

UNIVERSITY OF LAGOS

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

BSc (Hons.) FIRST SEMESTER DEGREE EXAMINATIONS (TEST)

2019/2020 Academic Session

CPE 435 (PROTOTYPING TECHNIQUES)

INSTRUCTION: Answer all questions

Time Allowed:

Question 1

Using transistor BFR-193, design a two-stage class A, capacitor coupled Radio Frequency Amplifier (RFA) having collector current (I_c) of 10mA, DC current gain (β) of 100 and DC rail voltage (V_{cc}) of 12V. AC input signal voltage is 5mV, frequency (VHF) at -3dB is 30MHz and base-emitter junction voltage (V_{bej}) is 0.7V as shown in figure Q1. See attached transistor datasheet for details.

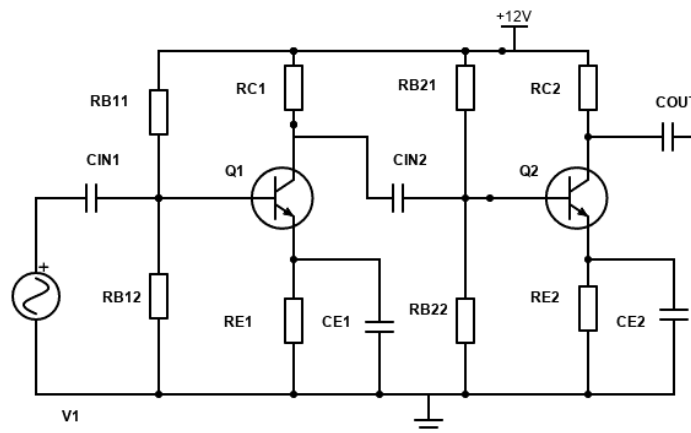


Figure Q1

State: -

- | | | |
|-------|---|---------|
| i. | any design assumptions | 2 marks |
| ii. | any design equations | 2 marks |
| iii. | Draw the DC equivalent circuit | 2 marks |
| | Calculate | |
| iv. | V_{CE1} , V_{CE2} , V_{RC1} , V_{RC2} , V_{RE1} , V_{RE2} , | 6 marks |
| v. | R_{C1} , R_{E1} , R_{C2} , and R_{E2} | 4 marks |
| vi. | I_{B1} , I_{B2} | 2 marks |
| vii. | V_{RB12} , V_{RB22} | 2 marks |
| viii. | I_{RB12} , I_{RB22} | 2 marks |
| ix. | R_{B12} , R_{B22} | 2 marks |
| x. | V_{RB11} , V_{RB21} | 4 marks |
| xi. | I_{RB11} , I_{RB21} | 2 marks |
| xii. | R_{B11} , R_{B21} | 2 marks |
| xiii. | Draw the AC equivalent circuit | 2 marks |

Calculate

- | | | |
|--------|---|----------|
| xiv. | C_{E1} , C_{E2} , C_{IN1} , C_{IN2} , C_{OUT} | 5 marks |
| xv. | Sketch the estimated frequency response for the circuit | 2 marks |
| xvi. | Comment on the behavior of the circuit as an amplifier | 1 mark |
| xvii. | With the first stage the disconnected, redraw and convert only the second stage of the RFA to a Colpitts oscillator | 2 marks |
| xviii. | Assume a total capacitance of 12nF, calculate the value of inductance required to generate oscillations at 90MHz | 4 marks |
| xix. | Sketch the frequency response of the oscillator | 1 mark |
| xx. | Considering the transition frequency f_T from the attached datasheet, comment on the suitability of this transistor for this design | 1 mark |
| | Total | 50 marks |

Question 2

With respect to grounding/earthing (GND) protection and use of diagrams where necessary, define ground and grounding (GND) in electronic systems 2 marks

- a. In a grounded electronic system, illustrate how to connect
 - i. Digital ground (DGND) connection 2 marks
 - ii. Analog ground (AGND) connection 2 marks
- b. Explain the effect of not grounding an electronic system 1 mark
- c. Explain the procedure for grounding an electronic system 1 mark
- d. Explain the function of inspection-chamber in a system ground. 1 mark
- e. Explain the effect of the following on earth resistance in electronic system grounding - soil type, moisture, salt, depth of earth electrode 4 marks
- f. In a ground connection, it was found that the ground path has a resistance of 0.5Ω and the system to be protected has a resistance of 0.45Ω , explain what you will do and why as the manager of the project 2 marks
- g. In a 200-floor building, a client wants to install a communication equipment on the 120th floor. What advice would you give the client concerning system grounding? 2 marks
- h. A telecommunication equipment is to be installed in an electric power generating station, what advice will you give concerning the grounding of the telecommunications equipment. 2 marks
- i. What is the importance of copper as a conductor in an earthing system instead of any other conductor such as aluminum? 2 marks
- j. List four methods of earthing 4 marks

Total 25 marks

Question 3

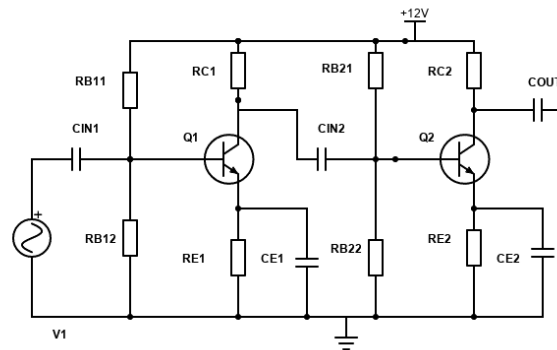


Figure Q3

- Define power de-coupling 2 marks
- Explain with diagrams one method of power decoupling 5 marks
- Differentiate between a decoupling capacitor and bypass capacitor 4 marks
- Redraw Figure Q3 by including a decoupling capacitor 4 marks
- Explain the function of feed-through capacitors 5 marks
- Explain the need for de-coupling in an electronic system 5 marks

Total 25 Marks

Question 4

Define soldering 1 mark

- Differentiate between soldering and welding 2 marks
- Differentiate between soldering and brazing 2 marks
- List and explain three methods of soldering 3 marks
- List and explain the types of component placements with respect to soldering and printed circuit board 3 marks
- Explain the function of any three items used in the soldering and de-soldering process 3 marks
- List four merits and four demerits of any type of component placement listed in (d) 4 marks
- As an alternative to electronic component physical on-board placement and connection fastening, explain the use of electronic design automation (EDA) in electronic circuit designs 3 marks
- List some EDA software that you know. 1 mark
- List 3 advantages and 3 disadvantages of EDA 3 marks
- In your opinion, how can EDA simulation results be made to be as close as possible to physical circuits construction and testing results 2 marks

Total 25 marks

Question 5

Explain the economic importance and design constraint in flexibility and speed between physical PCB and CAD based PCB in electronic design 6 marks

- a. List five merits and five de-merits of using physical PCB 5 marks
- b. List five merits and five de-merits of using CAD based PCB 5 marks
- c. State your view with simulation or real-life designs environment 3 marks
- d. At what level should CAD be introduced to students 3marks
- e. List three materials used in making high frequency PCB 3 marks

Total 25 marks