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UNIVERSITY OF ENERGY AND NATURAL RESOURCES, SUNYANI, GHANA

SCHOOL OF ENGINEERING

DEPARTMENT OF COMPUTER AND ELECTRICAL ENGINEERING

Level 300: First Semester Examinations 2020/2021

Bachelor of Science (Computer Engineering, Electrical & Electronic Engineering)

ELNG 303: LINEAR ELECTRONIC CIRCUITS

April, 2021

Time: 2½ hours

Material required: Class material (To be brought in by students)

INSTRUCTIONS: ANSWER ALL QUESTIONS (each question carries 15marks)

Question 1 ✓

(a) The following processes are used in the fabrication of monolithic ICs, explain each of them in detail:

- i. Oxidation
- ii. Diffusion
- iii. Epitaxy
- iv. Photolithography
- v. Thin Film Deposition

(b) Using the list in (a) provide a step-by-step masking levels of the fabrication of NPN transistor indicating the type of photo-resist used.

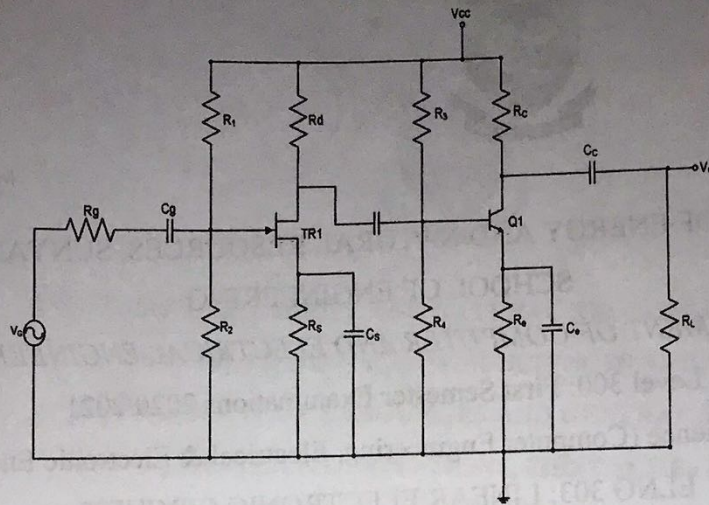
Question 2

The two-stage amplifier shown in Fig. 2 is designed with a *FET*, TR1 and silicon *BJT*, Q1 with the manufacturer's specifications for β (Q1) at 25°C as 150 and g_m (TR1) as 3500 μS . Given $R_g=1.5k\Omega$, $R_1=6 M\Omega$, $R_2=4M\Omega$, $R_d=2.4k\Omega$, $R_s=500\Omega$, $R_3=15k\Omega$, $R_4=4.7k\Omega$, $R_c=2.7k\Omega$, $R_e=470\Omega$, $R_L=2.2k\Omega$ and supply voltage as 20V. Using the Fig. 2 and component values given, answer the following questions.

Calculate:

- i) Emitter current I_E
- ii) Emitter resistance r_e
- iii) Voltage gain at stage 2, A_{v2}
- iv) Calculate input impedance of the second stage, Z_2
- v) Calculate the gain of the first stage, A_{v1}
- vi) Calculate the input impedance of the first stage Z_1
- vii) Calculate the overall gain, A
- viii) If v_g is a sinusoidal voltage of $5mV \cos \omega t$, what will the output voltage be?

Fig. 2



Question 3

- State and explain the different types of power amplifiers
- A complementary pair class B push-pull amplifier has a supply voltage of 45 V and the transistors are biased so that they are sinusoidally driven to provide a current which is 0.75 of the maximum value. Calculate:
 - The output power supplied to a speaker having a resistance of 15 Ω
 - The collector efficiency
 - The power dissipation of the transistors.

$g_m V_{gs}$

Question 4

- State the characteristics of an ideal op-amp.
- Fig. 4 shows the schematic of the two op-amp instrumentation amplifier. Find
 - An expression for V_{O1} and V_{O2}
 - Hence or otherwise an expression if $R_1 = R_2 = R_3 = R$
 - The current through R_L if $R_L = 10K\Omega$ and $V_i = 5V$

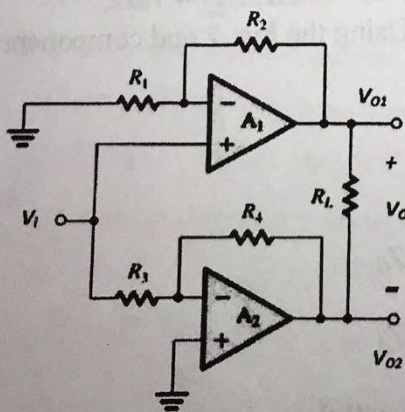


Fig. 4

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$P_{max} = \frac{V_{CC}}{8R_L}$
 204 max