Ref. No.: Ex/Met/ET/T/222/2019

B.MET.ENGG.2ND YR. 2ND SEM. EXAM.-2019

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)

1)

a) What are the different techniques current flows through a semiconductor?
b) When is a p-n junction diode said to be in (i) forward bias and (ii) reverse bias.
c) What is the importance of CMRR?
d) What are the ideal characteristics of an OP-AMP
e) What do you mean by CMRR & Slew Rate?

5x2=10

2)

a) Name two elemental and two compound semiconductors.
b) Define Fermi energy level at T=0K?
c) Why the effective mass of electron within a crystal is different from free electron mass?
d) Briefly explain two current conduction mechanisms in a semiconductor.
e) Find the conductivity of a bar of pure silicon at 300K. Given, μn = 0.13m2/(V.s), μp = 0.05m2/(V.s), ni = 1.5×1016/m3 and electronic charge e=1.6 × 10-19 coulombs .
f) Define mobility?

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

3)

a) Draw and level the energy band diagram of a p-n junction diode under- equilibrium, forward biased, and reverse biased conditions.
b) Consider a uniformly doped silicon pn junction with doping concentration NA=3×1017cm-3 and ND=1016cm-3 . What is the value of Vbi (built in potential barrier) at T = 300K. ni=1.5×1010cm-3. Thermal voltage is 26 mV.
c) Write down the current-voltage equation of p-n junction diode explaining all the symbols used.
d) 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.
e) What is zener break down ?

6+3+5+3+3 = 20

[Turn over

4)

a) What are the different modes of operation of a transistor? Define static characteristics of a transistor?

b) Draw and explain the input and output characteristics of a common emitter mode bipolar junction transistor indicating all regions of operation on the characteristic curve. What is Early effect? Show Early voltage on the characteristic curve.

c) Draw and explain the operation of a centre-tapped full wave rectifier. Find the values for (i) DC load current and (ii) ripple factor of the full wave rectifier.

d) Define transistor biasing. What are the factors determining the choice of the Q- point?

e) Define the three stability factors. Derive the relationship between α and β.

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

GROUP B

FULL MARKS : 50

Answer question no. 5 and any two from the rest (Q.6-Q.9)

5.

a. What are the typical detectors used in AC Bridge?

b. What are the advantages of potentiometer type transducer?

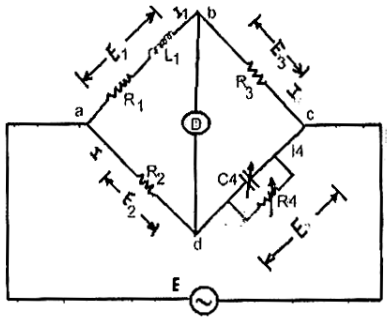
c. What are the fundamental transducer parameters?

d. Define gage factor.

e. Briefly explain two element rosettes? **5x2 =10**

6

i) 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 the frequency is 1000Hz.



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

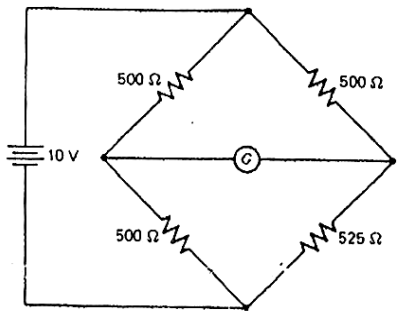
i) The impedance of the basic AC bridge are as follows Z1 = 100 (80^0) Ohm , Z2= 250 Ohm, Z3= 400 (30^0) Ohm and Z4= unknown . Determine the constant for unknown arm.

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

iii) Explain the operation of Wien's Bridge. **6+8+6=20**

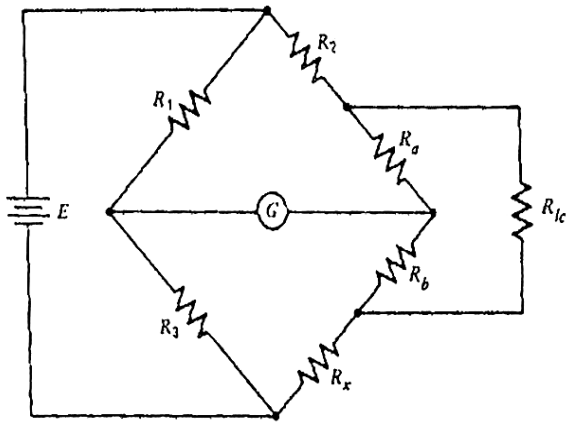
8

i) Calculate the current through the galvanometer from the following figure. Galvanometer resistance is 125 Ohm and it is a center zero 200-0-200 micro-Amp movement



ii) Explain the operation of Murray loop. How it is different from Varley loop?

iii) Calculate the R_x in the following circuit if R_a = 1200 Ohm, R_1 = 1.25 R_2 , R_1 = 800 R_b and R_b = 1600 Ohm.



5+5+5+5=20

9

i) Proof that the Gage factor depends on Poisson's ratio.

ii) Briefly describe some metallic sensing element to calculate the strain.

iii) Explain the operation of LVDT with proper figure.

iv) A resistance strain gage with a gage factor of 2.4 is mounted on a steel beam whose modulus of elasticity is 2 x 10^6 Kg/cm^2. The strain gage has an unstrained resistance of 120 Ohm which increases to 120.1 ohm when the beam is subjected to a stress. Calculate the stress at the point where the strain gage is mounted.

5+5+6+4=20