Ref. No.: Ex/Met/ET/T/222/2018

B.MET.ENGG.2ND YR. 2ND SEM. EXAM.-2018

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 two from the rest (Q.2-Q.4)
Each Questions (Q.2-Q.4) has two options, choose only one

1.

i. Explain the different techniques current flow through a semiconductor.
ii. When is a p-n junction diode said to be in (i) forward bias and (ii) reverse bias.
iii. How many diodes are there in a bridge rectifier and compare the properties of it with full wave center tap rectifier?
iv. Why a transistor is also known as BJT. Explain the types of transistor.
v. What do you mean by CMRR & Slew Rate?

5x2=10

2.

A)

i. Define semiconductors. What are their characteristics properties?
ii. Define the following terms – doping, dopants, donors, acceptor.
iii. Explain the phenomenon of diffusion and drift of current carriers in a semiconductor.
iv. Define the mobility of charge carriers in a semiconductor.
v. At 300 k the intrinsic carrier concentration of silicon is $1.5 \times 10^{16}\, m^{-3}$. If the electron and the hole mobilities are 0.13 and 0.05 m^2/V.s respectively, determine the intrinsic resistivity of silicon at 300K

(3+4+6+2+5)=20

OR

B)

i. What is a p-n junction diode?
ii. What is an abrupt and linearly graded p-n junction?
iii. How does a p-n junction diode behave under- equilibrium, forward bias, and reverse bias?
iv. The reverse saturation current at 300k of a p-n junction Ge diode is 5μA. Find the voltage to be applied across the junction to obtain a forward current of 50 mA.

(2+3+10+5)=20

3. A)

i. Draw the circuit diagram of a) a half wave rectifier and (b) a full wave rectifier. Explain the operation of each circuit.

ii. A bridge rectifier feeds a load resistance of 2500Ω from q 30v (rms) supply. Each diode of the rectifier has a forward resistance of 50Ω.calculate (a) the dc load voltage, (b) the ripple voltage at the output.

iii. Define the following terms for (a) DC load current (b) ripple factor.

iv. Explain the circuit operation of a bridge rectifier with capacitive filter at the load.

(8+5+2+5)

OR

B)

i. What are the different modes of operation of a transistor? What do you mean by static characteristics of a transistor?

ii. With respect to CB mode input output characteristics of a transistor, explain the active, saturation and the cutoff regions with diagram.

iii. Explain the term transistor biasing. What are the factors determining the choice of the Q- point? Define the three stability factors.

iv. Derive the relationship between α and β.

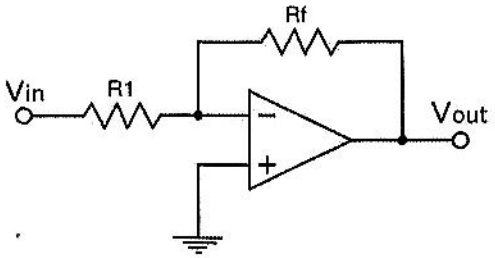
(6+6+6+2)=20

4. A)

i. Write a short note on Wien Bridge Oscillator with frequency of oscillation calculation.

ii. Describe the use of an OP AMP as an adder.

iii. The inverting amplifier circuit of the figure below has R1= 1KΩ and Rf=3 KΩ. Determine the output voltage, input resistance, and the input current for an input voltage of 2V.



(10+5+5)=20

OR

B)

i. Define the following terms in connection with an OP AMP – Input bias current, Input offset voltage, Input offset current,

ii. Explain the operating principle of a differentiator and integrator circuits with proper circuit diagram using OPAMP.

iii. Explain the concept of feedback in amplifiers. What do you mean by positive and negative feedback?

(8+8+4)=20

GROUP B

FULL MARKS : 50

Answer question no. 5 and any two from the rest (Q.6-Q.8)

Each Questions (Q.6-Q.8) has two options, choose only one

5.

a. What is the typical detector of AC Bridge?
b. What are the advantages of potentiometer type transducer?
c. Name two applications of Wheatstone Bridge
d. What is opposite angle measurement bridge?
e. What are disadvantages of Maxwell's inductance capacitance bridge?

5x2 =10

6

A

i) Explain the operating principle of Wheatstone Bridge. Deduce the Thevenin equivalent circuit to find out the Galvanometer resistance.

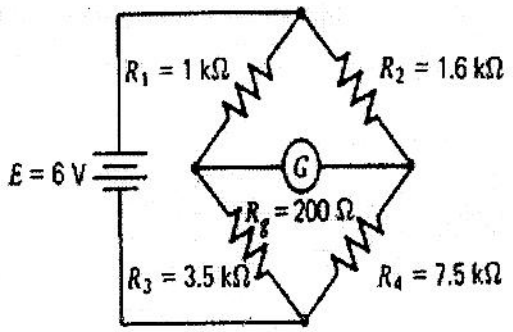
ii) What are the typical measurement errors in DC bridge measurement?

8+8+4=20

Or

B

i) Calculate the current through Galvanometer



ii) Why Kelvin Double Bridge has been used as a modification of Wheatstone Bridge?

iii) Explain the operation of Kelvin Double Bridge.

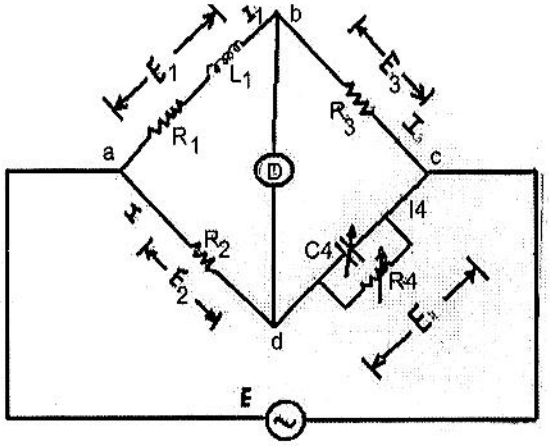
6+6+8=20

7

A.

i) The impedance of the basic AC bridge are as follows Z1 = 100 (80^0) Ohm , Z2= 250 Ohm, Z3= 400 (30^0) Ohm and Z4= unknown . Determine the constant for unknown arm.

ii In the following bridge R_2 = 400 Ohm, R_3= 600 Ohm, R_4 = 1000 Ohm, C_4 = 0.5 MicroFarad. Calculate the value of R_1 and L_1. Calculate the Q of coil if Frequency is 1000Hz.



iii) Explain the operation of Modified De- Sauty's Bridge with proper Phasor diagram. Why it is called as modified

6+6+8=20

Or

B

i) Explain with Phasor diagram of the operation of Hay's Bridge.

ii) How an unknown frequency can be measured using bridge?

iii) A sheet of Bakelite 4.5mm Thick is tested at 50Hz between electrodes of 0.12m in diameter. The Schering bridge employs a standard air capacitor C_2 of 106 pF capacitance, a non reactive resistance of $R_4 = 1000/\pi$ Ohm in parallel with a variable capacitor C_4 and a non reactive variable resistance R_3. Balance is obtained with C_4 = 0.5 microFarad and R_3 = 260 Ohm. Calculate the capacitance, power factor and relative permittivity of sheet.

8+6+6=20

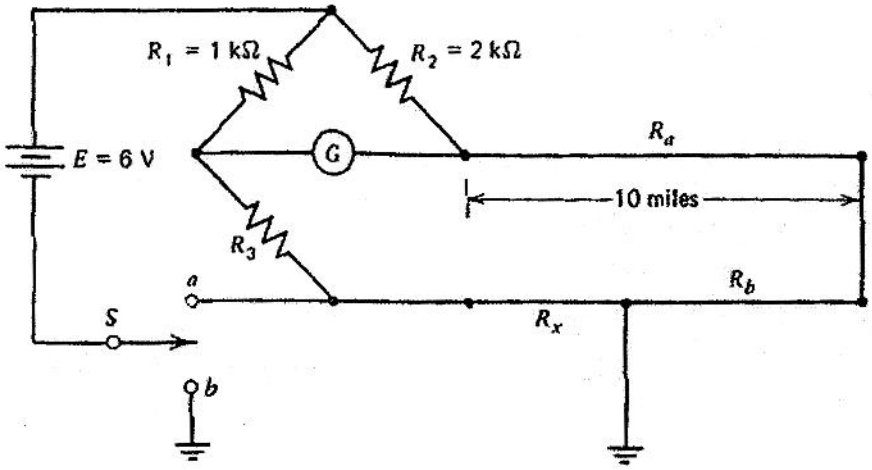
8

A

i) What is the working principle of Varley loop? Why it is advantageous over Murray loop?

ii) A bridge is balanced at 1000Hz and has the following constants; AB 0.2 microFarad pure capacitance, BC 500 Ohm, CD unknown and DA R= 300 Ohm in parallel with C = 0.1 microFarad. Find R, C, L of arm CD considering they all are in series circuit.

iii) 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.



4+4+6+6=20

Or

B

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

ii) 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