B.MET.ENGG.2ND YR. 2ND SEM. EXAM.-2017

APPLIED ELECTRONICS & INSTRUMENTATION

TIME : 3HOURS   **FULL MARKS :100**

(50 marks for each Part)
Use Separate Answer Scripts for Each Group

GROUP A

FULL MARKS :50

Answer question no. 1 and any three from the following questions

1. Answer any five of the following questions.   **1x5**
   - (i)   What is the position of the Fermi level in an intrinsic semiconductor?
   - (ii)   Name a material that can act as a n-type impurity in a semiconductor sample.
   - (iii)   Who are the carriers of the reverse current in a reverse biased pn junction diode?
   - (iv)   Why is the depletion region of a pn junction so called?
   - (v)   How many diodes are there in a bridge rectifier?
   - (vi)   When is a BJT said to be in cutoff?
   - (vii)   If α of a transistor is 0.05, find its β value.
   - (viii) Current gain is highest for CB, CE or CC BJT circuit?

2. What do you understand by an intrinsic semiconductor? Give two examples. Can an intrinsic semiconductor behave as an insulator? How are extrinsic semiconductors formed? Why are extrinsic semiconductors electrically neutral? Why does an extrinsic semiconductor behave as an intrinsic one at high temperature?   **2+2+3+3+3+2**

3. a) A rectangular n-type semiconductor specimen has a length of 0.2 cm, and a thickness of 0.1 cm. When a voltage of 1 V is applied across the lengrh of the sample which is placed in a transverse magnetic field of 1 kG, a Hall voltage of 0.04V is produced. Calculate the Hall mobility of the electrons.   **8**

   b) A Si pn junction diode operates at 300K. If the applied forward bias is increased, the current is doubled. Calculate the increase in the bias voltage.   **7**

4. a) Draw the energy band diagram of an open circuited pn junction. How does this band diagram change when a forward bias and a reverse bias are applied?   **2+4+4**
   b) What is junction breakdown? How many types of breakdown process are there?   **5**

5. a) Define the following terms for a rectifier-(i) dc load current, (ii) ripple factor, (iii) TUF.   6

    b) What is the function of a filter in a rectifier circuit? Give examples.   4

    c) A bridge rectifier feeds a load resistance of 2500Ω from a 30V (rms) supply. Each diode of the rectifier has a forward resistance of 50Ω. Calculate (i) the dc load voltage, (ii) the ripple voltage at the output, and (iii) the percentage regulation.   5

6. a) How does the BJT act as a current amplifier? Explain the various switching times when a transistor makes a transition from the cutoff state to the saturation state and back.
                                                                                                        4+6
    b)An n-p-n transistor with $\alpha=0.96$ and negligible I_{co} carries a base current of 0.2 mA in the active region. Determine the emitter and the collector currents.

                                                                                                        5

7. a) What is the significance of the load line of a transistor? Which factor affects the position of the Q point? Define the three stability factors.

                                                                                                        5+4

8. b) For a self bias circuit, V_{cc}=22.5 V,R_L=5.6k , R_1=90 k ,R_2=10 k , V_{BE}=0.7 V and β=55. For $I_B>>I_{co}$, calculate V_{CE} and I_C.   6

GROUP B

FULL MARKS : 50

Answer question no. 1 and any two from the following questions

Q.1   5x2=10

a. What is the typical detector of AC Bridge?

b. What are the advantages of potentiometer type transducer?

c. Explain bonded strain gauge?

d. What is the effect of thermal EMF in Wheatstone bridge?

e. Define sensitivity of transducer.

Q.2

a.   Explain the operation of strain gauge. Describe that, how change in strain can affect the change in resistance.

b.   A resistance strain gage with a gage factor of 2 is fastened to a steel member subjected to a steel of 1.050 kg/ cm^2. The modulus of elasticity is 2.1 x 10^6 kg/cm^2. Calculate the change in resistance

c. A strain gauge with 40cm wire length and 25 μm wire diameter has a resistance of 250Ohm and a gauge factor 2.5. Calculate the change in wire length and diameter when the resistance change is measured as 0.5Ohm. ?

                                                                                        4+6+5+5=20

Q.3

a. The resistance of a coil of nickel wire is 25Ohm at 20^0C. This rises to 37Ohm when the coil has been submerged in a liquid for some time. Calculate the temperature of the liquid.

b. Explain the basic principle of resistance temperature detector (RTD) and how it is used to sense the temperature.

c. What are the difference between RTD and termistor?

   6+5+5+4=20

Q. 4

a.   Explain the principle of operation of four probe method for measuring the resistivity of metal. Proof that $\log_e \rho = (E_g / 2kT) - \log_e K$

b. What are the drawbacks of two probe methods? How the resistivity of a thin slice conducting surface can be performed?

4+6+6+4=20

Q. 5

a. What is the working principle of Varley loop? Why it is advantageous over Murray loop?
b. The Varley loop test set consists of a defective conductor and a healthy conductor connected at the cable terminal located 10 miles from the test set. The cable have resistance of 0.05 ohm per 1000 feet. When the switch is in position a and the circuit is balanced, the balancing resistance is $R_3 = 100$ Ohm. When the switch is in position b the circuit is rebalanced and $R_3 = 99$ Ohm. Find the distance from the ground fault to the test set.
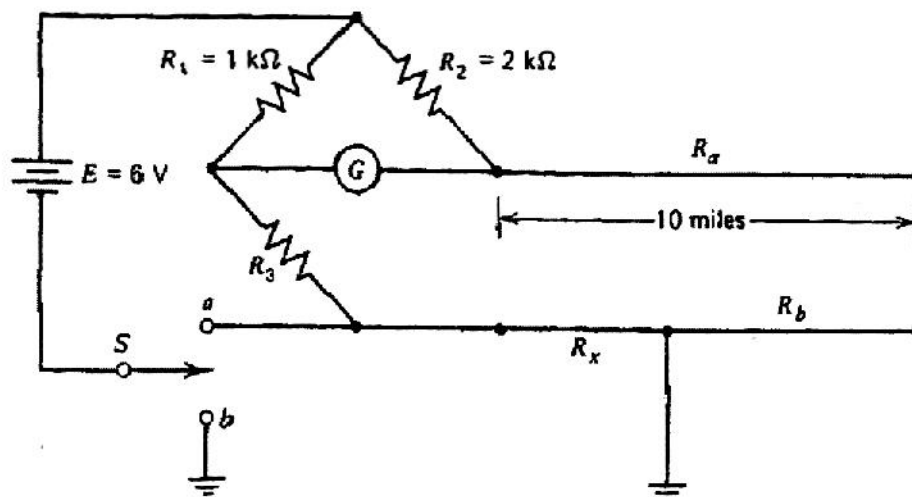

8+6+6=20

Q. 6

a. Explain the operation of Hay's Bridge using phasor diagram. What is the typical range of Q factor, which can be measured by using this bridge?

b. In the following AC Bridge working at 1KHz, arm 'ab' is 0.2μF of pure capacitance. Arm 'bc' is 500 ohm pure resistance, arm 'cd' contains unknown impedance and arm 'da' has 300 ohm resistance in parallel 0.1 μF capacitor. Estimate the unknown impedance in terms of resistance and either in capacitance or inductance considering, it is in series.
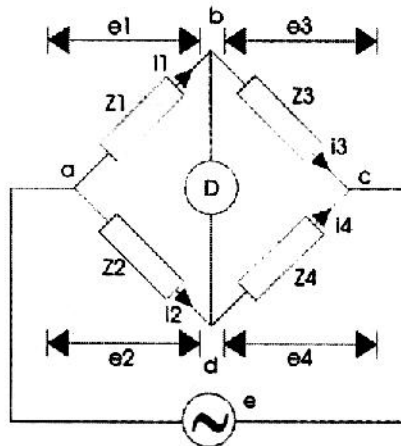
c. Explain the operation of Modified De Sauty's bridge

d. The arms of a Maxwell bridge is as follows BC and CD are non reactive resistance of 100 Ohm each (R_3 and R_4). Unknown branch has been changed to AD which contains R_2, L_2 and a tuning resistance of R = 1.36Ohm in series. Balance has been achieved with the AB branch having L_1 = 47.8mH and R_1 = 32.7Ohm. Find R_2 and L_2.

5+5+5+5=20