**Problem Statement:** The goal of this project is to analyze the brake disc and optimize using the Optimization Algorithms available on Ansys. The parameters taken into consideration are Maximum Stresses and also temperatures.
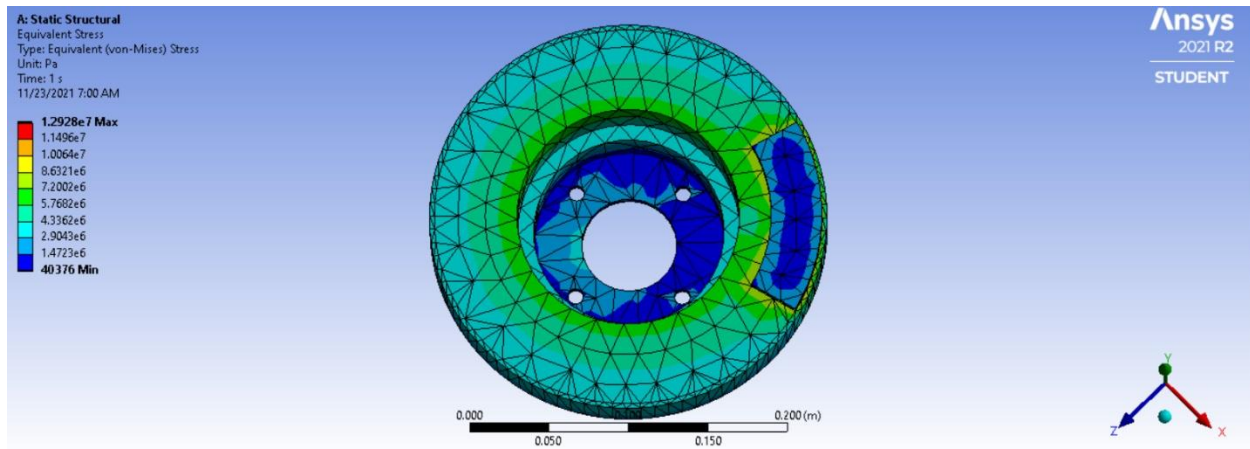
The various simulations done are:-

1) Static Structural
2) Modal Analysis
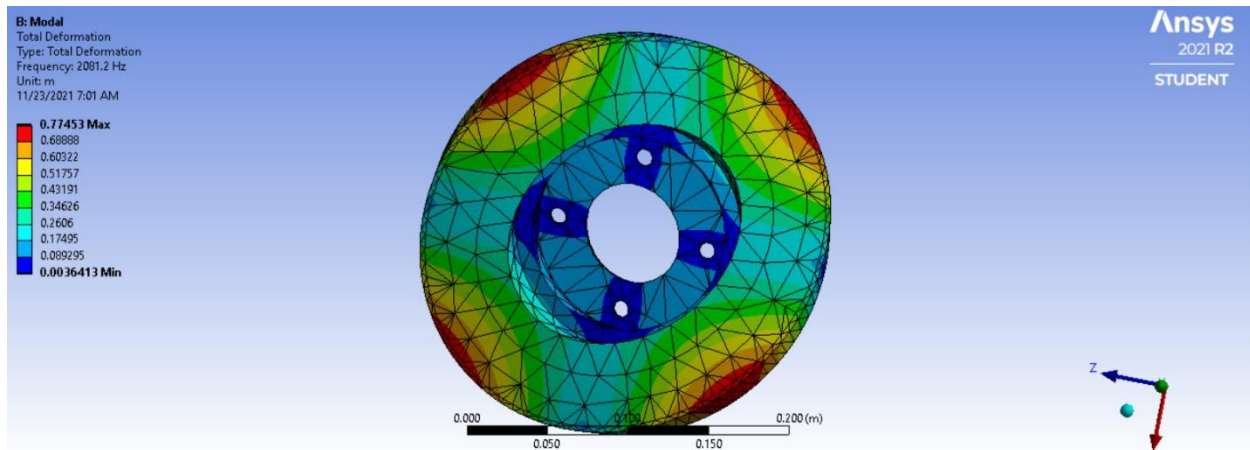3) Transient Thermal
4) Response Surface Optimization

Meshed Surface
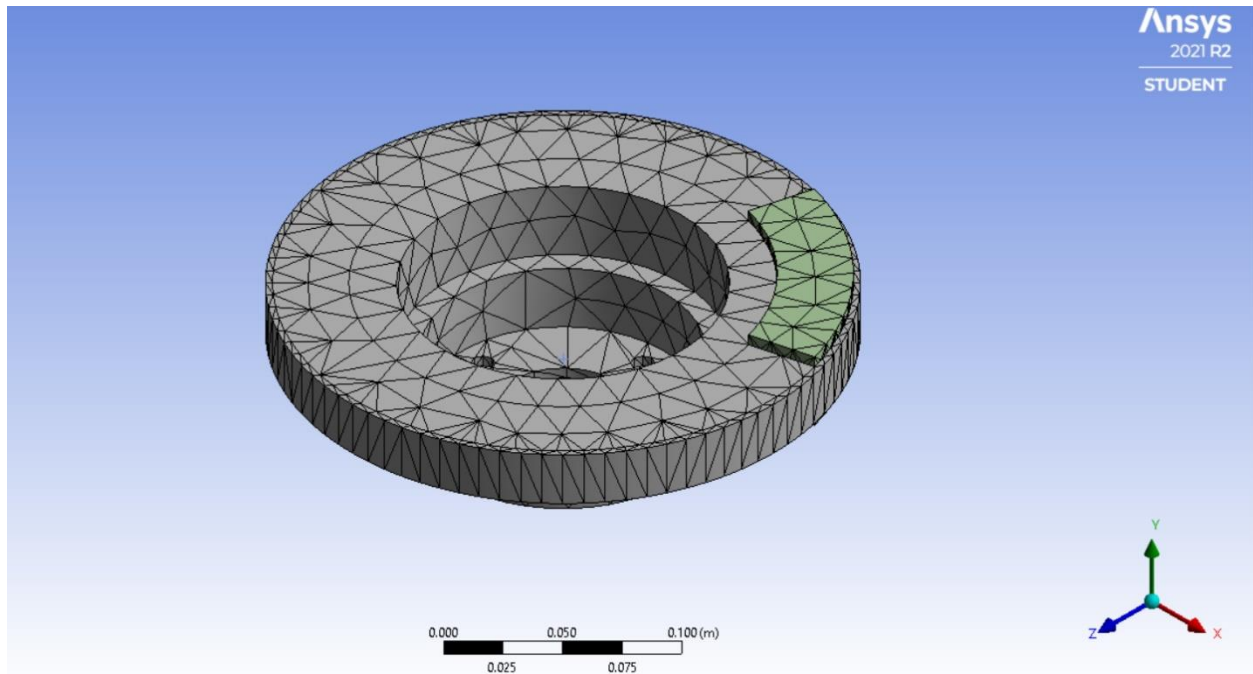
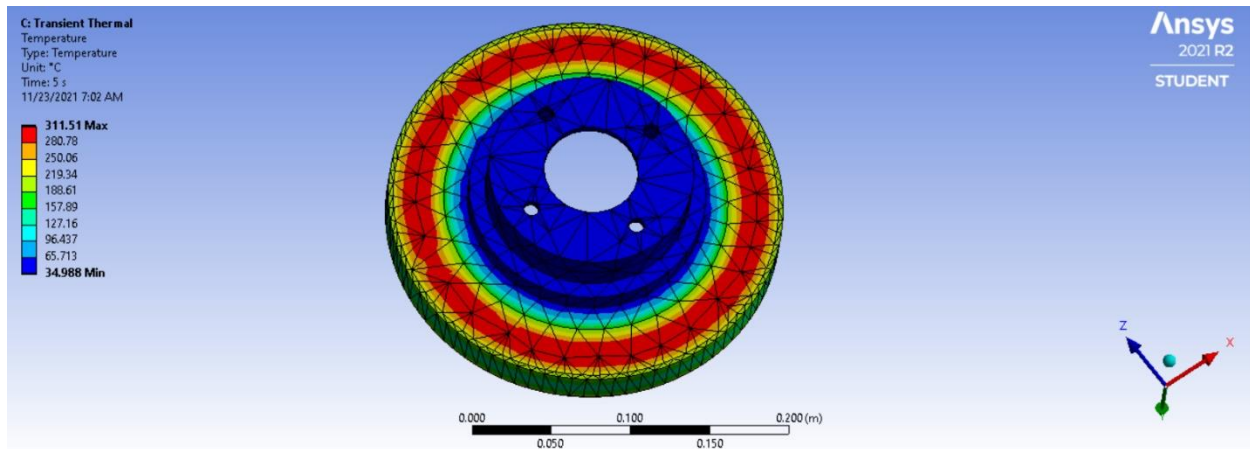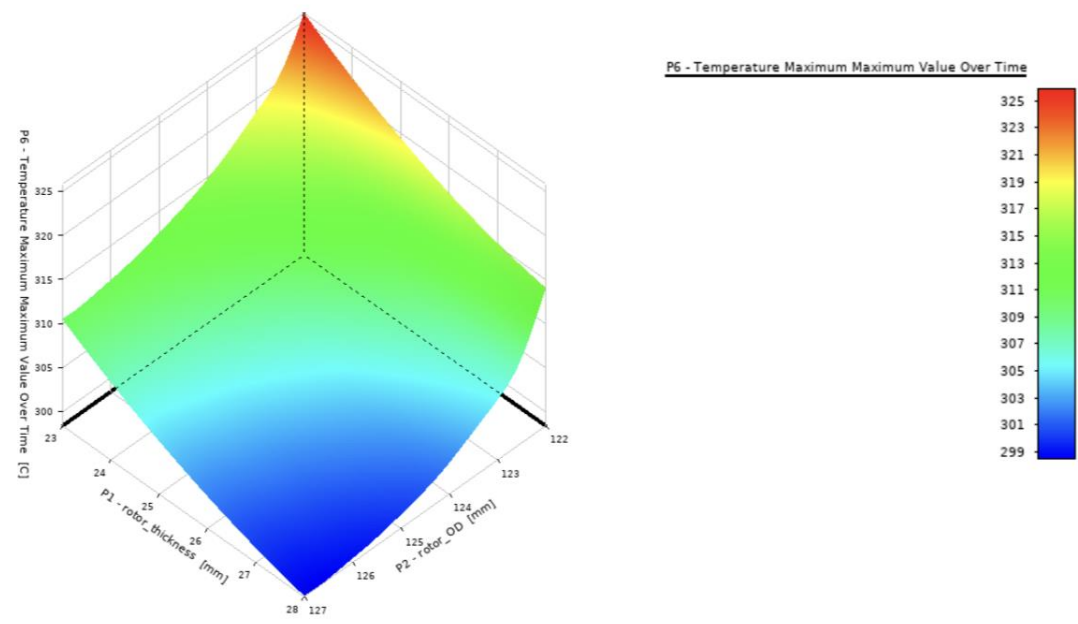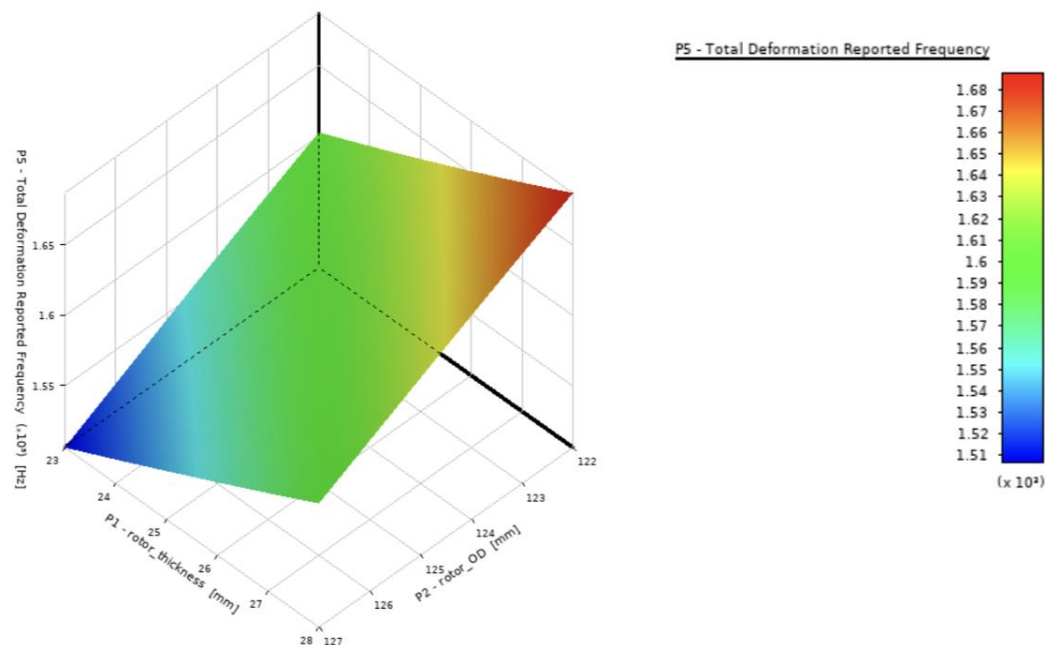# Static Structural Analysis
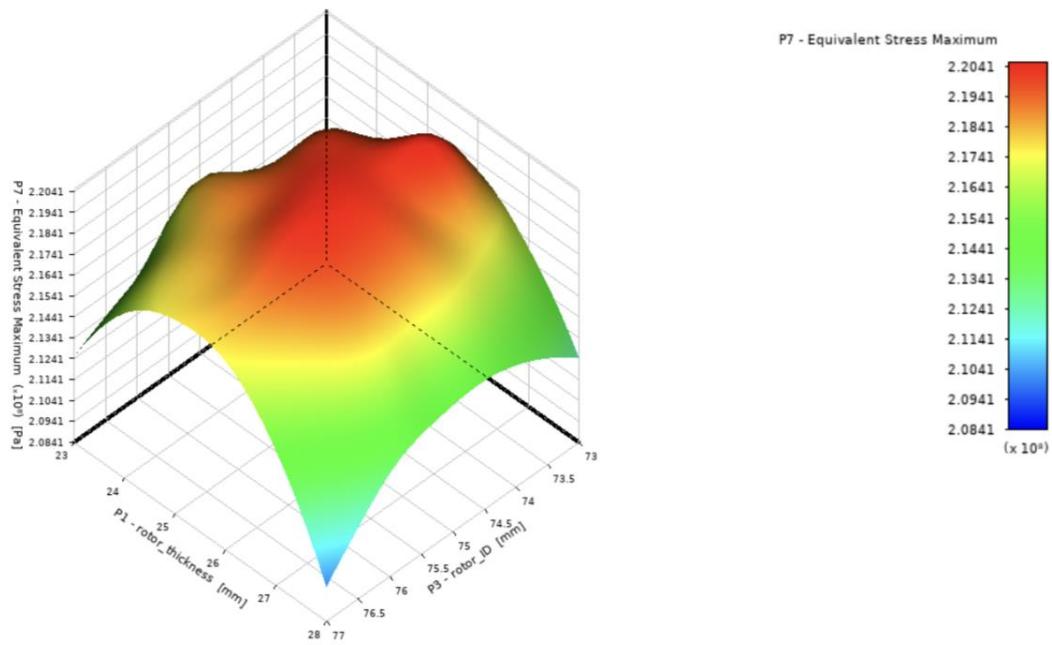

Modal Analysis

Transient Thermal Analysis

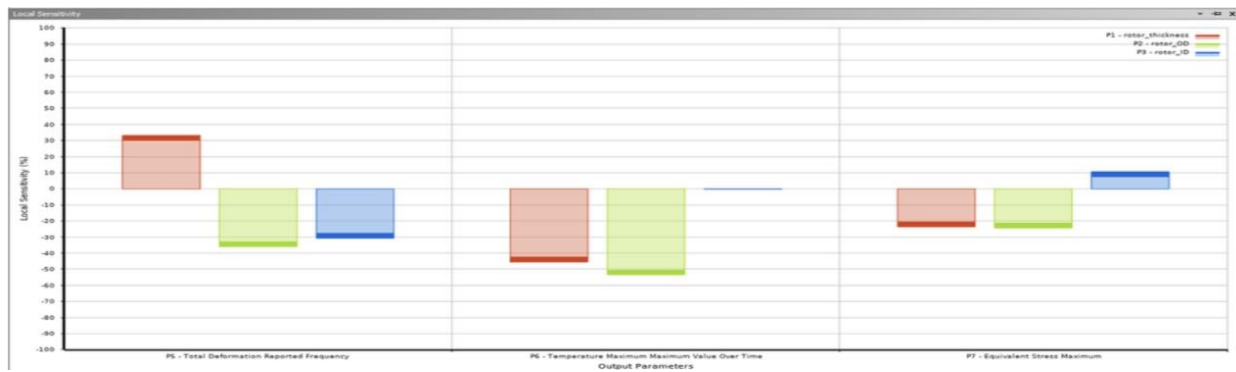# Optimized results from the Design Optimization Techniques on Ansys:-

	A	B	C	D	E	F	G
	Name	P1 - rotor_thickness (mm)	P2 - rotor_OD (mm)	P3 - rotor_ID (mm)	P5 - Total Deformation Reported Frequency (Hz)	P6 - Temperature Maximum Maximum Value Over Time (C)	P7 - Equivalent Stress Maximum (Pa)
1							
2	1	25.25	125.25	73.067	1614.1	305.23	2.1912E+08
3	2	26.083	125.58	74.933	1588.2	302.84	2.1863E+08
4	3	23.083	123.92	75.2	1563.9	314.76	2.197E+08
5	4	25.583	126.25	76.267	1541.7	303.4	2.1868E+08
6	5	23.417	123.25	74	1605.8	315.75	2.1298E+08
7	6	27.583	122.08	76.933	1632.3	314.13	2.1615E+08
8	7	25.417	126.58	74.533	1564.3	303.5	2.197E+08
9	8	27.417	126.42	76.533	1565.1	299.47	2.1857E+08
10	9	24.25	124.42	74.133	1594.1	309.5	2.1948E+08
11	10	23.917	126.92	76	1506.3	307.52	2.1948E+08
12	11	24.583	124.25	75.6	1574.1	308.87	2.1902E+08
13	12	23.75	123.58	73.6	1612.3	313.34	2.1941E+08
14	13	25.083	124.58	76.4	1560.1	306.76	2.1837E+08
15	14	26.417	122.25	74.267	1670.8	312.85	2.2839E+08
16	15	24.417	126.08	75.067	1547.2	306.61	2.1937E+08
17	16	27.083	124.08	74.8	1637	303.21	2.1852E+08
18	17	26.917	125.92	73.733	1619.3	300.81	2.1883E+08
19	18	25.917	123.75	73.467	1650	306.59	2.2047E+08
20	19	23.583	123.08	74.667	1598.7	315.9	2.1386E+08
21	20	23.25	122.92	76.133	1565.7	317.96	2.1321E+08
22	21	24.917	122.42	76.8	1585.3	315.33	2.3306E+08
23	22	27.25	124.92	75.867	1602.7	301.32	2.1831E+08
24	23	27.75	125.75	74.4	1625.3	299.44	2.1891E+08
25	24	24.083	125.08	75.467	1553.2	308.83	2.1937E+08
26	25	26.583	122.58	76.667	1613	309.82	2.1228E+08
27	26	25.75	123.42	73.2	1658.9	308.01	2.1317E+08
28	27	26.75	125.42	75.333	1595.2	301.62	2.1898E+08
29	28	26.25	124.75	73.867	1628	303.63	2.1884E+08
30	29	27.917	122.75	73.333	1708.8	306.2	2.1251E+08
31	30	24.75	126.75	75.733	1528.5	305.12	2.1917E+08

Response Surfaces

P5 - Total Deformation Reported Frequency

P6 - Temperature Maximum Maximum Value Over Time

P7 - Equivalent Stress Maximum

Local Sensitivity:

Optimized Sensitivity:

Final Optimized Results:

Table of Schematic F4: Optimization				
	A	B	C	D
1	⊟ Optimization Study			
2	Minimize P7	Goal, Minimize P7 (Default importance)		
3	P6 <= 317.96 C	Strict Constraint, P6 values less than or equals to 317.96 C (Default importance)		
4	P5 >= 1506.3 Hz	Strict Constraint, P5 values greater than or equals to 1506.3 Hz (Default importance)		
5	⊟ Optimization Method			
6	MOGA	The MOGA method (Multi-Objective Genetic Algorithm) is a variant of the popular NSGA-II (Non-dominated Sorted Genetic Algorithm-II) based on controlled elitism concepts. It supports multiple objectives and constraints and aims at finding the global optimum.		
7	Configuration	Generate 3000 samples initially, 600 samples per iteration and find 3 candidates in a maximum of 20 iterations.		
8	Status	Converged after 7619 evaluations.		
9	⊟ Candidate Points			
10		Candidate Point 1	Candidate Point 2	Candidate Point 3
11	P1 - rotor_thickness (mm)	23.007	23.004	23.006
12	P2 - rotor_OD (mm)	125.21	125.13	125.06
13	P3 - rotor_ID (mm)	73.002	73.007	73.005
14	P5 - Total Deformation Reported Frequency (Hz)	★★ 1576.2	★★ 1577.8	★★ 1579.4
15	P6 - Temperature Maximum Maximum Value Over Time (C)	★★ 312.02	★★ 312.18	★★ 312.3
16	P7 - Equivalent Stress Maximum (Pa)	★★ 2.0808E+08	★★ 2.0808E+08	★★ 2.0809E+08