**Assignment-4**

1. **Find the singular points and classify them for the equation** $x^3(x-2)y'' + x^3y' + 6y = 0$.
2. **Find the power series solution for the equation** $y'' + xy' + (1+x^2)\,y = 0$.
3. **Solve the initial value problem** $(x^2-1)y'' + 3x\,y' + xy = 0, y(0) = 4, y'(0) = 6$.
4. **Find the power series solution around the point** $x_0 = 1$ **for the equation** $x^2y'' + xy' + y = 0$.
5. **Find a polynomial approximation of fourth degree to the solution of the equation** $(1+2x)y'' - y' + y = 0, y(0) = 0, y'(0) = 1$.
6. **Find a polynomial approximation of fourth degree to the solution of the equation** $y'' + xy' + (1+x)y = 0, y(0) = -1, y'(0) = 0$.
7. **Express the polynomials** $x^3$ **and** $x^3 + 2x^2 - 3x + 6$ **in terms of Legendre polynomials.**
8. **Use first recurrence relation for Legendre polynomials to show that the value of** $\frac{P_{500}(L)}{P_{502}(L)}$ **is negative when** $P_{501}(L) = 0$.
9. **Use first recurrence relation for Legendre polynomials to show that** $\int_{-1}^{1} x\,P_n(x)P_{n-1}(x)dx = \frac{2n}{4n^2-1}$ .
10. **Use first recurrence relation for Legendre polynomials to find the value of** $\int_{-1}^{1} x^2P_n^2(x)dx$.