AL-Mansoura University
Faculty of Engineering
Communications and Elect. Dept.

Biomedical Electronics
3rd year Students
Time 3 Hours

Attempt in all questions and assume any missing data. You can use the Arabic Language in your answer.

Q1:(a)-Draw with explanation the general block diagram of the biomedical instrument.

(b)- Write a short note about the following:

1- Electrocardiograph (ECG).	2- Electroencephalograph (EEG).	3-Pacemaker.
4- Electrosurgical unit (ESU).	5-Ultrasound imaging device.	

Q2: (a)- Define the following:

1- Ficks's Law.	2- Particle drift Law.	3-Goldman's equation.	4-Nernst equation.

(b)- Suppose a cat skeletal muscle has the following ion concentration and permeabilities of the cell membrane:

Ion	Inside	Outside	Permeability
Na^+	15	160	2.5×10^{-8}
K^+	140	9	3.6×10^{-6}
Cl^-	8	125	5.3×10^{-6}

(i)-Compute the membrane voltage from inside to outside the cell at 38 °C (311 K). where the Boltzmann's constance $k = 1.38 \times 10^{-23}$ J/K and the electronic charge $q = 1.6 \times 10^{-19}$ C.

(ii)- Suppose that only the potassium ion contributes significantly to the membrane potential, compute the potential based on that assumption. Also, compute the percentage error introduced and evaluate the validity of the Nernest equation.

Q3: (a)- Define the following:

1- Action Potential.	2- Muscle Contraction.	3- Biopotentials in the heart.
4- The Electrocardiogram.	5-Electrical Shock.	

(b)- (i) Find the total stimulus current of a tissue at frequencies 150, 1000, 4000 Hz. The tissue has the following parameters:

Parameter	Its value
The area of the tissue	$1.5\ cm^2$
The number of the cell	450×10^6 cell $/cm^2$
The conductance of the interstitial fluid	$1.5\ \Omega^{-1}/cm^2$
The cell membrane has a thickness	$0.15\ \mu m$
The cell radius	$12\ \mu m$
The action potential	25 m v
The relative dielectric constance of the cell	2
The dielectric constance of the air	8.85×10^{-12} F/m

(ii) Compare between the results obtained in part (a) and make a deduction.
(iii) Design a Matlab function to plot the stimulus current as a function of frequency.

Q4: (a)- Define the following:

1- The surface electrode.	2-Thermal transducers.	3- The Wheatstone bridge.

(b)- A thermistor has a resistance of 11 Ω at T =308 K. The material constant β = 4000 K. The thermistor linearized with R_p and is placed in the Wheatstone bridge. The Wheatstone bridge parameters are, $R_1 = 4\ \Omega$, $R_2 = 1\ k\Omega$, $R_3 = 1\ k\Omega$, and $V_a = 10$ V.
(i)- Find the output voltage at T = 306 K.
(ii)- Design a Matlab function to plot of the output voltage V_{OUT} versus temperature T in the range 300K < T < 320 K.
(iii)- Compute the Wheatstone bridge sensitivity for this circuit.

Q5: (a)- Define the following:

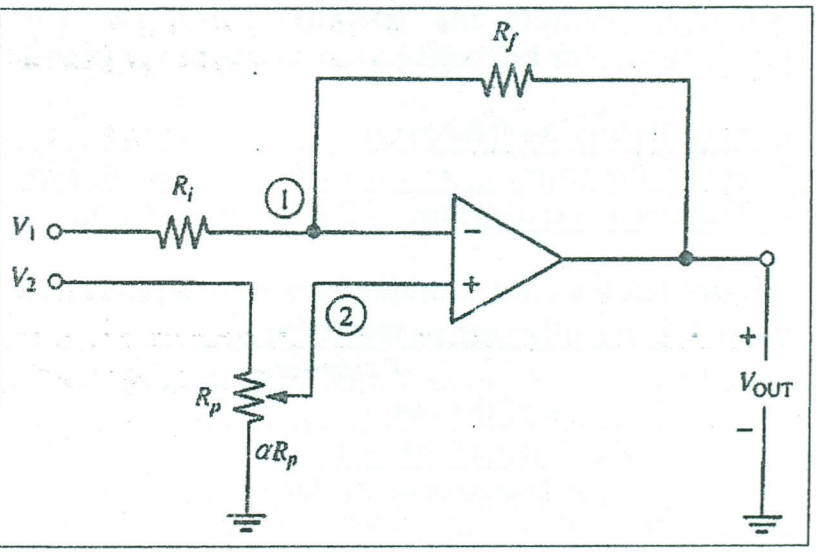
1- Strain gauges.	2 The differential capacitive transducer

(b)- A strain gauge has a gauge factor G = 4, the rest length is 0.9 inch, and the rest resistance is 2 kΩ, and it is placed in the Wheatstone bridge.
(i)- Find the output voltage when the strain gauge is lengthened by 0.04 inch.
(ii)- Design a Matlab to plot the output voltage V_{OUT} as a function of the elongation length (Δl) from 0 to 0.4 inch. $R_1 = 1\ k\Omega$, $R_2 = 2\ k\Omega$, $R_3 = 3\ k\Omega$, and $V_a = 10$ V.
(iii)- Compute the strain gauge sensitivity for the linear portion of the strain gauge from Δl = 0 to Δl = 0.01 inch.

Q6: (a) For the differential amplifier circuit with controlled gain shown in the Figure, derive an expression for the output voltage V_{OUT}.

(b) Find the value of α which makes a balance for this differential amplifier.

(c) Calculate the formula for the common-mode rejection ratio for this circuit.



Web Programming Foundations I
First Semester Exam 2011-2012
Dept of Comm & Electronics - Faculty of Engineering, Mansoura University

Answer All Questions

Q1.

A. Define the following HTML terms: img, table, tr, td, th, colspan, rowspan

B. Sketch the output of the following HTML code

```
<form name=frm method=post>
<table align=center width=100% cellpadding=0 cellspacing=0>
<tr><td><b>Student Image
<td><img src='student.jpg' width=100 height=100>
<tr><td><b>Student ID
<td><input type=text name=student_id size=10>
<td><b>Student name
<td><input type=text name=student_name size=30>
<tr><td><b>Student address
<td colspan=3><input type=text name=student_address
size=40>
<tr><td><b>Student gender
<td><b><select name=student_gender>
<option value='---'>---
<option value='Male'>Male
<option value='Female'>Female
</select>
<tr><td><button name=save value='Save'>
</table>
</form>
```

Q2.

A. Define the following Javascript operators: ++, --, +=, -=, /, %, && and ||

B. What is the 'alert' output of the following Javascript code, explain your answer

```
x = 3;
y = 4;
x++;
y--;
t = x%y;
t += x;
if (x < 4 && y>1){ alert(x);}
```

Q3.

A. What is the difference between 'break' and 'continue'

B. Describe the functionality of the following HTML file and write the output if the values entered in the text field are 3, 4, 5, -3, -1 and empty; respectively

```
<html>
<head>
  <script>
      function text_change(){
         frm.num.style.background = "#ff0000";
      }
      function calculate_result(){
         var number = frm.num.value;
         if (number == "")
             alert("Please, enter a number");
         else if (number < 0)
             alert("Not applicable");
         else{
             temp = 1;
             for (j=1; j<=number;j++) temp = temp*j;
             alert("The result is" + temp);
         }
      }
  </scrit>
</head>
<body>
  <form name=frm>
  <table dir=ltr align=center width=100%>
  <tr><td><b>Enter the number
  <td><b><input type=text name=num size=10
  onChange='text_change();'>
  <tr><td><button name=calculate value='calculate_result();'>
  </table>
  </form>
</body>
</html>
```

Q4.

A. What is the function of the following JavaScript methods: indexOf, split, join, pop, push

B. What is the output of the following Javascript piece of code

```
var x = "hassan@mans.edu.eg";
h1 = x.indexOf("@",0);
str1 = x.substr(0,h1);
str2 = x.substr(h1+1,x.length-h1);
document.write(str1 + "<br>");
document.write(str2 + "<br>");
r = str2.split(".");
r.push("hh");
document.write(r.pop() + "<br>");
document.write(r.pop() + "<br>");
```

Q5.

C. What is JQuery

D. Describe the behavior of the following JQuery codes sections:

Section I

```
<html>
<head>
     <script type="text/javascript" src="jquery.js"></script>
     <script type="text/javascript">
          $(document).ready(function(){
               $("p").click(function(){
                    $(this).hide();
               });
          });
     </script>
</head>
<body>
     <p>If you click on me, I will disappear.</p>
</body>
</html>
```

Section II

```
<html>
<head>
     <script type="text/javascript" src="jquery.js"></script>
     <script type="text/javascript">
          $(document).ready(function(){
               $(".flip").click(function(){
                    $(".panel").slideToggle("slow");
               });
          })
     </script>
     <style type="text/css">
          div.panel,p.flip { margin:0px; padding:5px; text-
          align:center;background:#e5eecc; border:solid 1px
          #c3c3c3;}
          div.panel { height:120px; display:none; }
     </style>
</head>
<body>
     <div class="panel">
     <p>Because time is valuable, we deliver quick and easy
          learning.</p>
     <p>At our University, you can study everything you
          need to learn, in an accessible and handy format.</p>
     </div>
     <p class="flip">Show/Hide Panel</p>
</body>
</html>
```

University of Mansoura
Faculty of Engineering
Dept. of Electronics & Communics.

3rd Year Electronics
Elective Course I
Time Allowed: 3 hrs.
Date: 27/1/2012

Microwave Electronics

USE NEAT SKETCHES TO CLARIFY YOUR ANSWERS:

1) A- Use Johnson's assumptions to explain high frequency limitations in conventional B.J.T.
   B- State the advantages and disadvantages of solid state microwave devices compared with vacuum tubes devices.

2) A- Explain the Gunn effect in transferred electron devices and the conditions required to get it in III – V semiconductors.
   B- Use RWH theory to explain the microwave oscillations in GaAs diode and derive the oscillation frequency.

3) A- Sketch the layer structure of Impatt diode, the field distribution and doping profile in the layers. Explain how its negative resistance is used to get microwave oscillations.
   B- Derive an expression for oscillation frequency in Read diode.
   An Impatt diode has the following parameters:
   Drift velocity $v_d = 2 \times 10^7$ cm/s Drift-region length $L = 6\ \mu m$
   Max. operating voltage $V_{Omax} = 100$ V Efficiency $\eta = 15\%$
   Max. operating current = $I_{Omax} = 200$ mA
   Compute:
   a- Maximum CW output power b- resonant frequency

4) A- Derive an expression for the coupling coefficient between density-modulated electron beam and a microwave circuit.
   B- Derive an expression for the electron transit time in 2-cavity klystron amplifier and use this expression to get the electron convection current at the output cavity.

5) A- Sketch the structure of reflex klystron and derive an expression for the transit time for electron round trip. Use this transit time expression to get a condition to start microwave oscillation.
   B- State the advantages of traveling wave tube (T.W.T) and derive an expression for the convection current in T.W.T. Explain how amplification is achieved.

بالتوفيق د. محمود الرباني