Optional Assignment

Tasks. To be submitted in latex format along with pdf

Sl No	Topics	Students

1.	**Lecture on 30-08-2024 and others**
	Orthogonal Polynomial: an intro with the least square fit problem.
	Example with quadratic polynomial and straight line fit. That is explain,
	Q = a2 x^2 + a1 x + a0;
	R = m x + c;
	E1 = Integrate[D[(Q - R)^2, m], {x, -1, 1}];
	E2 = Integrate[D[(Q - R)^2, c], {x, -1, 1}];
	m0 = Simplify[Solve[E1 == 0, {m}]];
	c0 = Simplify[Solve[E2 == 0, {c}]];
	R0 = R /. c0[[1]];
	R0 = R0 /. m0[[1]];
	Solve[Q - R0 == 0, x]
	
	P = (x - x0) (x - x1);
	J = Integrate[P^2, {x, -1, 1}];
	C1 = D[J, x0];
	C2 = D[J, x1];
	Solve[C1 == 0 && C2 == 0, {x0, x1}]
	J = Integrate[P^2/Sqrt[1 - x^2], {x, -1, 1}];
	C3 = D[J, x0];
	C4 = D[J, x1];
	Solve[C3 == 0 && C4 == 0, {x0, x1}]
	
	(Lecture on 02-09-2024)
		Anuranjan and Medhaj

	Continuation of orthogonal polynomials. Proof of why a least square fit is also an interpolating polynomial. Definitions of norms.	
2	Detailed/explanatory solutions to Quiz -1 and Quiz-2	Rishabh
3	**Problems** from George M. Philips, Interpolation and approximation by polynomials: **1.1.3,1.1.4, 1.5.2**	Abhigyan, and Agni
4	**Problems** from George M. Philips, Interpolation and approximation by polynomials: **1.5.4 , 1.5.5 , 1.5.6**	Yugesh and Darssavaanan
5	**Lecture on 04-09-2024 and others** Orthogonal polynomials are linearly independent Generate orthogonal polynomials (Gram-Schmidt process) Orthogonal polynomial roots are real and distinct in [a,b] Polynomial $p(x)$ that gives least square fit for x^{n+1}. Node distribution that gives least magnitude for norm -2 (unit weight function) for $(x - x_0)(x - x_1) \cdots (x - x_n)$	Kartik
6	Gauss-Jacobi rule Derivation of weights for Gauss-Jacobi rule for roots of Chebyshev polynomial as nodes	Amogh
7	Spectral methods in Matlab (Trefethen) 6.1,6.4	Harish