



- Significant equations sheet is attached.
- Answer all the following questions

- No. of questions : 5
- Total Mark: 90 Marks

Question (1) (15 Marks)

Choose the correct answer:

- 1- The bandwidth of a dc amplifier having an upper critical frequency of 100 kHz is
(a) 100 kHz (b) unknown (c) infinity (d) 0 kHz
- 2- Bias current compensation
(a) reduces gain (b) reduces output error voltage (c) increases bandwidth (d) has no effect
- 3- Common-mode gain is
(a) very high (b) very low (c) always unity (d) unpredictable
- 4- Using output bounding in a comparator
(a) makes it faster (b) keeps the output positive (c) limits the output levels (d) stabilizes the output
- 5- For a step input, the output of an integrator is
(a) a pulse (b) a triangular waveform (c) a spike (d) a ramp
- 6- In an OTA, the transconductance is controlled by
(a) the dc supply voltage (b) the input signal voltage (c) the manufacturing process (d) a bias current
- 7- The damping factor of an active filter determines
(a) the voltage gain (b) the critical frequency (c) the response characteristic (d) the roll-off rate
- 8- A maximally flat frequency response is known as
(a) Chebyshev (b) Butterworth (c) Bessel (d) Colpitts
- 9- The operation of a relaxation oscillator is based on
(a) the charging and discharging of a capacitor (b) a highly selective resonant circuit
(c) a very stable supply voltage (d) low power consumption
- 10- All of the following are parts of a basic voltage regulator except
(a) control element (b) sampling circuit (c) voltage-follower (d) error detector (e) reference voltage

Question (2) (25 Marks)

- 1- What's the meaning of:
 - a. *Common-mode rejection* in a differential amplifier
 - b. *Input offset voltage* in an op-amp.
 - c. *Slew rate* in an op-amp.
 - d. *Sallen-Key Filter*.
 - e. *Line regulation*.
 - f. *Capture range* in PLL.
- 2- What's the difference between differential mode and common mode of an op-amp?
- 3- Compare between bjt transistor and op-amp amplifier circuits.
- 4- What are the advantages of Active Filters?
- 5- What's the difference between linear regulators and switching regulators?

Question (3) (15 Marks)

- 1- Determine the output voltage waveform in Fig.1 .
- 2- For the circuit shown in Fig. 2:
 - a. Determine the critical frequency.
 - b. Determine the order and the type of this filter.

- c. Make the necessary changes to make this circuit works as a BPF with B.W. of 2 kHz around the center frequency calculated in (a), then determine:
- The Damping factor.
 - The Quality factor of this filter.

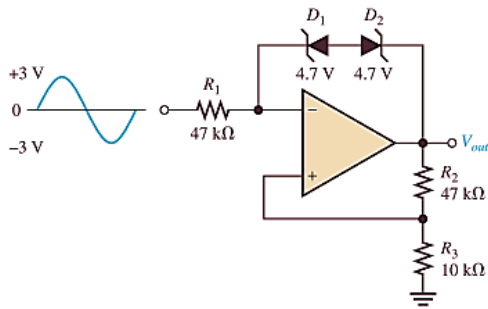


Fig. 1

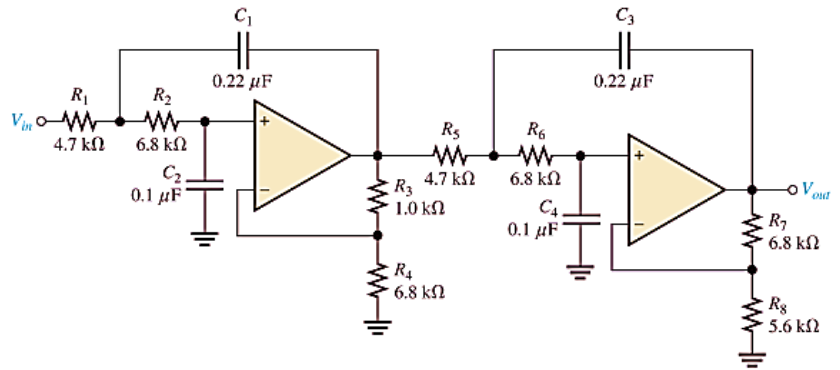


Fig. 2

Question (4) (15 Marks)

- Design a 1 kHz : 10 MHz sawtooth VCO circuit.
- Design an interface circuit that transmits a heart beats signal with peak value of 4.9 mV from the sensing electrodes to a microcontroller unit through a 3 line bus. (*Hint: you should build two blocks in this circuit*)

Question (5) (15 Marks)

- Give two applications of the Hardware Description Language (HDL).
- What is a test bench model?
- Write a VHDL code to implement the block shown in Fig. 3 with its internal behavior as defined by the shown truth table. Assume signal types of BIT.

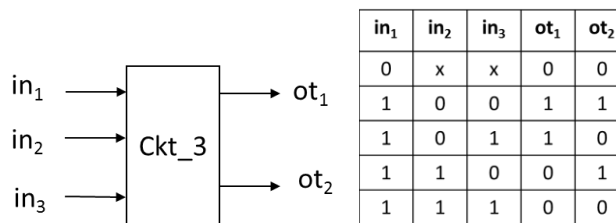


Fig. 3

***Good Luck,
Dr. Ahmad El-Banna***