

**ANALOG ELECTRONIC CIRCUITS  
(ECEN 2101)**

**Time Allotted : 3 hrs**

**Full Marks : 70**

***Figures out of the right margin indicate full marks.***

***Candidates are required to answer Group A and  
any 5 (five) from Group B to E, taking at least one from each group.***

***Candidates are required to give answer in their own words as far as practicable.***

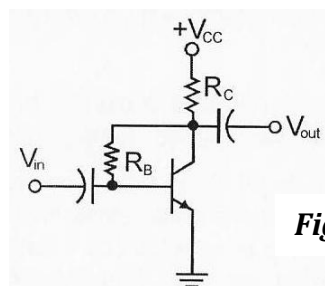
**Group – A  
(Multiple Choice Type Questions)**

1. Choose the correct alternative for the following: **10 × 1 = 10**
- (i) The input/output impedance of a transresistance amplifier, with negative feedback,
    - (a) Increases/Decreases
    - (b) Decreases/Increases
    - (c) Increases/Increases
    - (d) Decreases/Decreases.
  - (ii) Placing a bypass capacitor, in common-emitter configuration, is necessary to
    - (a) Achieve a stable Q point
    - (b) Prevent thermal runaway
    - (c) Prevent the fall of mid-band voltage gain
    - (d) None of these.
  - (iii) A circuit that removes positive or negative parts of waveform is called
    - (a) Clipper
    - (b) Limiter
    - (c) Clamper
    - (d) None of these.
  - (iv) In a bipolar junction transistor the base region is made very thin so that
    - (a) Recombination in base region is minimum
    - (b) Electric field gradient in base is high
    - (c) Base can be easily fabricated
    - (d) Base can be easily biased.
  - (v) An integrator circuit is basically a
    - (a) Low-pass filter
    - (b) Band-pass filter
    - (c) High-pass filter
    - (d) None of the above.
  - (vi) Maximum efficiency of transformer coupled class A power amplifier is
    - (a) 50%
    - (b) 100%
    - (c) 25%
    - (d) 78.5%.
  - (vii) The cross-over distortion is observed in which type of amplifier's operation?
    - (a) Class A
    - (b) Class B
    - (c) Class C
    - (d) Class AB.

- (viii) A Schmitt trigger uses  
 (a) Negative feedback  
 (c) Positive feedback  
 (b) Compensating capacitors  
 (d) Pull up resistors
- (ix) An ideal op-amp is an ideal  
 (a) Current controlled current source  
 (c) Voltage controlled current source  
 (b) Voltage controlled voltage source  
 (d) Current controlled current source
- (x) The 555 timer IC consists of  
 (a) SR flip-flop  
 (c) D flip-flop  
 (b) JK flip-flop  
 (d) T flip-flop.

### Group- B

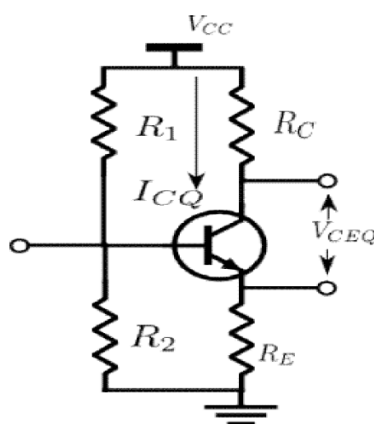
2. (a) What is thermal runaway and how can it be controlled?  
 (b) What is a load line? Explain the concept of Q-point.  
 (c) In a collector base biased circuit indicated in figure 1, a transistor with  $\beta = 50$  is used. Supply voltage  $V_{CC} = 12V$ ,  $V_{BE} = 0.7V$ , the collector resistance  $R_C = 1K\Omega$ . The bias is obtained by connecting  $50K\Omega$  resistor from collector to base. Find Q point and stability factor.



**Fig.1**

$$3 + (1 + 2) + 6 = 12$$

3. (a) Draw the hybrid parameter model of a bipolar junction transistor. Define the four hybrid parameters.  
 (b) Calculate the resistance ( $R_1$  &  $R_2$ ) to bias a transistor as shown in figure 2. Assume  $V_{CC} = 20V$ ,  $V_{CEQ} = 6V$ ,  $S = 6$ ,  $I_{CQ} = 0.6mA$ ,  $R_C = 1K\Omega$ ,  $\beta = 150$ .



**Fig.2**

$$(2 + 5) + 5 = 12$$

### Group - C

4. (a) State Barkhausen criterion and explain the conditions that must be satisfied for a feedback amplifier to produce steady oscillations.

- (b) Sketch the circuit diagram of a Colpitts oscillator. Calculate the frequency of the oscillation and the condition for sustained oscillation.

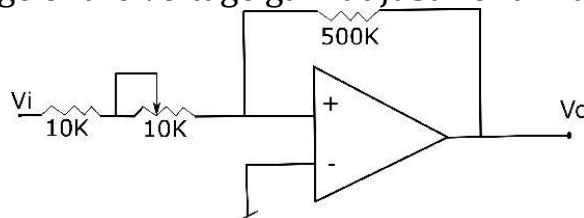
**4 + 8 = 12**

5. (a) Draw the circuit diagram of single stage R-C coupled amplifier. Discuss the frequency response curve of R-C coupled amplifier. Why does the gain fall off at low and high frequencies?
- (b) A single stage amplifier has a gain of 60. The collector load  $R_C = 500\Omega$  and the input impedance is  $1K\Omega$ , calculate the overall voltage gain when two stages are cascaded through R-C coupling.

**(2 + 3 + 3) + 4 = 12**

### **Group - D**

6. (a) Mention different types of differential amplifier. Draw the circuit of dual input balanced output differential amplifier.
- (b) Draw the block schematic of an op-amp and explain the function of each block.
- (c) What is the range of the voltage gain adjustment in the figure 3?



**Fig.3**

**(1 + 3) + 5 + 3 = 12**

7. (a) Explain with the help of a neat circuit diagram how an op amp is used to obtain logarithm of a signal, preventing variation due to temperature.
- (b) Write a short note on Instrumentation amplifier. Derive the expression for its output voltage.

**5 + 7 = 12**

### **Group - E**

8. (a) What is the difference between voltage and power amplifier? Classify the power amplifiers with respect to the biasing points.
- (b) Derive the efficiency of transformer coupled class A power amplifier.
- (c) What is cross over distortion and how it can be overcome?

**(3 + 2) + 5 + 2 = 12**

9. (a) What is 555 timer? Draw the circuit diagram of a monostable multivibrator and calculate time of unstable state for one cycle.
- (b) The timer IC555 is used as an astable multivibrator. It is desired to have square-wave output with 50% duty cycle of 1 KHz. The timing capacitor is of  $.01\mu F$ . Find the values of resistors required and draw the circuit.

**(2 + 2 + 3) + 5 = 12**

## B.TECH/ECE/3<sup>RD</sup> SEM/ECEN 2101(BACKLOG)/2021

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