

**ANALOG 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.*

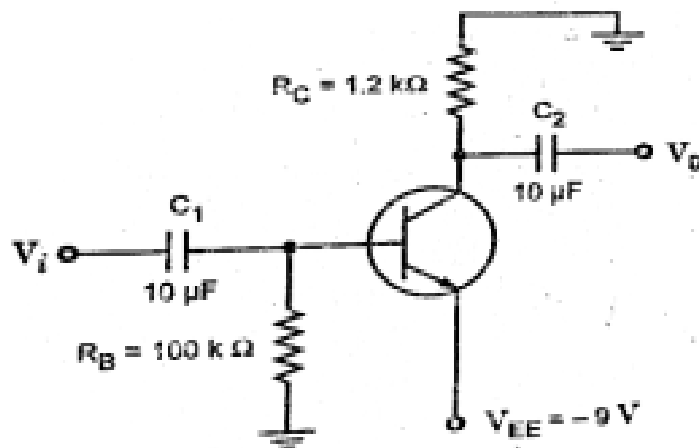
**Group – A**  
**(Multiple Choice Type Questions)**

1. Choose the correct alternative for the following: **10 × 1 = 10**
- (i) A circuit that can provide DC shift to any given signal is called  
(a) clipper (b) clamper  
(c) amplifier (d) oscillator.
  - (ii) The dynamic resistance of a p-n junction diode is  
(a) directly proportional to the dc diode current.  
(b) inversely proportional to the dc diode current.  
(c) directly proportional to the ac diode current.  
(d) inversely proportional to the ac diode current.
  - (iii) The maximum theoretical efficiency of a class B push-pull transistor amplifier is approximately  
(a) 25% (b) 50% (c) 70.7% (d) 78.5%.
  - (iv) In a phase shift oscillator, we use \_\_\_\_\_ RC sections in the feedback path.  
(a) two (b) three (c) four (d) five.
  - (v) Which one of the following is not applicable for ideal OPAMP?  
(a) Infinite voltage gain (b) Infinite input impedance  
(c) Infinite output impedance (d) Infinite slew rate.
  - (vi) If three cascaded stages of amplifier have gains 10, 20, 30 the overall gain will be  
(a) 200 (b) 400 (c) 1200 (d) 6000.

- (vii) Which of the following biasing circuit is prone to thermal runaway?  
 (a) fixed bias circuit (b) self bias circuit  
 (c) collector to base bias circuit (d) all of the above.
- (viii) An astable multivibrator generates  
 (a) triangular waveform (b) sinusoidal waveform  
 (c) square waveform (d) none of these.
- (ix) CMRR of an op-amp expresses its ability to  
 (a) suppress the noise voltage  
 (b) increase the frequency bandwidth  
 (c) make the signal less distorted  
 (d) decreases the gain.
- (x) Differential mode voltage gain of a dual input dual output differential amplifier with load resistance  $R_L$  is  
 (a)  $R_L / r_e$  (b)  $R_L * r_e$   
 (c)  $R_L / 2r_e$  (d)  $R_L * 2r_e$ .

### Group – B

2. (a) Derive an expression for the stability factor, 'S' for Self-bias circuit.  
 (b) Determine  $V_B$  and  $V_C$  for the following circuit, where  $\beta = 45$ ,  $V_{BE} = 0.7$  V.



6 + 6 = 12

3. (a) Explain the operating principle of a double diode parallel clipper circuit with sinusoidal input voltage and no load.  
 (b) Describe the voltage divider biasing circuit for npn BJT and explain how it provides compensation against any change in the collector current.

5 + 7 = 12

**Group – C**

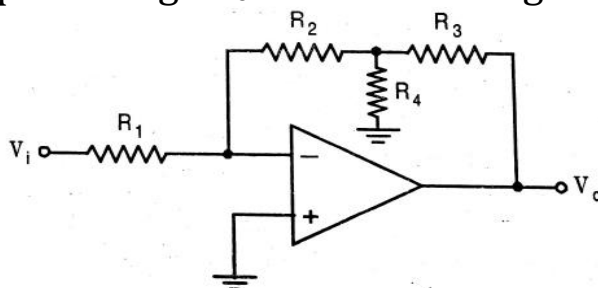
4. (a) Draw the circuit diagram of a two-stage RC coupled CE transistor amplifier. Show how the magnitude and the phase angle of its voltage gain vary with frequency.
- (b) What is the effect of negative feedback on the input impedance of voltage-series feedback amplifier?
- (c) The total harmonic distortion of an amplifier reduces from 10% to 1 % on the introduction of negative feedback. Determine the open loop and closed loop gain value.

**6 + 3 + 3 = 12**

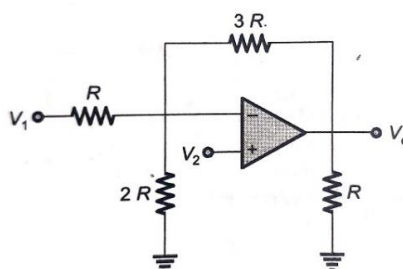
5. (a) Sketch the circuit of Wien-bridge oscillator. Explain the principle of operation and write the expression for the frequency of oscillation.
- (b) A Collpitt's oscillator is designed with  $C_1=0.0001 \mu\text{F}$  and  $C_2=0.01 \mu\text{F}$ . The inductance is variable. Determine the range of inductance value if the frequency of oscillation is to vary between 950 kHz to 2050 kHz.

**6 + 6 = 12****Group – D**

6. (a) Explain logarithmic amplifier with circuit diagram.
- (b) Find the output voltage  $V_o$  of the following circuit.

**6 + 6 = 12**

7. (a) Describe instrumentation amplifier circuit using OPAMP.
- (b) The problems of conventional half wave rectifier are solved using precision rectifier: explain with proper example.
- (c) Assuming the OPAMP is ideal, if  $V_1=1\text{V}$  and  $V_2=2\text{V}$ , find out the output voltage  $V_o$ .

**4 + 4 + 4 = 12**

**Group – E**

8. (a) Derive the maximum efficiency of a class B push-pull amplifier. What is the major drawback of class B operation and how it can be avoided?
- (b) A class B push pull power amplifier is supplied with  $V_{cc}=50$  V. The signal swings the collector voltage down to  $V_{min}=5$  V. The total dissipation in both transistors is 40 W. Find the total power and conversion efficiency.
- 6 + 6 = 12**
9. (a) Determine the frequency and duty cycle for 555 astable multi-vibrator output for  $C=0.01 \mu\text{F}$ ,  $R_A=2 \text{ k}\Omega$  and  $R_B=100 \text{ k}\Omega$ .
- (b) Explain how a 555 timer can be used to generate a square wave. Also derive the expression of time period of the generated square wave.
- 5 + 7 = 12**

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CSE B	<a href="https://classroom.google.com/w/MjQxNTYyNDIxOTg2/tc/MjkxNDQ1Mzc5OTY3">https://classroom.google.com/w/MjQxNTYyNDIxOTg2/tc/MjkxNDQ1Mzc5OTY3</a>
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Department & Section	Submission Link (Backlog)
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