

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

**Course: Instrumentation and Measurement (ELEG 221)**

**Semester: IV**

**Program: B. Tech. (EE+BCT)**

**Time: 03 hrs.**

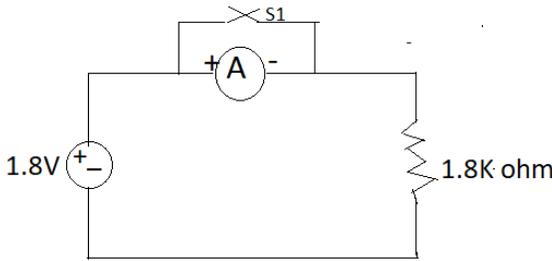
**Max. Marks: 100**

**Instructions: All questions are compulsory.**

**SECTION A (4\*5=20 marks)**

S. No.		Marks	CO
Q 1	A voltmeter having a guaranteed accuracy of 1% reads 9V on a 0-150 V voltmeter scale. Calculate the % limiting error?	5	CO3
Q 2	A spring control instrument uses phosphor bronze spring to produce the controlling torque, if the ratio of length of the spring to the thickness of spring is 3000 for the deflection of $90^\circ$ , what should be this ratio if the scale is extended to $120^\circ$ ?	5	CO3
Q 3	The moving coil instrument of resistance of $5 \Omega$ , requires a potential difference of 75mV to give a Full Scale Deflection. The value of shunt resistance needed to give a full scale deflection at 30A is-----?	5	CO3
Q 4	Compare Digital Instruments with Analog instruments on behalf of different parameters such as input impedance, speed of response, resolution, accuracy and operational power consumption.	5	CO1

**SECTION B (4\*10=40 marks)**

Q 5	A voltmeter reads 40 V on its 100 V range and the ammeter reads 75mA on its 150 mA range in the circuit. Both the instruments are guaranteed to an accuracy of $\pm 2\%$ of full scale deflection. Calculate the limiting error in the measured power?	10	CO3
Q 6	<p>The PMMC ammeter A shown in figure has arrange of 0-3mA. When switch S1 is opened, the pointer swings to the 1mA mark returns &amp; settles at 0.9mA mark. The meter is:</p> <p>a.) Critically damped and has a coil resistance of <math>100 \Omega</math>.            b.) Critically damped and has a coil resistance of <math>200 \Omega</math>.            c.) Underdamped and has a coil resistance of <math>100 \Omega</math>.            d.) Underdamped and has a coil resistance of <math>200 \Omega</math>.</p> <div style="text-align: center;">  </div>	10	CO4
Q 7	A 4 1/2 digit digital multimeter has an error specification of 0.2 % of the reading +10 counts. If a DC voltage of 100 volts is read on its 200V full scale. The maximum error that can be expected in a reading is.....?	10	CO3
Q 8	Illustrate Piezoelectric effect. Derive the expression for measurement of Pressure using Active Transducers.	10	CO2

**SECTION-C(2\*20=40)**

Q 9	Design a Digital Voltmeter which comprises of a Sample rate multivibrator, Gate( time elapsed between closing and opening is 5 msec), two comparator and the system's accuracy is as high as +/- 0.0015% of the reading, and is characterized by errors due to non-linearity's present on the input signal, based on the operation of Voltage to Time Conversion.	<b>20</b>	<b>CO2</b>
Q10	a.) Considering a cylindrical wire, find the generalized expression of gauge factor for metal wire strain gauges.	<b>10</b>	<b>CO4</b>
	b.) A quartz, piezoelectric transducer $0.5\text{cm}^2$ in area and 1mm thick is connected to a charge amplifier having a feedback capacitance of 30pF. The charge sensitivity of transducer is 2pC/N. In the frequency range of operation of transducer, the amplifier can be assumed to have an infinite input impedance and a negligible output impedance. A sinusoidal force of $30 \cdot 10^{-3} \sin 150t$ N is applied on a transducer. What is a peak to peak voltage swing and the amplifiers output?	<b>10</b>	<b>CO4</b>
	*****ALL THE BEST*****		