S D M College of Engineering & Technology, Dharwad
Department of Mathematics
Engineering Mathematics-II (Python LAB)
List of Programs (CSE- STREAM)

Lab-1: Fnding GCD using Euclieds algorithm.

1. Write a Python program to find the gcd of (614, 124)
2. Write a Python program to prove that 163 and 512 are relatively prime.
3. Write a Python program to prove that 8 divides 128.
4. Write a Python program to calculate the gcd of (*a*, *b*) and express it as linear combination of *a* and *b*. Calculate gcd = *d* of 76 and 13, express gcd as $76x+13y = d$.

Lab-2: Solving linear congruence of the form *ax = b(mod m).*

1. Write a Python program to show that the linear congruence $6x \equiv 5 (\mathrm{mod}\, 15)$ has no solution.
2. Write a Python program to find the solution of the congruence $5x \equiv 3 (\mathrm{mod}\, 13)$.
3. Write a Python program to find the inverse of 5 mod 13.

Lab-3: Program to compute area, Volume and centre of gravity

1. Write a Python program to evaluate the integral $\int_0^1 \int_0^x (x^2 + y^2) dy dx$.
2. Write a Python program to evaluate the integral $\int_0^3 \int_0^{3-x} \int_0^{3-x-y} (xyz) dz dy dx$.
3. Write a Python program to find the area of an ellipse by double integration $A = 4\int_0^a \int_0^{(b/a)\sqrt{(a^2-x^2)}} dy dx$.
4. Write a Python program to find the area of a cardioid $r = a(1+\cos\theta)$.
5. Write a Python program to find the volume of the tetrahedron bounded by the planes

   $x = 0, y = 0, z = 0$ and $\frac{x}{a} + \frac{y}{b} + \frac{z}{c} = 1$.

Lab 4: Solution of algebraic and transcendental equations by Regula falsi and Newton Raphson method

1. Write a Python program to obtain a root of the equation $x^3 - 2x - 5 = 0$ between 2 and 3 by Regula falsi method. Perform 5 iteration.
2. Write a Python program to find a root of the equation $3x = \cos x + 1$, near 1 by Newton Raphson method perform 5 iteration.

Lab 5: Interpolation/Extrapolation using Newtons forward and backward differencen formulae.

1. Write a Python program to Use Newtons forward interpolation and obtain the interpolating polynomial and hence calculate $y(2)$ for the following

x:	1	3	5	7	9
y:	6	10	62	210	502

2. Write a Python program to use Newton's backward interpolation and obtain the interpolating polynomial and hence calculate $y(8)$ for the following

x :	1	3	5	7	9
y:	6	10	62	210	502

Lab-6: Computation of area under the curve using Trapezoidal, Simpson's 1/3rd and Simpson's 3/8th rule

1. Write a Python program to evaluate $\int_0^5 \frac{1}{1+x^2} dx$ using Trapezoidal rule.
2. Write a Python program to evaluate $\int_0^5 \frac{1}{1+x^2} dx$ using Simpson's $1/3^{rd}$ rule.
3. Write a Python program to evaluate $\int_0^6 \frac{1}{1+x^2} dx$ using Simpson's $3/8^{th}$ rule.

Lab-7: Solution of ODE of first order and first degree by Taylor's series and Modified Euler's method

1. Write a Python program to solve $\frac{dy}{dx} - 2y = 3e^x$ with $y(0) = 0$ using Taylor's series method at $x(0.1), x(0.3)$ and $h = 0.1$.
2. Write a Python program to solve $y' = -ky$ with $y(0) = 100$ using Modiied Euler's method at $x = 100$ and taking $h = 25$.

LAB-8: Solution of ODE of first order and first degree by Runge Kutta fourth order method and Milne's predictor and corrector method.

1. Write a python program to apply the Runge Kutta method to find the solution of $\frac{dy}{dx}=1+\left(\frac{y}{x}\right)$ at $y(2)$ taking $h=0.2$. Given that $y(1)=2$.
2. Write a python program to apply Milne's predictor and corrector method to solve $\frac{dy}{dx}=x^2+\left(\frac{y}{2}\right)$ at $y(1.4)$. Given that $y(1)=2, y(1.1)=2.2156, y(1.2)=2.4649, y(1.3)=2.7514$. Use corrector formula thrice.

LAB-9: Evaluation of improper integrals, Beta and Gamma Functions.

1. Write a python program to evaluate $\int_0^\infty e^{-x}dx$.
2. Write a python program to evaluate $\Gamma(5)$ by using definition of gamma function.
3. Write a python program tocalculate $\beta(5/2,7/2)$ and $\Gamma(5/2)$.
4. Write a python program to verify that $\beta(m,n)=\frac{\Gamma(m)\Gamma(n)}{\Gamma(m+n)}$ for $m=5$ *and* $n=7$.

LAB-10: Finding gradient, divergent, curl and their geometrical interpretation.

1. Write a python program to find gradient of $\phi=x^2yz$.
2. Write a python program to find divergence of $\vec{F}=x^2y\hat{i}+yz^2\hat{j}+x^2z\hat{k}$.
3. Write a python program to find curl of $\vec{F}=xy^2\hat{i}+2x^2yz\hat{j}-3yz^2\hat{k}$.

LAB-11: Computation of basis and dimension for a vector space and graphical representation of linear transformation.

1. Write a python program to verify the rank-nullity theorem for the linear transformation $T:R^3\to R^3$ defined by $T(x,y,z)=(x+4y+7z,\ 2x+5y+8z, 3x+6y+9z)$.
2. Write a python program to find the dimension of subspace spanned by the vectors (1,2,3), (2,3,1) and (3,1,2).
3. Write a python program to represent the reflection transformation $T:R^2\to R^2$ geometrically. Find the image of vector (10,0) when it is reflected about *y*-axis.
4. Write a python program to represent the shear transformation $T:R^2\to R^2$ geometrically. Find the image of(2,3) under shear transformation.

LAB-12: Computingthe inner product and orthogonality.

1. Write a python program to find the inner product of the vectors (2,1,5,4) and (3,4,7,8).
2. Write a python program to verify whether the following vectors (2,1,5,4) and (3,4,7,8) are orthogonal.