - x^2y - xy^2 + x + y + 1 = 0$
2. If  $u = x^y$ , show that  $\frac{\partial^3 u}{\partial x^2 \partial y} = \frac{\partial^3 u}{\partial x \partial y \partial x}$
3. If  $z = \log(u^2 + v)$  and  $u = e^{x^2 + y^2}$ ,  $v = x^2 + y$ , find  $\frac{\partial z}{\partial x}$  and  $\frac{\partial z}{\partial y}$
4. Given  $x + y + z = a$ , find the maximum value of  $x^m y^n z^p$
5. Find the reduction formula for  $\int x^m (\log x)^n dx$
6. Find the volume formed by the revolution of loop of the curve  $y^2(a+x) = x^2(3a-x)$  about the X-axis.
7. Evaluate  $\int_0^5 \int_0^{3^2} x(x^2 + y^2) dx dy$

### PART III

Answer any five questions

(5 x 4=20)

1. Prove that every square matrix can be uniquely expressed as a sum of a symmetric and skew-symmetric matrix.
2. If  $A = \begin{pmatrix} 1 & 2 & 3 \\ 3 & -2 & 1 \\ 4 & 2 & 1 \end{pmatrix}$  Compute  $\text{adj } A$  and  $A^{-1}$
3. Using Maclaurin's series expand  $\tan x$  upto the term containing  $x^5$
4. Show that the radius of curvature at any point of the cycloid  $x = a(\theta + \sin\theta)$ ,  $y = a(1 - \cos\theta)$  is  $4a\cos\frac{\theta}{2}$
5. Trace the curve  $x = a\cos^3t$ ,  $y = a\sin^3t$ .
6. Verify Euler's theorem on homogeneous functions for the function  $z = x^n \log(\frac{y}{x})$ .
7. Examine the following function for the extreme values  $f(x, y) = x^4 + y^4 - 2x^2 + 4xy - 2y^2$

### PART IV

Answer any one Question.

1 x 10 = 10

1. a) State Cayley-Hamilton theorem.  
b) Find the characteristic equation of the matrix  $A = \begin{pmatrix} 2 & -1 & 1 \\ -1 & 2 & -1 \\ 1 & -1 & 2 \end{pmatrix}$  and verify Cayley-Hamilton theorem and hence obtain  $A^{-1}$   
c) Determine  $\lim_{x \rightarrow 0} x \log x$
2. a) Find the volume bounded by the cylinder  $x^2 + y^2 = 4$  and the planes  $y + z = 4$  and  $z = 0$   
b) Evaluate  $\int_0^{\infty} \int_0^{\infty} e^{-(x^2+y^2)} dx dy$  by changing to polar coordinates.  
c) Show that  $\Gamma(n+1) = n\Gamma(n)$