



TECHNICAL UNIVERSITY OF MOMBASA

**Faculty of Engineering and Technology**

**DEPARTMENT OF MEDICAL ENGINEERING**

**DIPLOMA IN MEDICAL ENGINEERING**

**DME 215 Y2S1**

**EHL 2201**

**MEDICAL ELECTRONICS II**

**SPECIAL SUPPLEMENTARY EXAMINATIONS**

**SERIES: SEPT. 2017**

**TIME: 2 HOURS**

**INSTRUCTIONS TO THE CANDIDATE:**

1. You should have the following for this examination:
  - Answer Booklet
  - Scientific Calculator
  - Drawing Instrument
2. This paper consists of **FIVE** questions. Answer Question **ONE (COMPULSORY)** and any other **TWO** Questions.
3. Do not write on the question paper.
4. This paper consists of **THREE** printed pages.

**QUESTION ONE**

- (a) (i) State **THREE** characteristics of small signal amplifiers  
  
(ii) Describe with the help of a diagram the operation of NPN common emitter amplifier (10 marks)
- (b) (i) State **TWO** ways of classifying power amplifiers  
  
(ii) Explain the differences between class A, B and C power amplifiers using simple waveforms (8 marks)
- (c) (i) State **THREE** characteristics of an ideal opamp  
(ii) Draw a non inverting opamp circuit and derive an expression of its output voltage gain  
(iii) Give **THREE** applications of opamps (12 Marks)

## QUESTION TWO

- (a) (i) The output characteristics of a silicon NPN transistor connected to a supply voltage of 6V and load resistor of 1.5 K $\Omega$  are given below.

VCE	Collector current (mA)				
	I <sub>B</sub> =0	I <sub>B</sub> =20 $\mu$ A	I <sub>B</sub> =40 $\mu$ A	I <sub>B</sub> =60 $\mu$ A	I <sub>B</sub> =80 $\mu$ A
1	0.2	1.15	1.9	2.8	3.7
4	0.3	1.25	2.05	2.95	4.0
7	0.4	1.35	2.20	3.25	4.3

- (I) Plot the characteristics curves and load line  
(II) Determine the current gain the base current is varied from 20 $\mu$ A to 60  $\mu$ A  
(10 marks)

- (b) (i) Describe with the help of a suitable diagram the operation of a JFET  
(ii) State any three advantages of FETs over BJTs (10 marks)

## QUESTION THREE

- (a) Describe with the aid of a diagram the operation of a class A Power amplifier (10 marks)
- (b) (i) Show that the efficiency of a class A amplifier is approximately 25 %  
(ii) State three advantages of class A power amplifier (10 marks)

## QUESTION FOUR

- (a) (i) Describe the following terms as applied to operational amplifiers  
(I) Open loop voltage gain  
(II) Common mode rejection ratio  
  
(ii) With the aid of a diagram, derive the expression of an opamp when used as an integrator (10 marks)
- (b) (i) explain the meaning of a differential amplifier

(ii) The figure shown in Fig. Q4 is a non inverting opamp

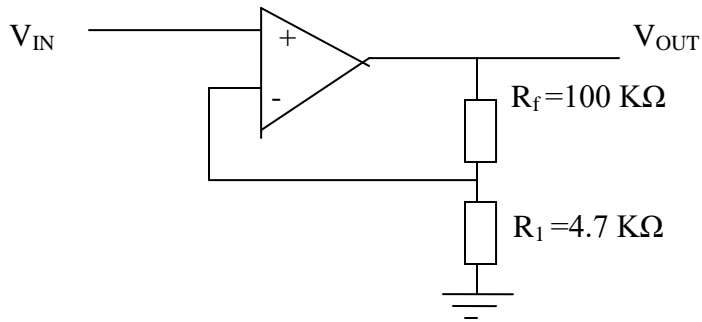
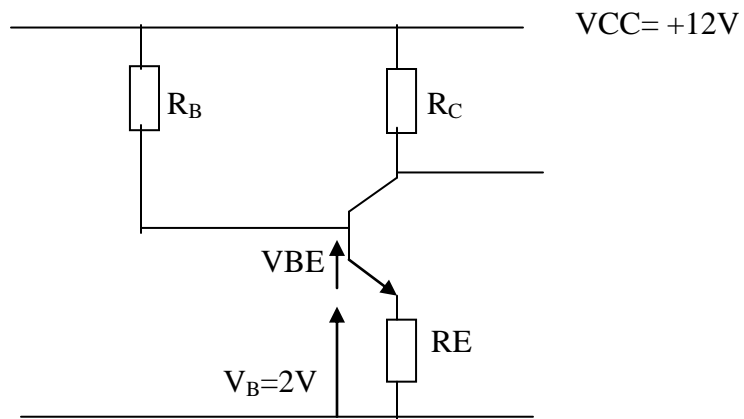


Fig. Q4

- (i) Derive an expression of closed loop voltage gain
- (ii) Calculate the Closed loop voltage gain of the Fig. Q4 (10 marks)

**QUESTION FIVE**

- (a) In **FIG. Q5** calculate the values of  $R_B$ ,  $R_E$  and  $R_C$ . Given  $h_{FE}=100$ ,  $V_{CE}=6V$ ,  $V_{BE}=0.7$ ,  $I_B=20\mu A$  and  $V_B=2V$ .



(8 Marks)

(b) (i) With a help of a diagram describe the principle of operation of Colpits oscillator, giving an expression of oscillation

(ii) State two applications of oscillators in Medical Equipment (12 marks)