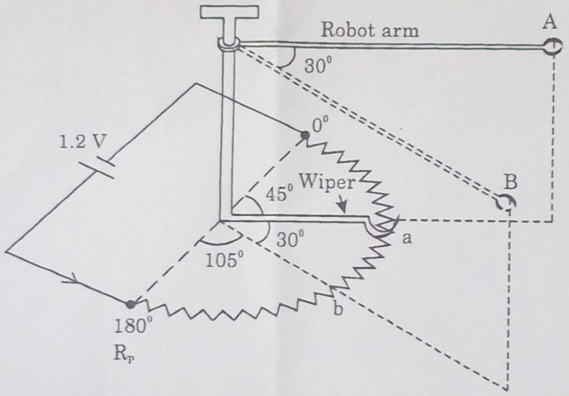
28 Aug 2016 **711 Minor-1** **Max 20 marks Max 1 hour**

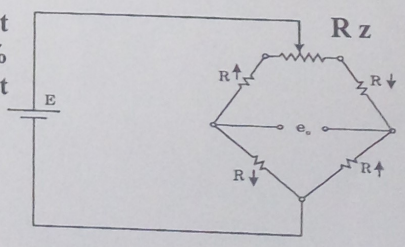
Attempt all questions. Make neat diagrams. Be brief, to the point.

Q1 The **angular** motion of a robotic arm is to be measured by a semi-circular potentio-meter as shown in the diagram. The robotic arm moves from the initial position **A** to the final position **B**, and corresponding the potentiometer wiper moves from location **a** to **b** as shown in the diagram covering an angle of 30^0. The total possible wiper movement is **180** degrees. The wiper when at **a** is having an angle of 45 degrees as shown in the diagram. The potentiometer with $R_p = 1000$ ohms is excited by **1.2** V battery with polarity as shown. It is desired that an **offset and sensitivity circuit** is added to the system such that the output (at OPAMP output) is 0 V when the arm is at A, and 5 V when the arm is at B. Draw the OPAMP circuit and give its design. Make suitable assumptions where required



(a) Draw the complete Circuit for above requirement. (3)
(b) Derive formula for gain of the OP AMP circuit (3)
(c) Draw, explain working, and Justify the choice of OFF SET circuit (2)
(d) Explain working of SENSITIVITY set circuit, what precautions be taken. (2)
(e) Explain a method of calibrating **linear** displacement sensor with any one standard (4)

Q.2a A strain gauge bridge circuit as shown has a zero adjustment potentiometer R_Z. If the tolerance of strain gauge resistance R is ± 10% , derive the smallest value of R_Z (in terms of R), which can zero adjust the bridge in the worst tolerance case (3 marks)



Q.2b A strain gauge bridge circuit as shown has a sensitivity adjustment potentio-meter R_S as shown. If the gauge factor G due to manufacturing tolerances can have highest value G_{max} and lowest value G_{min}. Derive minimum value of R_S (in terms of R) that can adjust the sensitivity as G varies between its extreme values. (3 marks)