

The rubrics in the table below correspond to the outcomes relating to the lab on operational amplifier.

Indicator	4	3	2	1
A. Students are able to derive the input-output relations of all five circuits (inverting amplifier, noninverting amplifier, differentiator, integrator and the practical differentiator).	All derivations are done correctly.	The derivations for the inverting and noninverting amplifiers are done correctly. There are minor mistakes in the derivations for some or all of the other three circuits.	Only the derivations for the inverting and noninverting amplifiers are done correctly. There are major mistakes in the derivations for some or all of the other three circuits.	The derivation for one circuit or none of the circuits is done correctly.
B. Noninverting amplifier design: For a given input voltage, the students can calculate the values of the resistances to achieve a desired output voltage and a maximum power dissipation.	The design was carried out successfully. All calculations were well explained.	The design steps were well explained but calculation mistakes were noted.	The calculations were carried out but no reasoning was presented.	The calculations were inadequate and students could not carry out the design.
C. Practical differentiator: Students successfully ran the given MATLAB code, deduced the bandwidth for which differentiation is performed and identified the frequencies for which the circuit acts like an inverting amplifier.	Students ran the MATLAB code successfully and performed the required analysis.	Students ran the MATLAB code successfully but made minor errors in the interpretation of the magnitude response.	Students ran the MATLAB code successfully but could not interpret the magnitude response.	Students could not run the MATLAB code and got no results.
D. Practical differentiator: Students build the circuit and explain the output for sine wave inputs of 500, 1000, 1500, 2000, 3000, 5000, 10000, 20000, 30000 and 40000 Hz.	The explanations are completely correct.	There are minor flaws in the reasoning.	Students comprehend the circuit behavior for low or high frequencies but not both..	Students do not comprehend how the practical differentiator works for the various frequencies.