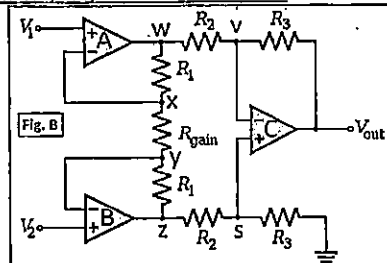
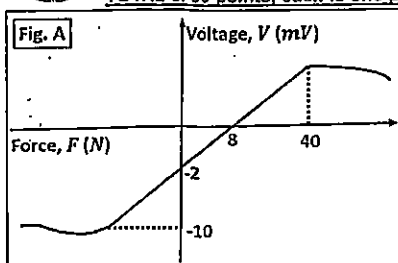




TOTAL of 50 points, each is one point, select one choice, only one choice is correct



- In Fig. A, the relation between the force (F , in N) and the sensor output (V , in mV) is ..
(a) $V = 0.25F - 2$ (b) $V = 0.25F + 2$ (c) $V = 8F - 2$ (d) $V = 8F - 10$
- In Fig. A, the input linear range of the sensor is N
(a) -8 to 40 (b) -10 to 40 (c) -40 to 40 (d) -36 to 40
- In Fig. A, during sensor calibration, a known input of 8 N produces a voltage of 3 mV, then the absolute error in sensor reading=N
(a) 1 (b) 2 (c) 4 (d) 8
- At reset state, the excited cell has a potential
(a) zero (b) negative (c) positive (d) very high
- After depolarization, the excited cell reach a potential
(a) zero (b) negative (c) positive (d) very high
- In Fig B, the job of opamp 'A' and opamp 'B' is to achieve....
(a) resistor matching (b) higher Z_{in} (c) precise resistors (d) both (a) & (c)
- In Fig. B, the opamp that do the job of voltage differencing is
(a) opamp 'A' (b) opamp 'B' (c) opamp 'C' (d) opamp 'A' and 'B'
- In Fig B, the voltage at node 'X' ideally equals to.....
(a) V_1 (b) V_2 (c) V_z by matching (d) V_y by matching
- In Fig. B, ideally $V_{out} = \dots (V_w - V_z)$
(a) $-\frac{R_3}{R_2}$ (b) $\frac{R_2}{R_3}$ (c) $\frac{R_3}{R_2}$ (d) $\frac{R_3}{R_2} + 1$
- To use Fig. B to record ECG, an electrode is put between a limb and ground to
(a) reject noise (b) amplify signal (c) increase Z_{in} (d) decrease z_o
- An electrode is used to exchange
(a) ions to electrons (b) electrons to ions (c) photons to ions (d) ions to photons
- The half-cell potential of an electrode is measured with respect to at
(a) $H_2 / 0^\circ C$ (b) $H_2 / 25^\circ C$ (c) $Hg / 0^\circ C$ (d) $Hg / 25^\circ C$

```
void setup() {
    pinMode(12, OUTPUT);
    pinMode(11, INPUT); }

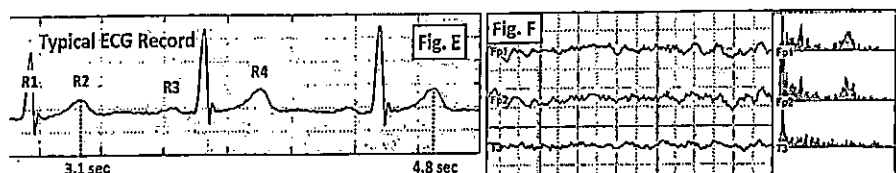
void loop() {
    int y=digitalRead(11);
    int x=analogRead(1);
    if (y) {
        if (x>10)
            {digitalWrite(12, HIGH);
             delay(500);
             digitalWrite(12, LOW);
             delay(750); }
        else {digitalWrite(12, LOW);}
    }
}
```

Code, Fig. H

- To reset the memory 4th to 0H, the...microprocessor control signal should be active
(a) read (b) reset (c) interrupt (d) write
- A memory of 2KByte contains a number oflocations, each of a one..... information
(a) 2000, byte (b) 2000, bit (c) 2048, byte (d) 2048, bit
- According to the code (Fig. H), If an alarm LED is connected, it should be using....
(a) Pin 1 (b) Pin 12 (c) Pin 11 (d) either (b) or (c)
- According to the code (Fig. H), If a (switch to 3.3V or 0) is connected, it should be using....
(a) Pin 1 (b) Pin 12 (c) Pin 11 (d) either (b) or (c)
- According to the code, if a 3V is connected to pin 1, with $V_{ref}=3.3V$, then it will read ...
(a) 614 (b) 615 (c) 931 (d) 930
- According to the code (Fig. H), if pin 12 is connected to [a suitable resistor, followed by a LED (using its positive terminal), then a 3.3V power supply] in series, then the LED will be...
(a) always OFF (b) always ON (c) ON if pin is HIGH (d) ON if pin is LOW
- According to the code (Fig. H), the maximum possible value of x is....
(a) 10 (b) 256 (c) 1024 (d) 1023
- According to the code (Fig. H), the maximum possible value of y is....
(a) 1 (b) 256 (c) 1024 (d) 1023
- According to the code (Fig. H), a LED connected to PIN 12, will be always OFF if
(a) PIN 11 is LOW (b) PIN 11 is HIGH (c) PIN 1 is LOW (d) PIN 11=PIN12
- According to the code (Fig. H), A LED connected to PIN 12 will be only flash if the voltage connected to Pin 1 exceeds
(a) 10V (b) 3.3V (c) $(10/1024)*3.3$ (d) $(10/1023)*3.3$

ALL BEST WISHESDr. Ahmed Elmakib

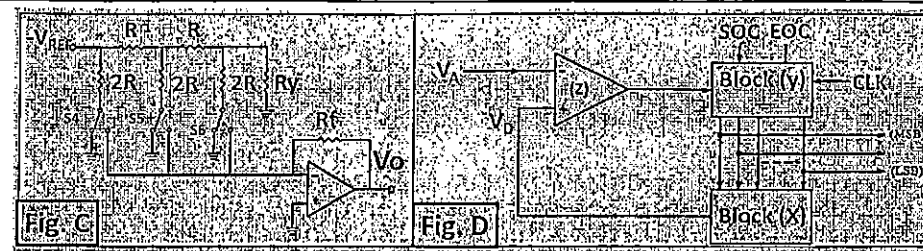
MODEL A



26. A chamber in which oxygenated blood enters the heart is....
 (a) left atrium (b) right atrium (c) left ventricle (d) right ventricle
27. In Fig. E, during the region, the atriums are contracted
 (a) R1- (b) R2 (c) R3 (d) R4
28. In Fig. E, during the region, the blood is pumped towards the ventricles
 (a) R1 (b) R2 (c) R3 (d) R4
29. In Fig. E, the heart rate equals to.....beat per minute
 (a) 60/4.8 (b) 120/1.7 (c) 60/1.7 (d) 30/1.7
30. If the normal rate is between 50 and 80 bpm, then the RR interval should be between ...
 (a) 0.75-1.2 sec (b) 0.75-1.2 min (c) 0.8-1.2 sec (d) 0.8-1.2 min
31. In Fig. F, Fp1 indicates a.....
 (a) time location (b) given frequency (c) brain location (d) heart location
32. In the right part of Fig. F indicates amplitudes associated with
 (a) time progression (b) frequencies (c) spatial positioning (d) none of the given
33. Electroencephalogram signals are usually be ... for sleep and awake conditions
 (a) same (b) different (c) very close (d) any of the given
34. When an inhibitory post synaptic potential is generated, the neuron is.....
 (a) unpolarized (b) depolarized (c) repolarized (d) hyperpolarized
35. electrodes are usually used to measure EEG signals .
 (a) Floating (b) Internal (c) Foam-pad (d) Suction

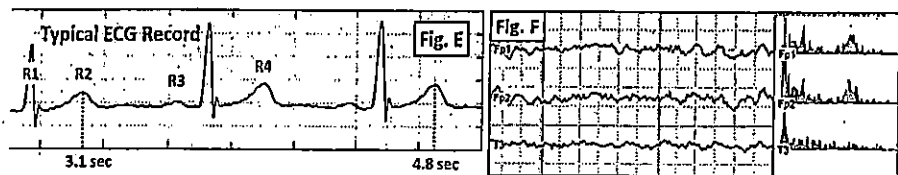
(36-40) Applying a filter, with no padding (بدون إضافة عينات زائدة) on the ECG samples=[75,70,85,80,70,90], answer the following questions (36-40):

36. The first output sample, using a moving average filter of length 5, will be
 (a) 70 (b) 75 (c) 76 (d) 80
37. The job of the moving average filter is to perform
 (a) smooth the signal (b) low pass filter (c) high pass filter (d) both (a) & (b)
38. The maximum output sample, using a moving average filter of length 5, will be
 (a) 90 (b) 80 (c) 76.67 (d) 75
39. The first output sample, using a median filter of length 5, will be
 (a) 90 (b) 80 (c) 76.67 (d) 75
40. The job of the median filter is to perform.....
 (a) smooth the signal (b) band pass filter (c) high pass filter (d) both (a) & (b)



13. An electrode equivalent circuit include a half cell potential in series with a resistor and a..
 (a) capacitor (b) resistor (c) parallel capacitor/resistor (d) series capacitor/resistor
14.electrodes are used to measure potential difference across cell membrane .
 (a) Surface (b) Internal (c) Foam-pad (d) Suction
15. The impedance of Ag/AgCl Electrode with frequency changes
 (a) increases (b) decreases (c) remains constant (d) either (a) or (b)
16. To implement a digital to analog converter (DAC), one may use
 (a) Fig. C (b) Fig. D (c) Block (X) in Fig. D (d) either (b) or (c)
17. In Fig. D, Block (y) works as
 (a) a register (b) a comparator (c) a sampler (d) an ADC
18. In Fig. C, if $V_O = V_{REF} \left(\frac{V_1}{2} + \frac{V_2}{4} + \frac{V_3}{8} + \dots + \frac{V_n}{2^{n-1}} \right)$, then
 (a) $R_f = R_y = R$ (b) $R_f = R_y = 2R$ (c) $R_f = 0.5R$ & $R_y = 2R$ (d) $R_f = R$ & $R_y = 2R$
19. If two analog samples are converted using a 3-bit ADC of Fig. C/D, this will take....
 (a) 2 clocks "CLK" (c) 3 clocks "CLK" (d) 6 clocks "CLK" (d) 9 clocks "CLK"
20. If $V_A = \frac{5.8}{16} V_{REF}$ is converted using a 3-bit ADC of Fig. C/D, then its digital code is....
 (a) 001 (c) 010 (d) 011 (d) 101
21. In the fluorescence excitation stage, jump from an excited state to the ground state
 (a) an electron (b) a photon (c) a proton (d) an atom
22. In a fluorescence-microscope, a dichroic mirror is used to photons
 (a) reflect emission (b) absorb excited (c) absorb emission (d) reflect excited
23. If the emission energy=100 KeV & Stoke's shift=50KeV, then the excitation energy is
 (a) 50 KeV (b) 100 KeV (c) 150KeV (d) not of the given
24. Fluorescence photon excitation energy isthan emission photon energy
 (a) lower (b) higher (c) same (d) double
25. The and the dichroic mirror should have the same frequency spectrum
 (a) light source (b) emission filter (c) excitation filter (d) not of the given

MODEL B

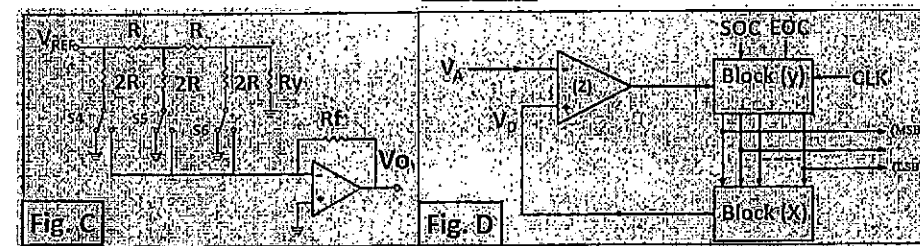


26. A chamber in which oxygenated blood is pumped out from the heart is....
 (a) left atrium (b) right atrium (c) left ventricle (d) right ventricle
27. In Fig. E, during the region, the atriums are contracted
 (a) R4 (b) R3 (c) R2 (d) R1
28. In Fig. E, during the region, the blood is pumped towards the ventricles
 (a) R4 (b) R3 (c) R2 (d) R1
29. In Fig. E, the heart rate equals to.....beat per minute
 (a) 60/4.8 (b) 120/1.7 (c) 30/1.7 (d) 60/1.7
30. If the normal rate is between 50 and 80 bpm, then the RR interval should be between ...
 (a) 0.75-1.2 min (b) 0.75-1.2 sec (c) 0.8-1.2 min (d) 0.8-1.2 sec
31. In Fig. F, Fp1 indicates a.....
 (a) brain location (b) given frequency (c) time location (d) heart location
32. In the right part of Fig. F indicates amplitudes associated with
 (a) frequencies (b) time progression (c) spatial positioning (d) none of the given
33. Electroencephalogram signals are usually be ... for sleep and awake conditions
 (a) same (b) very close (c) different (d) any of the given
34. When an inhibitory post synaptic potential is generated, the neuron is....
 (a) unpolarized (b) depolarized (c) hyperpolarized (d) repolarized
35. electrodes are usually used to measure EEG signals
 (a) Floating (b) Foam-pad (c) Internal (d) Suction

(36-40) Applying a filter, with no padding (بدون اضافة عينات زائدة) on the ECG samples=[75,70,85,80,70,90], answer the following questions (36-40):

36. The first output sample, using a moving average filter of length 5, will be
 (a) 80 (b) 76 (c) 75 (d) 70
37. The job of the moving average filter is to perform
 (a) smoothing (b) band pass filter (c) high pass filter (d) both (a) & (b)
38. The maximum output sample, using a moving average filter of length 5, will be
 (a) 75 (b) 76.67 (c) 80 (d) 90
39. The first output sample, using a median filter of length 5, will be
 (a) 75 (b) 76.67 (c) 80 (d) 90
40. The job of the median filter is to perform.....
 (a) smooth the signal (b) low pass filter (c) high pass filter (d) both (a) & (b)

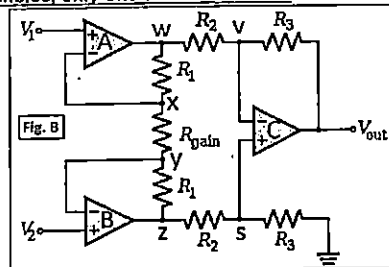
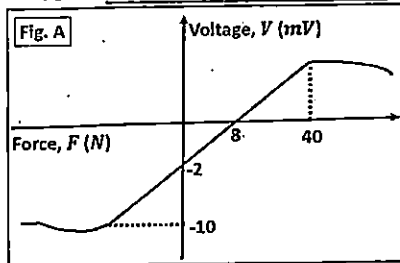
MODEL B



13. An electrode equivalent circuit include a half cell potential in series with a resistor and a....
 (a) capacitor (b) resistor (c) series capacitor/resistor (d) parallel capacitor/resistor
14.electrodes are used to measure potential difference across cell membrane
 (a) Surface (b) Suction (c) Foam-pad (d) Internal
15. The impedance of Ag/AgCl Electrode with frequency increases
 (a) increases (b) decreases (c) remains constant (d) either (a) or (b)
16. To implement an analog to digital converter (ADC), one may use
 (a) Fig. C (b) Fig. D (c) Block (X) in Fig. D (d) either (b) or (c)
17. In Fig. D, Block (y) works as
 (a) a comparator (b) a register (c) a sampler (d) an ADC
18. In Fig. C, if $V_o = V_{REF} \left(\frac{V_1}{2} + \frac{V_2}{4} + \frac{V_3}{8} + \dots + \frac{V_n}{2^{n-1}} \right)$, then
 (a) $R_f = R_y = 2R$ (b) $R_f = R_y = R$ (c) $R_y = 0.5R$ & $R_f = 2R$ (d) $R_y = R$ & $R_f = 2R$
19. If two analog samples are converted using a 3-bit ADC of Fig. C/D, this will take....
 (a) 9 clocks "CLK" (c) 6 clocks "CLK" (d) 3 clocks "CLK" (d) 2 clocks "CLK"
20. If $V_A = \frac{5.8}{16} V_{REF}$ is converted using a 3-bit ADC of Fig. C/D, then its output code is....
 (a) 001 (c) 011 (d) 101 (d) 010
21. In the fluorescence excitation stage, jump from an excited state to the ground state
 (a) an atom (b) a photon (c) a proton (d) an electron
22. In a fluorescence microscope, a dichroic mirror is used to photons
 (a) reflect excited (b) absorb excited (c) absorb emission (d) reflect emission
23. If the excitation energy=100 KeV & Stoke's shift=50KeV, then the emission energy is
 (a) 50 KeV (b) 100 KeV (c) 150KeV (d) not of the given
24. Fluorescence photon emission energy isthan excitation photon energy
 (a) lower (b) higher (c) same (d) double
25. The and the dichroic mirror should have the same frequency spectrum
 (a) light source (b) excitation filter (c) emission filter (d) not of the given



TOTAL of 50 points, each is one point, select one choice, only one choice is correct



1. In Fig. A, the relation between the force (F , in N) and the sensor output (V , in mV) is ..

- (a) $V = 0.25F + 2$ (b) $V = 0.25F - 2$ (c) $V = 8F - 2$ (d) $V = 8F - 10$

2. In Fig. A, the input linear range of the sensor is N

- (a) -8 to 40 (b) -10 to 40 (c) -36 to 40 (d) -40 to 40

3. In Fig. A, during sensor calibration, a known input of $8 N$ produces a voltage of $3 mV$, then the absolute error in sensor reading= N

- (a) 8 (b) 4 (c) 2 (d) 1

4. At reset state, the excited cell has a potential

- (a) negative (b) zero (c) positive (d) very high

5. After depolarization, the excited cell reach a potential

- (a) zero (b) positive (c) negative (d) very high

6. In Fig B, the job of opamp 'A' and opamp 'B' is to achieve....

- (a) resistor matching (b) precise resistors (c) higher Z_{in} (d) both (a) & (b)

7. In Fig. B, the opamp that do the job of voltage differencing is

- (a) opamp 'C' (b) opamp 'B' (c) opamp 'A' (d) opamp 'A' and 'B'

8. In Fig B, the voltage at node 'X' ideally equals to.....

- (a) V_2 (b) V_1 (c) V_z by matching (d) V_y by matching

9. In Fig. B, ideally $V_{out} = \dots\dots (V_w - V_z)$

- (a) $\frac{R_3}{R_2}$ (b) $-\frac{R_2}{R_3}$ (c) $\frac{R_3}{R_2}$ (d) $\frac{R_3}{R_2} + 1$

10. To use Fig. B to record ECG, an electrode is put between a limb and the ground to

- (a) amplify signal (b) reject noise (c) increase Z_{in} (d) decrease z_o

11. An electrode is used to exchange

- (a) electrons to ions (b) ions to electrons (c) photons to ions (d) ions to photons

12. The half-cell potential of an electrode is measured with respect to at

- (a) $H_2 / 0^\circ C$ (b) $Hg / 25^\circ C$ (c) $Hg / 0^\circ C$ (d) $H_2 / 25^\circ C$

```
void setup() {
    pinMode(12, OUTPUT);
    pinMode(11, INPUT);
}

void loop() {
    int y=digitalRead(11);
    int x=analogRead(1);
    if (y) {
        if (x>10)
            {digitalWrite(12, HIGH);
             delay(500);
             digitalWrite(12, LOW);
             delay(750); }
        else {digitalWrite(12, LOW);}
    }
}
```

Code, Fig. H

41. To reset the memory 4^{th} to $0H$, the...microprocessor control signal should be active

- (a) read (b) write (c) interrupt (d) reset

42. A memory of $2KByte$ contains a number of locations, each of a one..... information

- (a) 2000 , bit (b) 2000 , byte (c) 2048 , bit (d) 2048 , byte

43. According to the code (Fig. H), If an alarm LED is connected, it should be using.....

- (a) Pin 11 (b) Pin 1 (c) Pin 12 (d) either (a) or (c)

44. According to the code (Fig. H), If a (switch to $3.3V$ or 0) is connected, it should be using.....

- (a) Pin 11 (b) Pin 1 (c) Pin 12 (d) either (a) or (c)

45. According to the code, if a $3V$ is connected to pin 1, with $V_{ref}=3.3V$, then it will read ...

- (a) 614 (b) 615 (c) 930 (d) 931

46. According to the code (Fig. H), if pin 12 is connected to [a suitable resistor, followed by a LED (using its positive terminal), then a $3.3V$ power supply] in series, then the LED will be...

- (a) always ON (b) always OFF (c) ON if pin is HIGH (d) ON if pin is LOW

47. According to the code (Fig. H), the maximum possible value of x is....

- (a) 10 (b) 256 (c) 1023 (d) 1024

48. According to the code (Fig. H), the maximum possible value of y is....

- (a) 256 (b) 1 (c) 1023 (d) 1024

49. According to the code (Fig. H), a LED connected to PIN 12, will be always OFF if

- (a) PIN 11 is HIGH (b) PIN 11 is LOW (c) PIN 1 is LOW (d) PIN 11=PIN12

50. According to the code (Fig. H), A LED connected to PIN 12 will be only flash if the voltage connected to Pin 1 exceeds

- (a) $10V$ (b) $3.3V$ (c) $(10/1023)*3.3$ (d) $(10/1024)*3.3$

ALL BEST WISHES Dr. Ahmed Elnahib