

**COURSE CODE:** PHY 308  
**COURSE TITLE:** ELECTRONICS I  
**CREDIT UNIT:** 2  
**TIME ALLOWED:** (2 HRS)  
**INSTRUCTION:** Answer question one and any other 3 questions

**QUESTION 1**

1. a) What is an Amplifier? List its main properties. (4 marks)
  - b) List the “Classes” of amplifier and give examples of each type. (4 marks)
  - c) Determine the input power, output power and circuit efficiency of a Class B amplifier providing a 30 V peak signal to a 20 Ω (speaker) and a power supply of  $V_{cc} = 35\text{ V}$ . (4 marks)
  - d) Mention the elements of a two-junction transistor (Bipolar Junction Transistor) (4 marks)
  - (e) In a tabular form, describe the behavior of a bipolar transistor in various circuit configurations to produce different circuit characteristics with regards to Input impedance, Output impedance and Gain. (4 marks)
  - (f) List the factors on which h-parameter depends. (5 marks)
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2. a) Explain briefly the terms given below when they are associated with a p-n junction:
    - (i) conduction in intrinsic semiconductors (2 marks)
    - (ii) majority and minority carriers, and (2 marks)
    - (iii) diffusion (2 marks)
  - (b) Explain briefly why a junction between p-type and n-type materials creates a contact potential. (2 marks)

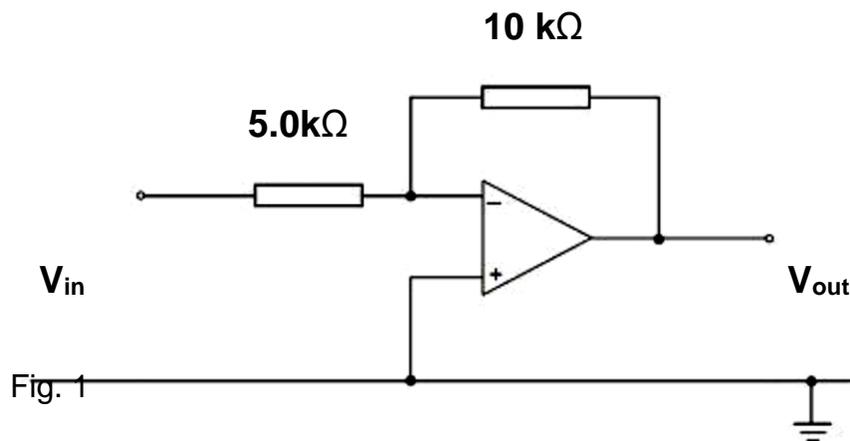


Fig. 1

2. (c) Fig. 1 shows an amplifier circuit.
  - (i) What is its voltage gain  $A_0$ ? (3 marks)
  - (ii) What is the output voltage when the input voltage is
    - (a) +0.5 V (2 marks)
    - (b) -1.3 V. (2 marks)

3. (a) An amplifier circuit for a microphone is shown in Fig. 2 above.
- (i) Name the type of feedback used with this op-amp. (3 marks)
  - (ii) The output potential difference  $V_{OUT}$  is 5.8 V for a potential difference across the resistor R of 69 mV. Calculate:
    - (b) the gain of the amplifier circuit, (4 marks)
    - (c) the resistance of resistor X. (4 marks)
    - (d) State one effect on the amplifier output of reducing the resistance of resistor X. (4 marks)

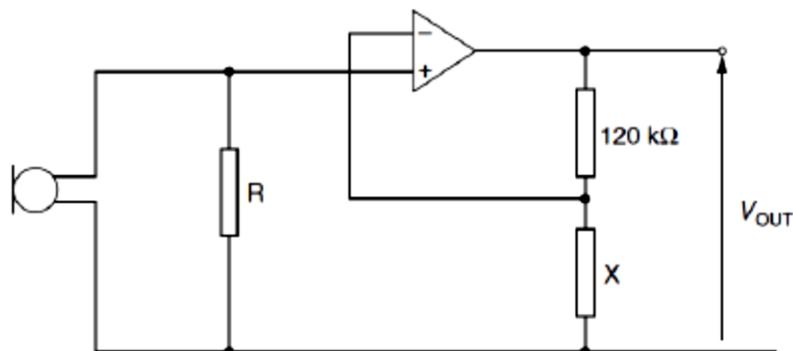


Fig.2

4. (a) State the conditions for a Bipolar Junction Transistor operating in each of the following regions a. Cutoff Region b. Active Region c. Saturation Region (6 marks)
- (b) For the fixed-bias configuration of fig 3, determine the following;
- (i)  $I_{BQ}$  and  $I_{CQ}$  (3 marks)
  - (ii)  $V_{CEQ}$   $V_B$  and (3 marks)
  - (iii)  $V_C$  and  $V_{BC}$  (3 marks)

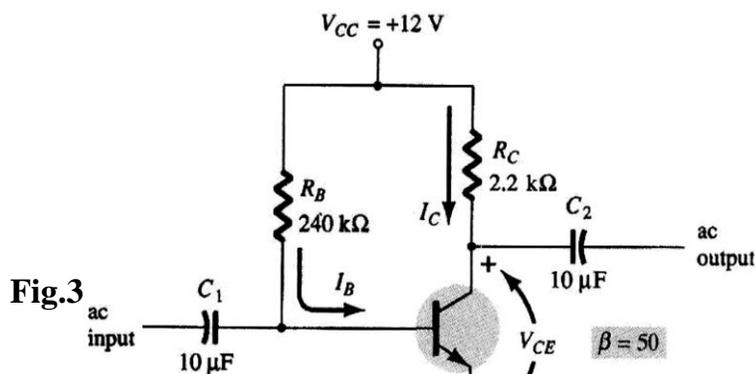


Fig.3

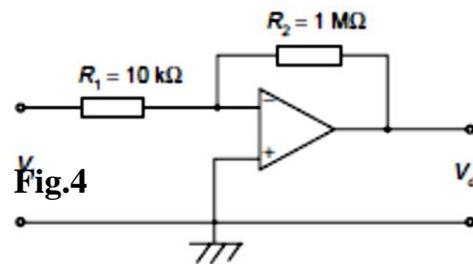


Fig.4

- 5.a) List the main properties of an Operational Amplifiers. (5 marks)
- (b) A differential amplifier has an open-loop voltage gain of 120. The input signals are 2.45 V and 2.35 V. Calculate the output voltage of the amplifier. (5 marks)
- (c) Determine the common-mode gain of an op amp that has a differential voltage gain of 150 and a common-mode rejection ratio (CMRR) of 90 dB. (5 marks)