COURSE CODE: PHY 308
COURSE TITLE: ELECTRONICS I
CREDIT UNIT   2
TIME ALLOWED   (2 HRS)
INSTRUCTION: *Answer question 1 and any other three questions*

Question one
(a) Define (i) an amplifier **(2 mark)** (ii) Define the gain of an amplifier **(2 marks)**
(b). List the three basic properties of an amplifier **(3 mark)**
(c). What are the three basically possible ways to connect a Bipolar Transistor within an electronic circuit? **(3 mark)**
(d). List the three elements of the two-junction transistor **(3 mark)**
(e). List the two classes of Integrated Circuits (ICs) based on the function **(2 marks)**
(f). The input and output voltages of a filter network are 16 mV and 8 mV respectively.**(2 marks)**
(g). Differentiate between negative feedback and positive feedback **(2 marks)**
(h). What are the determining factors in judging the stability of a feedback amplifier as a function of frequency? **(2 marks)**
(i). Differentiate between the gain margin and phase margin of an amplifier **(2 marks)**
**(j).** When is the resonance effect said to occur in an LC circuit? **(2 marks)**

Question two
(a) List the different classes of amplifier operations **(5 mark)**.
(b). Write short notes on any two of the classes of amplifier operation **(10 mark)**.

Question three
(a) What is an operational amplifier? **(2 mark)**
(b) Determine the output voltage of an op-amp for input voltages of $V_{i1} = 150$ μV and $V_{i0} = 140$ μV. The amplifier has a differential gain of $A_d = 4000$ and the value of CMRR is (i) 100 and (ii) 10^5 **(13 mark)**
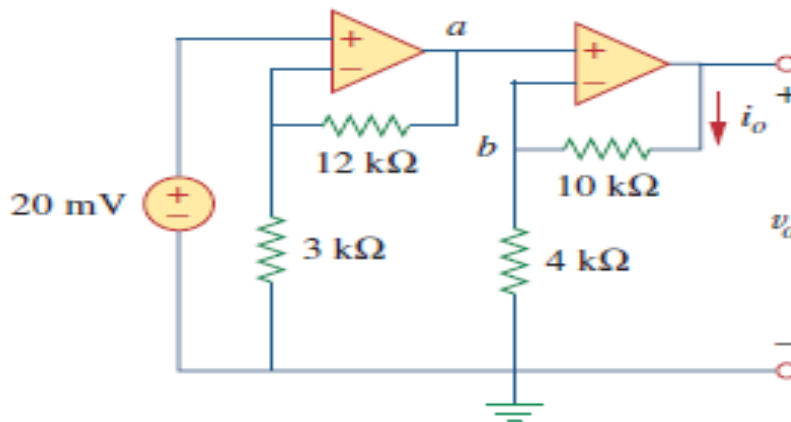
Question four
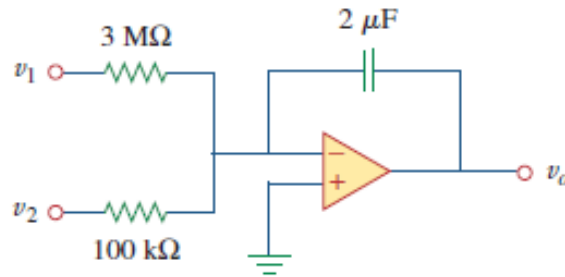
(a) Differentiate between an integrator and a differentiator (**6 marks**)

(b) If $v_1 = 10\cos 2t$ mV and $v_2 = 0.5t$ mV, find v_o in the op amp circuit shown. Assume that the voltage across the capacitor is initially zero (**9 marks**)

Question five

(a) Define (i) an oscillator (ii) a noninverting amplifier (**4 marks**)

(b). In the circuit shown, find (i) input voltage v_o and (ii) i_o (**11 marks**)

Question six

(a) What range of variable capacitor can be used in a tuned-collector oscillator which has a fixed inductance of 100 µH for it to be tunable over the frequency band of 500 kHz to 1500 kHz?

(**7 marks**)

(b). Calculate the oscillation frequency for an FET Colpitts oscillator having the following circuit value: $C_1 = 750$ pF, $C_2 = 2000$ pF and $L = 40$ µH (**4 marks**)

(c). Calculate the oscillator frequency for an FET Hartley oscillator having the following circuit values: $C = 250$ pF, $L_1 = L_2 = 1.5$ mH, and $M = 0.5$ mH. (**4 marks**)