MODULE TITLE : DIGITAL & ANALOGUE DEVICES & CIRCUITS

TOPIC TITLE : OPERATIONAL AMPLIFIERS

TUTOR MARKED ASSIGNMENT 1 (v1.1)

NAME..

ADDRESS ....

....

....

.... *HOME TELEPHONE* ....

EMPLOYER..

....

....

.... *WORK TELEPHONE*...

Student declaration:

I declare that all the work submitted is my own work and that no part of it has been copied from any other source without full acknowledgement and complies with the University's guiding principles as stated in the Regulations Relating To Academic Misconduct.*

Student signature:...

Date: ....

Student code: ....

Email: ....

*http://www.tees.ac.uk/docs/index.cfm?folder=Student%20Regulations&name=Academic%20Regulations

DADC - 1 - TMA (v1.1)

Published by Teesside University Open Learning (Engineering)
School of Science & Engineering
Teesside University
Tees Valley, UK
TS1 3BA
+44 (0)1642 342740

IMPORTANT

Before you start please read the following instructions carefully.

1. This assignment forms part of the formal assessment for this module. If you fail to reach the required standard for the assignment then you will be allowed to resubmit but a resubmission will only be eligible for a Pass grade, not a Merit or Distinction.

   You should therefore not submit the assignment until you are reasonably sure that you have completed it successfully. Seek your tutor's advice if unsure.

2. Ensure that you indicate the number of the question you are answering.

3. **Make a copy** of your answers before submitting the assignment.

4. **Complete all details on the front page of this TMA** and return it with the completed assignment including supporting calculations where appropriate. The preferred submission is via your TUOL(E) Blackboard account:

   https://eat.tees.ac.uk

5. Your tutor’s comments on the assignment will be posted on Blackboard.

Assessment Criteria

This assignment relates to the application of the operational amplifier to a variety of circuits and to the design and testing of operational amplifier circuits. The assignment forms Element 2 of the module's assessment criteria that covers in part Learning Outcomes 1, 2 and 4 as indicated below.

MODULE LEARNING OUTCOMES
Knowledge and Understanding
1. Demonstrate an understanding of a variety of electronic circuits including power supplies, operational amplifier circuits and digital logic circuits.
Cognitive and Intellectual Skills
2. Choose appropriate circuit components for the design of electronic circuits.
Practical and Professional Skills
3. Build, simulate and test simple electronic circuits.
Key Transferable Skills
4. Demonstrate the application of numerical skills to the solution of problems relating to digital and analogue devices and circuits.

PASS	**MERIT** Criteria in excess of the pass grade.	**DISTINCTION** Criteria in excess of the merit grade.
Learning outcomes are satisfied as evidenced by substantially correct understanding of the operation and application of simple operational amplifier circuits.	The transfer of competence gained in one situation to related but unfamiliar circumstances.	The ability to integrate knowledge from two or more topic areas to solve a more complex problem.

1. FIGURE 1 shows two amplifier circuits, each of which has one or two unknown voltages (shown highlighted). Select, from TABLE A, the most appropriate value for the unknown voltages for each circuit. Assume that the op-amps are ideal and that the magnitude of their output voltages is less than their maximum peak output voltage swing (V_{OM}). **Show all working!**

– 100 mV	+ 100 mV	– 1 V	+ 1 V
– 200 mV	+ 200 mV	– 2 V	+ 2 V
– 300 mV	+ 300 mV	– 3 V	+ 3 V
– 400 mV	+ 400 mV	– 4 V	+ 4 V
– 500 mV	+ 500 mV	– 5 V	+ 5 V
– 600 mV	+ 600 mV	– 6 V	+ 6 V

TABLE A

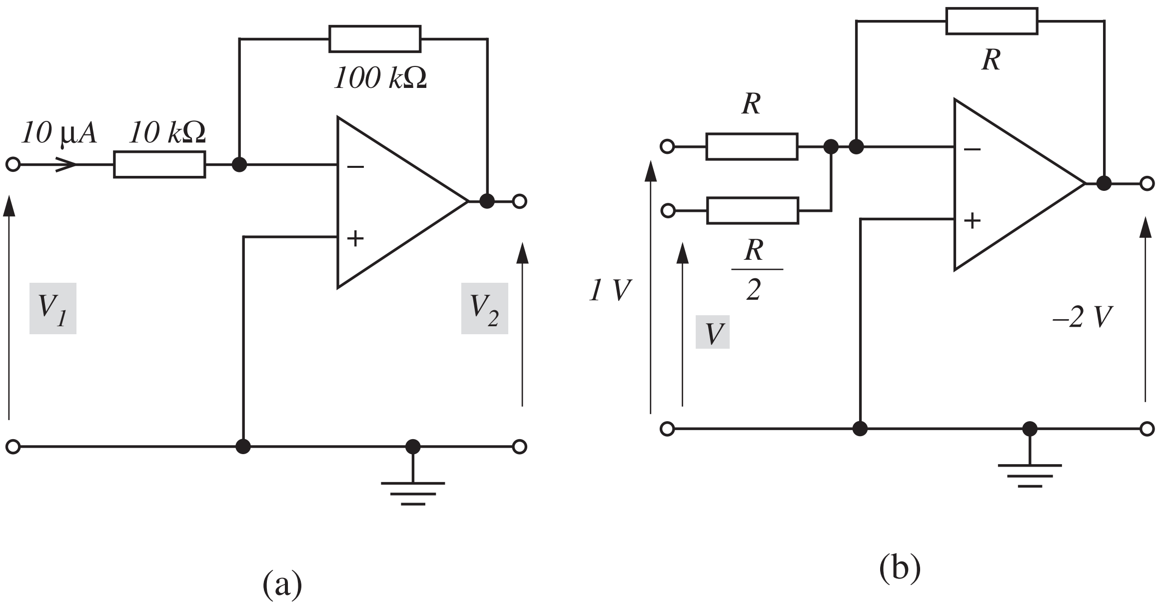

FIG. 1

2. (a) The circuit of FIGURE 2 is known as a transimpedance circuit used for the measurement of very small currents. Derive the relationship between the output voltage V and the input current I; i.e. if $V = kI$ find k in terms of R_1, R_2 and R_f.

(b) Calculate the current I if $R_f = 10$ MΩ, $R_1 = 90$ kΩ, $R_2 = 10$ kΩ and V –0.1 V.

(c) Model the circuit of FIGURE 2 using PSPICE [using an ideal op-amp] and use the model to confirm the calculation made in (b).

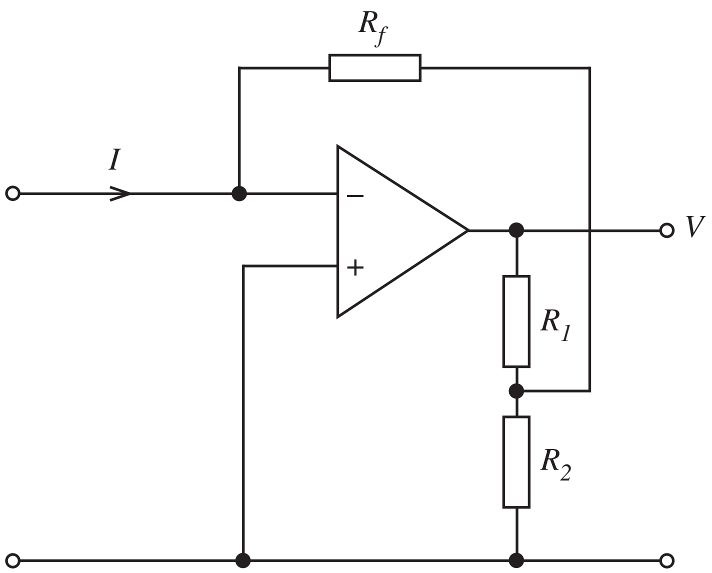

FIG. 2

3. FIGURE 3 shows the block diagram of an electronic system required to give the output

$$V_o = 8V_4 + 4V_3 + 2V_2 + V_1$$

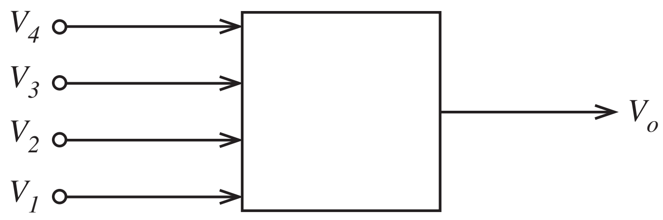

FIG. 3

(a) Sketch a suitable op-amp circuit to give the required output and show the required resistor ratios.

(b) Suggest an application for the circuit.

4. FIGURE 4 shows an op-amp circuit where R_P is a 10 kΩ potentiometer.

Determine the gain, $\frac{V_o}{V_{in}}$, of the amplifier for when

(a) $x = 0$

(b) $x = 0.7$

(c) $x = 1$.

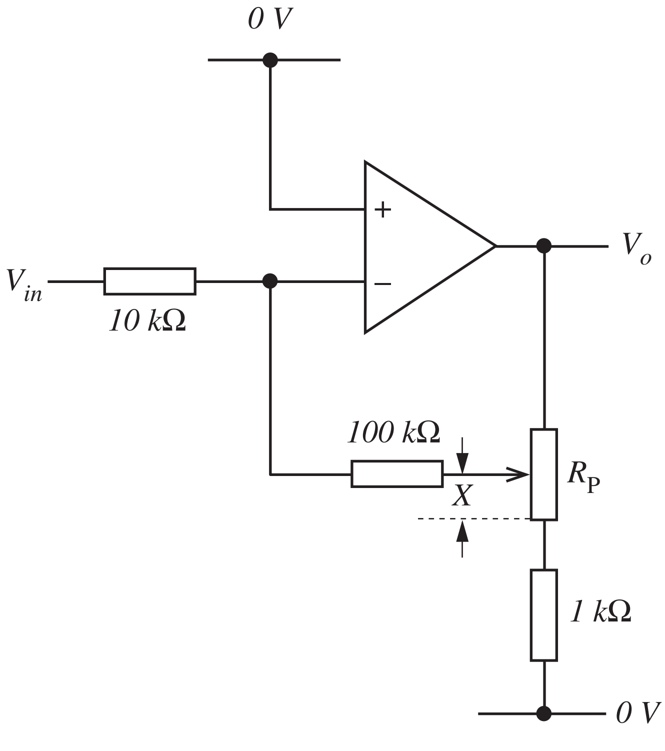

FIG. 4

Question No.	

Question No.	

Question No.	