Name:

Enrolment No:

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, May 2018

Course: Signal Conditioning and Telemetry (ICEG351)
Semester: VI
Program: BTech (ICE)
Time: 03 hrs. **Max. Marks: 100**

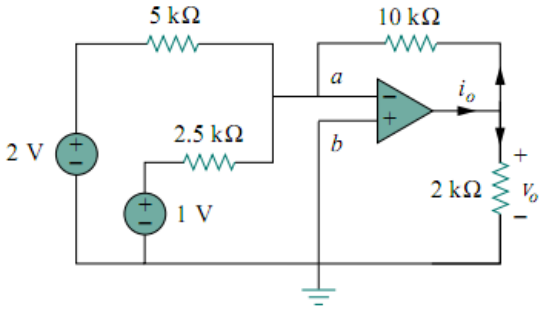
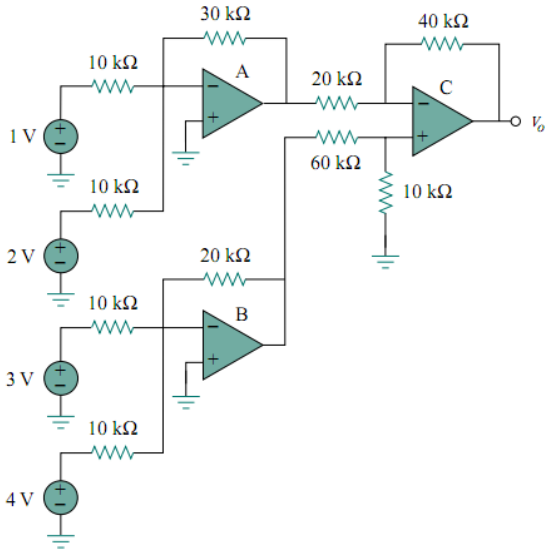
Instructions: All questions are compulsory.

SECTION A

S. No.		Marks	CO
Q 1	Name any four protocols for **serial and parallel data transmission**. Also, compare the advantages of serial vs. parallel data transmission.	**5**	**CO4**
Q 2	Draw and explain the block diagram of **Data Acquisition System** considering any Industrial Application.	**5**	**CO4**
Q 3	Find the **full-scale analog output** for a 16-bit DAC **and its resolution**, if V_{Ref} = 10 V.	**5**	**CO3**
Q 4	Discuss the **selection criteria of operational amplifiers** for any application.	**5**	**CO2**

SECTION B

Q 5	A **push-pull capacitive transducer** is used in a **Blumlein Bridge**. The frequency of Bridge supply is 1 MHz. At balance, the capacitance if each half (arm) of the transducer is 500 pF. a. Determine suitable values of inductance (L_C) for the tightly coupled ratio arms to make the bridge sensitivity essentially independent of variations in inductance (L_C) and bridge supply frequency, b. Output impedance of bridge under balanced and unbalanced conditions.	**10**	**CO1**
Q 6	Compare **wired vs. wireless networks** on the basis of installation, cost, mobility, reliability, security, types, quality of service (QoS), speed and bandwidth.	**10**	**CO4**
Q 7	**Draw and discuss** the working of an **8-Bit Flash Type ADC**. Considering the **V_{Ref} of 10 V**, **calculate the analog input** provided to the ADC if the output of the same ADC is **10111011**. Also, calculate the **resolution** of this ADC.	**10**	**CO3**

<table>
<tr><td>Q 8</td><td>Calculate Vo and Io for the following circuitry:
 
</td><td>10</td><td>CO2</td></tr>
<tr><td colspan="4">SECTION-C</td></tr>
<tr><td>Q 9</td><td>Design a Third-order Unity-gain Bessel High-Pass Filter with the corner frequency (f_C) of 100 KHz. Use the following data for your design:
<table><tr><th>Bessel coefficients</th><th>Ai</th><th>Bi</th></tr><tr><td>Filter 1</td><td>a1 = 0.756</td><td>b1 = 0</td></tr><tr><td>Filter 2</td><td>a2 = 0.9996</td><td>b2 = 0.4772</td></tr></table></td><td>20</td><td>CO2</td></tr>
<tr><td>Q10</td><td>(A) A Sensor develops output of 10 to 200 mV as the input (measurand) varies from minimum to maximum of range. Develop a signal conditioning scheme with high input impedance, low output impedance and output voltage between 0-10 Volts.</td><td>10</td><td>CO1</td></tr>
<tr><td></td><td>(B) Determine the output of the following op-amp circuitry:
 
</td><td>10</td><td>CO2</td></tr>
</table>

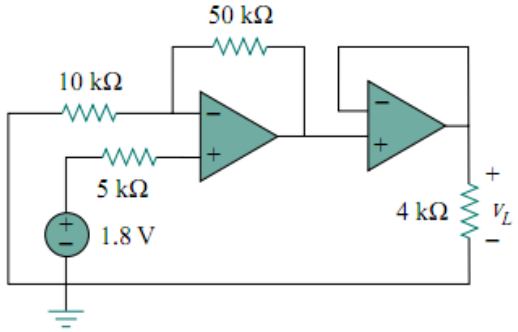
Name: **Enrolment No:**	UPES

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, May 2018

Course: Signal Conditioning and Telemetry (ICEG351)
Semester: VI
Program: BTech (ICE)
Time: 03 hrs. **Max. Marks: 100**

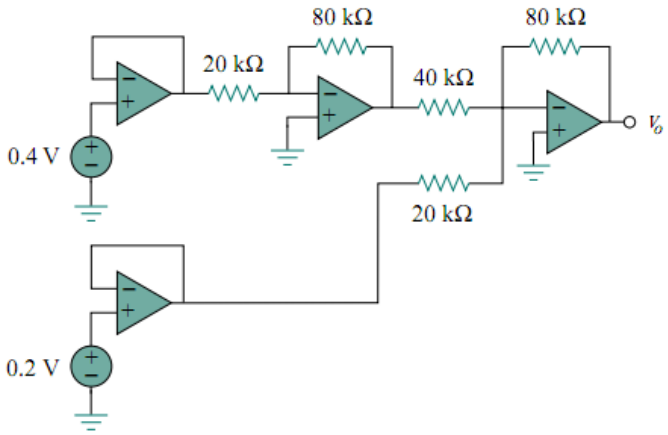
Instructions: All questions are compulsory.

SECTION A

S. No.		Marks	CO
Q 1	Draw and explain the **telemetry architecture** for small, medium and longer distances showing all components involved along with their details.	**5**	**CO4**
Q 2	Determine the **Load Voltage (V_L)** for the following circuit: 	**5**	**CO2**
Q 3	Find the **full-scale analog output** for a 12-bit DAC **and its resolution**, if $V_{Ref} = 5$ V.	**5**	**CO3**
Q 4	Discuss the **selection criteria of operational amplifiers** for any application.	**5**	**CO2**

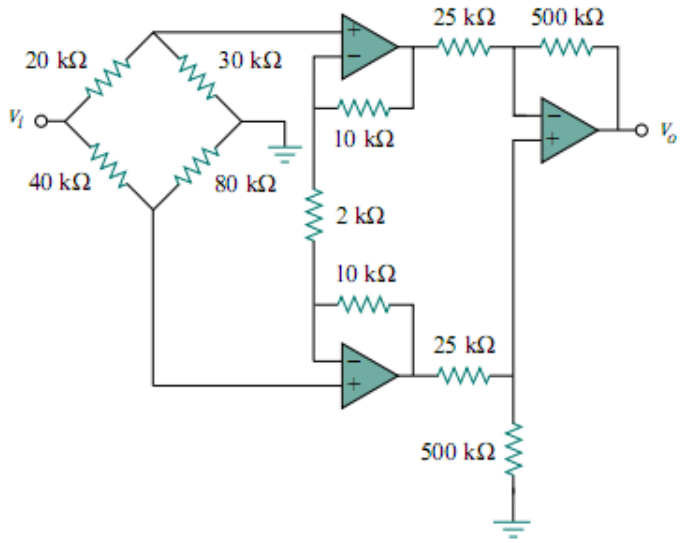
SECTION B

Q 5	A **Maxwell's Inductance Bridge**, is having arm ab consists of a coil with inductance L1 and resistance r1 in series with a non-inductive resistance R. Arm bc and cd are each a non-inductive resistances of 220 Ω. Arm ad consists of a standard variable inductor (L) of 45.7 Ω. Balance is obtained when L2 = 67.8 mH and R = 5.36 Ω. a. Draw the circuit diagram of the bridge circuit, as mentioned above. b. Formulate the necessary equations for Maxwell's Inductance Bridge circuit. c. Find the Resistance and inductance of the coil in the arm ab.	**10**	**CO1**

Q 6	Compare **wired vs. wireless networks** on the basis of installation, cost, mobility, reliability, security, types, quality of service (QoS), speed and bandwidth.	**10**	**CO4**
Q 7	**Draw and discuss** the working of an **8-Bit Successive Approximation Type ADC**. Considering the $\mathbf{V_{Ref}}$ **of 8 V**, **calculate the analog input** provided to the ADC if the output of the same ADC is **10001011**. Also, calculate the **resolution** of this ADC.	**10**	**CO3**
Q 8	Calculate the output voltage of the following circuit 	**10**	**CO2**

Please refer the next page for **Section C**

SECTION-C

Q 9	Design a **Fifth-order Unity-gain Butterworth Low-Pass Filter** with the **corner frequency of F_C of 60 KHz**. Please use the following data for your design: **Butterworth coefficients** / **Ai** / **Bi** Filter 1 / a1 = 1 / b1 = 0 Filter 2 / a2 = 1.6180 / b2 = 1 Filter 3 / a3 = 0.6180 / b3 = 1	**20**	**CO2**
Q10	(A) A Sensor develops **output of 10 to 300 mV** as the input (measurand) varies from minimum to maximum of range. Develop a signal conditioning scheme with **high input impedance, low output impedance** and **output voltage between 0-8 Volts**.	**10**	**CO1**
	(B) Figure shown below is an instrumentation amplifier driven by a bridge. Find the **output voltage (Vo)** if the **input voltage (Vin)** is **200 mV**. Also, find the **gain (Vo/Vin)** of the shown amplifier.  	**10**	**CO2**