

KERALA AGRICULTURAL UNIVERSITY

B.Tech (Food.Engg) 2012 Previous Admission

Ist Semester Final Examination- January-2015

Cat. No: Basc.1102

Title: Engineering Mathematics -I (3+0)

Marks: 80

Time: 3 hours

PART I

Answer all Questions

10 × 1 = 10

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

Answer any ten Questions

10 × 3 = 30

1. Prove that the inverse of a matrix if it exists is unique.
2. Find the rank of the matrix $A = \begin{pmatrix} 0 & 1 & 2 & -2 \\ 4 & 0 & 2 & 6 \\ 2 & 1 & 3 & 1 \end{pmatrix}$ by reducing it to the normal form.
3. Test for consistency of the system of equations $2x + 6y + 11z = 0$, $6x + 20y - 6z + 3 = 0$, $6y - 18z + 1 = 0$.
4. Evaluate $\lim_{x \rightarrow 0} \frac{\log x}{\cot x}$

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

PART III

Answer any six Questions

6 × 5 = 30

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 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 $x = a \cos^3 t$, $y = a \sin^3 t$.
6. Verify Euler's theorem on homogeneous functions for the function $z = x^n \log\left(\frac{y}{x}\right)$.
7. Examine the following function for the extreme values $f(x, y) = x^4 + y^4 - 2x^2 + 4xy - 2y^2$
8. Obtain the reduction formula for $\int \sin^n x dx$

PART IV

Answer any one Question.

1 × 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 $\Gamma(n+1) = n\Gamma(n)$