# INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomus)
Dundigal, Hyderabad - 500 043

## ELECTRONICS AND COMMUNICATION ENGINEERING

## TUTORIAL QUESTION BANK

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| **Course Name** | : | **ELECTRONIC CIRCUIT ANALYSIS** |
| **Course Code** | : | **AEC004** |
| **Class** | : | **B. Tech IV Semester-R16** |
| **Branch** | : | **ECE** |
| **Academic Year** | : | **2018– 2019** |
| **Course Coordinator** | : | **Mr.J. Siva Ramakrishna, Assistant Professor ,ECE** |
| **Course Faculty** | : | **Mr.J. Siva Ramakrishna, Assistant Professor ,ECE**<br>**Mr.K. Ravi, Assistant Professor ,ECE** |

## COURSE OBJECTIVES;

**The course should enable the students to:**

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| I | Familiarize the student with the analysis and design of different amplifier circuits (single and multi stage) using Bipolar Junction Transistors. |
| II | Understand the analysis of transistor at low frequencies and high frequencies. |
| III | Familiarize with different multi stage amplifiers and learn about various tuned amplifiers and their frequency responses. |
| IV | Understand the concepts of feed back in amplifiers and emphasis on feedback amplifiers (circuits implementing different topologies) and oscillators. |
| V | Familiarize with different power amplifier circuits using Bipolar Junction Transistor and designing the power amplifier. |

## COURSE LEARNING OUTCOMES:

**Students, who complete the course, will have demonstrated the ability to do the following:**

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| CAEC004.01 | Design various amplifier circuits using Bipolar Junction Transistors in Common Emitter, Common Base and Common Collector configurations. |
| CAEC004.02 | Understand the effect of coupling and bypass capacitances on frequency response of single stage amplifiers. |
| CAEC004.03 | Understand various BJT amplifier circuits and their frequency responses at low, mid and High frequencies. |
| CAEC004.04 | Understand the usefulness of amplifiers using semiconductor devices in various real time circuit making. |
| CAEC004.05 | Understand and Remember the concept of Bipolar Junction Transistor amplifiers at high frequencies. |
| CAEC004.06 | Understand various high frequency parameters like Conductance's, resistances and Capacitances in Hybrid-$\pi$ model. |
| CAEC004.07 | Understand RC, Transformer and Direct coupling techniques used in multi stage amplifiers and also Remember the differences between them. |
| CAEC004.08 | Analyze various multistage amplifiers such as Darlington, Cascode (Common Emitter-Common Base) etc. |
| CAEC004.09 | Understand the concept of tuned circuits used in single tuned amplifier, double tuned amplifiers and stagger tuned amplifiers. |
| CAEC004.10 | Understand and Remember the conditions required by an electronic circuit using Bipolar Junction Transistor to act like an Oscillator. |
| CAEC004.11 | Understand and design various sinusoidal Oscillators like RC Phase shift, Wien bridge, Hartley and Colpitts oscillator for various frequency ranges. |

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| CAEC004.12 | Understand the importance of positive feedback and negative feedback in connection in electronic circuits. |
| CAEC004.13 | Understand and Analyze various types of feedback amplifiers like voltage series, current series, current shunt and voltage shunt. |
| CAEC004.14 | Understand the difference between small signal amplifiers and large signal amplifiers using Bipolar Junction Transistors. |
| CAEC004.15 | Understand types of power amplifiers based on position of Quiescent or operating point on load lines and also understand its parameters. |
| CAEC004.16 | Design different types of power amplifiers for practical applications of desired specifications like efficiency, output power, distortion etc. |
| CAEC004.17 | Acquire experience in building and troubleshooting simple electronic analog circuits using Bipolar Junction Transistor. |
| CAEC004.18 | Acquire the knowledge and develop capability to succeed national and international level competitive examinations. |

## TUTORIAL QUESTION BANK

| S. No | Questions | Blooms Taxonomy Level | Course Learning Outcome |
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| **UNIT-I** | | | |
| **SINGLE STAGE AMPLIFIERS AND FREQUENCY RESPONSE** | | | |
| **PART-A (SHORT ANSWER QUESTIONS)** | | | |
| 1 | List the classification of amplifiers. | Remember | CAEC004.03 |
| 2 | List the classification of amplifiers based on frequency of operation | Remember | CAEC004.03 |
| 3 | Define various hybrid parameters. | Remember | CAEC004.03 |
| 4 | Draw the hybrid equivalent model of CE Amplifier | Understand | CAEC004.03 |
| 5 | Reason out the causes and results of Phase distortion. | Understand | CAEC004.03 |
| 6 | Reason out the causes and results of Frequency distortions in transistor Amplifiers. | Understand | CAEC004.03 |
| 7 | Reason out the causes and results of Amplitude distortions in transistor Amplifiers. | Understand | CAEC004.03 |
| 8 | Write the expressions for $A_V$ and $R_{in}$ of a CE amplifier signals | Remember | CAEC004.03 |
| 9 | Write the expressions for $A_V$ and $R_{in}$ of a CB amplifier | Remember | CAEC004.03 |
| 10 | Write the expressions for $A_V$ and $R_{in}$ of a CC amplifier | Remember | CAEC004.03 |
| 11 | What is the effect of bypass capacitor? | Understand | CAEC004.02 |
| 12 | What is the effect of coupling capacitor? | Understand | CAEC004.02 |
| 13 | Write down the expression for $f_l$ and $f_h$ of a CE amplifier considering the effects of bypass and coupling capacitors | Understand | CAEC004.01 |
| 14 | Draw the frequency response of BJT amplifier. | Remember | CAEC004.03 |
| 15 | State Miller's theorem. Specify its relevance in the analysis of a BJT amplifier. | Remember | CAEC004.03 |
| **PART-B (LONG ANSWER QUESTIONS)** | | | |
| 1 | Analyze general transistor amplifier circuit using h parameter model. Derive the expressions for $A_I$, $A_V$, $R_i$, $R_o$, $A_{Is}$, $A_{Vs}$. | Understand | CAEC004.01 |
| 2 | Draw the circuit of an emitter follower, and derive the expressions for $A_I$, $A_v$, $R_i$, $R_0$ in terms of CE parameters. | Remember | CAEC004.01 |
| 3 | Write the analysis of a CE amplifier circuit using h parameters. Derive the expressions for $A_I$, $A_V$, $R_i$, $R_o$, $A_{Is}$, $A_{Vs}$. | Understand | CAEC004.01 |
| 4 | Define h-parameter of a transistor in a small signal amplifier. What are the benefits of h-parameters? | Remember | CAEC004.01 |
| 5 | Analysis for CE amplifier with emitter resistance | Remember | CAEC004.01 |
| 6 | Explain about different types of distortions that occur in amplifier circuits. | Understand | CAEC004.01 |
| 7 | Explain the effect of coupling and bypass capacitors on amplifier at low frequencies. | Understand | CAEC004.01 |
| 8 | Draw the low frequency parameter equivalent circuit of a CE amplifier and explain the significance of each parameter. | Remember | CAEC004.01 |
| **PART-C (PROBLEM SOLVING AND CRITICAL THINKING QUESTIONS)** | | | |
| 1 | A CE amplifier is driven by voltage source with internal resistance $R_s$=800Ω.The load impedance $R_L$=2k Ω. The h-parameters are | Understand | CAEC004.01 |

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| | $h_{ie}$=1.1K,$h_{re}$=2.5*$10^{-4}$,$h_{fe}$=50,$h_{oe}$=25µA/V. Compute $A_{I,}A_V$, $A_{Is}$, $R_i$, $Z_o$ & $A_p$. | | |
| 2 | A CB amplifier is driven by voltage source with internal resistance $R_s$=800Ω.The load impedance RL=2k Ω. The h-parameters are $h_{ib}$=22 Ω ,$h_{rb}$=3*$10^{-4}$,$h_{fb}$=-0.98,$h_{oe}$=0.5µA/V. Compute $A_{I,}A_V$, $A_{Is}$, $R_i$, $Z_o$ & $A_p$. | Understand | CAEC004.01 |
| 3 | A CC amplifier is driven by voltage source with internal resistance Rs=800Ω.The load impedance RL=2k Ω. The h-parameters are hic=1.1K, hrc=1,hfc=-51,hoc=25µA/V. Compute AI, AV, AIs, Ri, Zo & Ap. | Understand | CAEC004.01 |
| 4 | A CE amplifier is driven by voltage source with internal resistance Rs=600Ω,RL=1200Ω. The h-parameters are hie=1.1K,hre=2.5x10-4,hfe=50,hoe=25µA/V. Compute AI,AV, AIs, Ri, Zo & Rot using (a)exact analysis (b) Approximate Analysis. | Understand | CAEC004.01 |
| 5 | Draw the circuit of CE amplifier. Draw it's equivalent circuit using Approximate model. Calculate AI, AV, Ri, Zo & Rot if Rs=1000Ω, RL=1200Ω. The h-parameters are hie=1.1K,hre=2.5*10-4,hfe=50,hoe=24µA/V. | Understand | CAEC004.01 |
| 6 | Draw the circuit of CB amplifier. Draw it's equivalent circuit using Approximate model. Calculate AI, AV, Ri, Zo & Rot if Rs=900Ω, RL=2000Ω. The h-parameters are hie=1.1K,hre=2.5*10-4,hfe=50,hoe=24µA/V. | Understand | CAEC004.01 |
| 7 | Draw the circuit of CC amplifier. Draw it's equivalent circuit using Approximate model. Calculate AI, AV, Ri, Zo & Rot if Rs=500Ω, RL=2000Ω. The h-parameters are hie=1.1K,hre=2.6*10-4,hfe=54,hoe=26µA/V. | Understand | CAEC004.01 |
| 8 | A CE amplifier with emitter resistor RE=800Ω , RL=1k Ω. The h-parameters are hie=1.1K,hre=5*10-4,hfe=50,hoe=25µA/V. Compute AI, AV, AIs, Ri, Rot . Use the Approximate model if permissible. | Understand | CAEC004.01 |
| 9 | Draw the circuit of CE amplifier with emitter resistor RE. Draw it's equivalent circuit using Approximate model. Calculate AI, AV, Ri, Zo & Rot if Rs=600Ω, RL=1000Ω, RE=800Ω. The h-parameters are hie=1.2K,hre=3*10-4, hfe=50, hoe=25µA/V. | Understand | CAEC004.01 |
| 10 | A CC amplifier with emitter resistor RE=800Ω , Rc=400 Ω in the collector circuit. The h-parameters are hie=1.1K, hre=2.4*10-4,hfe=60,hoe=25µA/V. Compute AI,AV, Ri . Use the Exact model. | Understand | CAEC004.01 |
| **UNIT-II** | | | |
| **HIGH FREQUENCY RESPONSE OF AMPLIFIER** | | | |
| **PART-A(SHORT ANSWER QUESTIONS)** | | | |
| 1 | State how an emitter follower behaves at high frequencies. | Remember | CAEC002.06 |
| 2 | State how the hybrid – π parameters vary with respect to $I_c$. | Remember | CAEC002.06 |
| 3 | What is the relationship between $f_T$ and $f_β$? Discuss the significance of $f_T$. | Understand | CAEC002.05 |
| 4 | Draw simplified high frequency model of CE amplifier. | Remember | CAEC002.05 |
| 5 | Write the hybrid-π conductance equations of common emitter transistor. | Remember | CAEC002.06 |
| 6 | How does $g_m$ and $C_e$ vary with $\|I_C\|$, $V_{CE}$ and T. | Understand | CAEC002.06 |
| 7 | Define the gain bandwidth product of common emitter amplifier in terms of high frequency parameters. | Remember | CAEC002.06 |
| 8 | Show that in Hybrid – π model, the diffusion capacitance is proportional to the emitter bias current. | Remember | CAEC002.06 |
| 9 | Define $f_β$ , $f_T$ and $f_α$. | Remember | CAEC002.06 |
| 10 | Write the expression for upper 3-dB frequency of a single stage CE amplifier. | Remember | CAEC002.05 |
| 11 | Define hybrid –π parameters. | Remember | CAEC002.06 |
| 12 | Write the expression for current gain for a CE amplifier with o/p short circuit. | Remember | CAEC004.06 |
| 13 | Write the expression for current gain for a CE amplifier with resistive load | Remember | CAEC004.06 |
| **PART-B (LONG ANSWER QUESTIONS)** | | | |
| 1 | (a)Draw the small-signal equivalent circuit for an emitter follower stage at high frequencies and Obtain the voltage gain.<br>(b) Derive the expressions for $f_β$ and $f_T$. | Understand | CAEC004.06<br>CAEC004.05 |

| S. No | Questions | Blooms Taxonomy Level | Course Learning Outcome |
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| 2 | (a) Explain why the 3-dB frequency for current gain is not the same as $f_H$ for voltage gain.<br>(b) Derive the expression for the CE short-circuits current gain Ai with resistive load. | Understand | CAEC004.06 |
| 3 | Draw the hybrid-pi model, explain and derive the conductance and capacitances. | Remember, | CAEC004.06 |
| 4 | (a) Draw the hybrid-π equivalent of a CE transistor valid for high frequency and<br>(b)Explain significance of each parameter. | Understand | CAEC004.05 |
| 5 | (a) Derive the expression of gain bandwidth product for voltage.<br>(b) Derive the expression of gain bandwidth product for current. | Understand | CAEC004.06 |
| 6 | (a) Prove that (i) $h_{fe}=g_{m*}\, r_{b'e}$ for a Hybrid -π model of CE amplifier.<br>(b) How does a $C_e$ and $C_c$ vary with $\mid I_c \mid$ and $\mid V_{CE} \mid$.<br>(c) How does gm vary with $\mid I_c \mid$ and $\mid V_{CE} \mid$, T | Understand | CAEC004.06 |
| 7 | Draw the high frequency equivalent circuit of a BJT and explain the same. | Remember | CAEC004.05 |
| 8 | Give the typical values of various Hybrid- π parameters. | Remember | CAEC004.06 |
| 9 | Derive the expressions for Hybrid - π parameters., $C_e$, $r_{bb}$', $r_{b'e}$, $C_c$ | Understand | CAEC004.06 |
| 10 | Derive the expression for the Hybrid - π t parameters gm, rce, Ce and rb'e, gce. | Understand | CAEC004.06 |
| 11 | Explain about Hybrid - π capacitances. How do Hybrid - π parameters vary with temperature. | Understand | CAEC004.06 |
| **PART-C (PROBLEM SOLVING AND CRITICAL THINKING QUESTIONS)** | | | |
| 1 | A CE amplifier with the load impedance RL=2k Ω. The hybrid-π parameters are rb'e=1K Ω, Ce=100pF,hfe=50,CC =3pF,gm=50mS. Draw the high frequency hybrid-π circuit neglecting R1, R2, rbb'. Calculate the time constants of output & input circuits & fH & AI at 100 KHz. | Understand | CAEC004.06 |
| 2 | At Ic=1mA & VCE=10V a certain transistor has Cc= Cb'c=3pF and wt=500Mrad/sec. Calculate rb'e,Ce,gm & wβ. | Understand | CAEC004.06 |
| 3 | Short circuit current gain of CE amplifier is 25 at frequency=2Mhz. If fβ=200Khz.Calculate fT, hfe, \|AI\| at frequency of 10Mhz & 100 Mhz. | Understand | CAEC004.06 |
| 4 | A high frequency CE amplifier with the Rs=0 calculate fH if load impedance RL=0k Ω & RL=1k Ω. Assume typical hybrid-π parameters. | Understand | CAEC004.06 |
| 5 | A high frequency CE amplifier with the Rs=1K Ω calculate fH , AVSlow and AVShigh if load impedance RL=0k Ω & RL=1k Ω. Assume typical hybrid-π parameters. | Understand | CAEC004.06 |
| 6 | A CE amplifier is measured to have a bandwidth of 4Mhz with the RL=600 Ω calculate Rs that will give the required bandwidth. Assume typical hybrid-π parameters rbb'=100Ω , ,hfe=100,CC =2pF, gm=50mS, fT=300Mhz. | Understand | CAEC004.06 |
| 7 | A BJT has the following parameters measured at IC=1mA, ,hie=3k , hfe=100, CC =2pF , Ce =18pF ,fT=4Mhz. Find , rbb', rb'e,gm & fH for RL=1K Ω . | Understand | CAEC004.06 |
| 8 | The hybrid-π parameters are rb'e=1K Ω, rb'c=4M Ω, rce=80K Ω, rbb'=100Ω,Ce=100pF hfe=50,CC =3pF,gm=50mS. Find upper 3db frequency of current gain AI, AVS. | Understand | CAEC004.06 |
| 9 | For a single stage CE amplifier Find the value of Rs that will give 3db frequency fH which is twice the value obtained with Rs=∞(ideal current source). rb'e=1K Ω, Ce=100pF, hfe=50,CC =3pF, gm=50mS, rbb'=100 Ω. | Understand | CAEC004.06 |
| 10 | The following low frequency parameters are given at 3000K, Ic=10mA, Vce=8V, hie=500 Ω , hre=10-4,hfe=100,hoe=2*10-4A/V. Calculate the values of hybrid-π parameters. | Understand | CAEC004.06 |

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| **UNIT-III** | | | |
| **MULTI STAGE AMPLIFIERS AND TUNED AMPLIFIERS** | | | |
| **PART-A(SHORT ANSWER QUESTIONS)** | | | |
| 1 | Compute the overall lower cut-off frequency of an identical two stage cascade of amplifier with individual lower cut-off frequency given 432 Hz. | Understand | CAEC004.07 |
| 2 | List out the special features of Darlington pair and cascode amplifiers. State the areas where these amplifiers are used? | Remember | CAEC004.08 |
| 3 | Differentiate between various coupling methods. | Remember | CAEC004.07 |
| 4 | In a cascade amplifier, what is the coupling method which is capable of providing highest gain? | Remember | CAEC004.07 |
| 5 | If 5-stages of single tuned amplifier are cascaded with each circuit resonant frequency of 25KHz. Find the overall band width. | Understand | CAEC004.08 |
| 6 | In a multistage amplifier, what is the coupling method required to amplify dc signals? | Remember | CAEC004.07 |
| 7 | Write the expression for lower 3 – dB frequency of an n – stage amplifier with non – interacting stages. | Remember | CAEC004.07 |
| 8 | Two stages of amplifier are connected in cascade. If the first stage has a decibel gain of 40 and second stage has an absolute gain of 20 then what is the overall gain in decibels. | Understand | CAEC004.08 |
| 9 | Why the overall gain of multistage amplifier is less than the product of gains of individual stages. | Understand | CAEC004.08 |
| 10 | What are the main characteristics of a Darlington amplifier? | Understand | CAEC004.08 |
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| 1 | Why direct coupling is not suitable for amplification of high frequency? | Understand | CAEC004.07 |
| 2 | Mention the salient features of tuned amplifiers. | Remember | CAEC004.09 |
| 3 | List out the applications of tuned amplifier. | Remember | CAEC004.09 |
| 4 | Give the reason for using two tuned circuits are used in double tuned amplifier | Understand | CAEC004.09 |
| 5 | Discuss the necessity of stabilization circuits in tuned amplifiers. | Understand | CAEC004.09 |
| 6 | Define the expression for effective bandwidth of cascaded tuned amplifier. | Remember | CAEC004.09 |
| 7 | Classify tuned amplifier based on the input signal applied, no of tank circuits and based on coupling | Understand | CAEC004.09 |
| 8 | Give the reasons why parallel resonance circuits are used in tuned amplifiers? | Understand | CAEC004.09 |
| 9 | Write the expression for voltage gain for a capacitive coupled single tuned amplifier and also gain at resonance? | Remember | CAEC004.09 |
| 10 | Explain Why transformer coupling is not used in the initial stage of a multistage amplifier? | Understand | CAEC004.09 |
| 11 | Define a tuned amplifier. State how its frequency response is different from an un tuned amplifier? | Understand | CAEC004.09 |
| **PART-B (LONG ANSWER QUESTIONS)** | | | |
| 1 | Draw and explain the two stage amplifier with Darlington connection. Give the advantages of this circuit What are the drawbacks of a Darlington amplifier. | Remember | CAEC004.08 |
| 2 | Compare emitter follower and Darlington emitter follower configurations in respect of<br>i. current gain<br>ii. input impedance<br>iii. voltage gain<br>iv. output impedance. | Understand | CAEC004.08 |
| 3 | Compare the different types of coupling methods used in multistage amplifiers. | Remember | CAEC004.07 |
| 4 | Sketch two RC-coupled CE transistor stages. Show the middle and low frequency model for one stage. Write the expressions for current gains | Remember | CAEC004.07 |
| 5 | Draw the circuit diagram of cascode amplifier with and without biasing circuit. What are the advantages of this circuit? | Remember | CAEC004.08 |

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| 1 | Explain about different methods of Inter stage coupling in amplifiers. When 2- stages of identical amplifiers are cascaded, obtain the expressions for overall voltage gain, current gain and power gain. | Understand | CAEC004.08 |
| 2 | a. Draw the circuit diagram of a tuned primary amplifier. Derive expression for its voltage gain at resonance and bandwidth.<br>b. Differentiate between single tuned and double tuned amplifiers. | Understand | CAEC004.09 |
| 3 | a. Derive the expression for quality factor of a single tuned inductively Coupled amplifier.<br>b. Derive the expression for current gain to the tapped tuned circuit | Understand | CAEC004.09 |
| 4 | a. List possible configurations of tuned amplifiers.<br>b. Draw and explain the circuit diagram of a single tuned capacitance coupled amplifier. Explain its operation. | Remember | CAEC004.09 |
| 5 | Derive the expressions for Bandwidth and Q-factor of single tuned, capacitive coupled amplifiers. List the assumptions made for the derivation. | Understand | CAEC004.09 |
| 6 | Draw the circuit of double tuned transformer coupled amplifier and the working of it in detail and Discuss the nature of response of the amplifier for different values of KQ = 1, KQ > 1 and KQ < 1. | Understand | CAEC004.09 |
| 7 | Draw the circuit diagram of a tapped single tuned capacitive coupled amplifier and explain its operation and derive $A/A_{res}$ and plot the frequency response of it. | Understand | CAEC004.09 |
| 8 | Using the circuit diagram and equivalent circuit of inductively coupled single stage tuned amplifier. Derive expressions bandwidth which interrelated to the circuit component values and quality factor of the tuned circuit and resonant frequency. | Understand | CAEC004.09 |
| **PART-C (PROBLEM SOLVING AND CRITICAL THINKING QUESTIONS)** | | | |
| 1 | A Darlington emitter follower circuit uses two identical transistors having the following h-parameters hie=1.1K, hre=2.5*10-4,hfe=60,hoe=20µA/V. RE=2KΩ, RS=500Ω Compute overall A I & AV, Ri, Ro & Rot . | Understand | CAEC004.08 |
| 2 | A Darlington emitter follower circuit uses two identical transistors having the following h-parameters hie=1.1K, hre=2.2*10-4,hfe=50,hoe=20µA/V. RE2=3KΩ , RS=400Ω, . R1=90KΩ , R2=10KΩ Compute overall A I & AV, Ri, Ro & Rot . | Understand | CAEC004.08 |
| 3 | A CE-CC Amplifier uses RS=1KΩ, . RC1= RE2=4KΩ . The h-parameters hie=1.2K, hre=5*10-4,hfe=50,hoe=25µA/V, hic=1.2 Ω ,hrc=1,hfc=-51,hoc=25µA/V. Compute individual & overall A I & AV, Ri, Ro & Rot . | Understand | CAEC004.08 |
| 4 | A CE-CB (cascode) Amplifier uses RS=1KΩ, . RC1=25KΩ, RE=100Ω , R3=200KΩ R4=10KΩ . The h-parameters hie=2K, hre=0,hfe=100,hoe=0. Compute individual & overall A I & AV, Ri, Ri', Ro & Rot . | Understand | CAEC004.08 |
| | | | |
| 1 | A CE-CE(cascade) Amplifier uses RS=1KΩ, . RC1=15KΩ, RE1=100Ω , RC2=4KΩ , RE2=330Ω,R1=200KΩ R2=10KΩ for the first stage,for second stage R1=47KΩ R2=4.7KΩ . The h-parameters hie=1.2K, hre=2.5*10-4,hfe=50,hoe=25*10-6 A/V. Compute individual & overall A I & AV, Ri, Ri', Ro& Rot . | Understand | CAEC004.08 |
| 2 | In a tuned amplifier circuit C=500PF, L=20µH, RL=1.5K and the transistor has hfe=50 and input resistance of 200 . The coil used has Q factor=30. Calculate<br>i. resonant frequency of the tuned circuit<br>ii. impedance of the tuned circuit<br>iii. Voltage gain of the stage. | Understand | CAEC004.08 |
| 3 | A single tuned transistor amplifier is used to amplifier modulated RF carrier of 500 KHz and bandwidth of 20KHz. The circuit has a total output resistance Rt=40K and output capacitance Co=50PF. Calculate values of inductance and capacitance of the tuned circuit. | Understand | CAEC004.08 |
| 4 | In a tuned amplifier circuit C=400PF, L=30µH RL=1.5K and the transistor has hfe=60 and input resistance of 200. The coil used has Q factor = 30. Calculate<br>i. $f_r$ of the tuned circuit<br>ii. ii. impedance of the tuned circuit | Understand | CAEC004.08 |

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| | iii. iii. Voltage gain of the stage. | | |
| **UNIT-IV** | | | |
| **FEEDBACK AMPLIFIERS & OSCILLATORS** | | | |
| **PART-A(SHORT ANSWER QUESTIONS)** | | | |
| 1 | What is feedback and what are feedback amplifiers. | Remember | CAEC004.12 |
| 2 | What is meant by positive and negative feedback. | Remember | CAEC004.12 |
| 3 | What are the advantages and disadvantages of negative feedback. | Understand | CAEC004.12 |
| 4 | Differentiate between voltage and current feedback in amplifiers. | Understand | CAEC004.12 |
| 5 | Define sensitivity. | Remember | CAEC004.12 |
| 6 | Define De-sensitivity. | Remember | CAEC004.12 |
| 7 | What are the conditions for sustained oscillator or what is Barkhausen Criterion. | Remember | CAEC004.10 |
| 8 | What is Oscillator circuit. | Understand | CAEC004.10 |
| 9 | What are the classifications of Oscillators. | Understand | CAEC004.10 |
| 10 | What are the types of feedback oscillators. | Understand | CAEC004.11 |
| 11 | Define Piezo-electric effect. | Remember | CAEC004.11 |
| 12 | Draw the equivalent circuit of crystal oscillator. | Understand | CAEC004.11 |
| 13 | What is Miller crystal oscillator? Explain its operation. | Remember | CAEC004.11 |
| 14 | State the frequency for RC phase shift oscillator. | Remember | CAEC004.11 |
| 15 | Give the topology of current amplifier with current shunt feedback. | Remember | CAEC004.13 |
| 16 | What are gain margin and phase margin. | Remember | CAEC004.12 |
| 17 | What is the minimum value of $h_{fe}$ for the oscillations in transistorized RC Phase shift oscillator. | Remember | CAEC004.11 |
| 18 | What is LC oscillator. | Remember | CAEC004.11 |
| 19 | Draw the circuit of Clapp oscillator. | Remember | CAEC004.11 |
| 20 | How does an oscillator differ from an amplifier. | Understand | CAEC004.10 |
| 21 | Name two low frequency oscillators. | Remember | CAEC004.10 |
| 22 | Calculate the frequency of oscillation for the Clapp oscillator with c1=0.1µf, c2=1µf, c3=100pF and L=470µH. | Understand | CAEC004.11 |
| **PART-B (LONG ANSWER QUESTIONS)** | | | |
| 1 | Explain the concept of feedback as applied to electronic amplifier circuits. | Understand | CAEC004.12 |
| 2 | What are the advantages and disadvantages of positive and negative feedback. | Understand | CAEC004.12 |
| 3 | With the help of a general block schematic diagram explain the term feedback. | Understand | CAEC004.12 |
| 4 | What type of feedback is used in electronic amplifiers? What are the advantages of this type of feedback. Prove each one mathematically. | Understand | CAEC004.12 |
| 5 | Give the equivalent circuits, and characteristics of ideal and practical amplifiers of the following types (i) Voltage amplifier, (ii) Current amplifiers, (i i i) Trans-resistance amplifier, (iv) Trans-conductance amplifier. | Understand | CAEC004.12 |
| 6 | Derive the expression for the input resistance with feedback $R_{if}$ and output resistance with feedback $R_{Of}$ in the case of (a) Voltage series feedback amplifier. (b) Voltage shunt feedback amplifier. (c) Current series feedback amplifier. (d) Current shunt feedback amplifier | Remember | CAEC004.13 |
| 7 | In which type of amplifier the input impedance increases and the output impedance decreases with negative impedance? Prove the same drawing equivalent circuit. | Remember | CAEC004.13 |
| 8 | Draw the circuit for Voltage series amplifier and justify the type of feedback. | Understand | CAEC004.13 |
| 9 | Derive the expressions for Av, Ri and Ro for the circuit. | Understand | CAEC004.13 |
| 10 | Draw the circuit for Current series amplifier and justify the type of feedback. | Understand | CAEC004.13 |
| 11 | Derive the expressions for Av, Ri and Ro for the circuit. | Understand | CAEC004.13 |

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| 12 | Draw the circuit for Voltage shunt amplifier and justify the type of feedback. | Understand | CAEC004.13 |
| 13 | Derive the expressions for Av, Ri and Ro for the series – shunt feed back amplifier circuit. | Understand | CAEC004.13 |
| 14 | Draw the circuit for Current shunt amplifier and justify the type of feedback. | Understand | CAEC004.13 |
| 15 | Derive the expressions for Av, Ri and Ro for series – series feed back amplifier circuit. | Understand | CAEC004.13 |
| 16 | Explain the basic principle of generation of oscillations in LC tank circuits. What are the considerations to be made in the case of practical L.C. Oscillator Circuits? | Understand | CAEC004.11 |
| 17 | Deduce the Barkausen Criterion for the generation of sustained oscillations. | Understand | CAEC004.10 |
| 18 | How are the oscillations initiated? | Understand | CAEC004.10 |
| 19 | Draw the circuit and explain the principle of operation of RC phase-shift oscillator circuit. What is the frequency range of generation of oscillations? Derive the expression for the frequency of oscillations. | Understand | CAEC004.11 |
| 20 | Derive the expression for the frequency of Hartely oscillators. | Understand | CAEC004.11 |
| 21 | Derive the expression for the frequency of Colpitt Oscillators. | Understand | CAEC004.11 |
| 22 | Derive the expression for the frequency of Wein Bridge Oscillators. | Understand | CAEC004.11 |
| 23 | Derive the expression for the frequency of Crystal Oscillators. | Understand | CAEC004.11 |
| 24 | Explain how better frequency stability is obtained in crystal oscillator? | Understand | CAEC004.11 |
| 25 | Draw the equivalent circuit for a crystal and explain how oscillations can be generated in electronic circuits, using crystals. | Remember | CAEC004.11 |
| 26 | Reason out the need for three identical R-C sections in R-C phase-shift oscillator circuits? | Understand | CAEC004.11 |
| **PART-C (PROBLEM SOLVING AND CRITICAL THINKING QUESTIONS)** | | | |
| 1 | The following information is available for the generalized feedback network. Open loop voltage amplification ($A_V$) = - 100. Input voltage to the system (V,') = 1mV. Determine the closed loop voltage amplification, the output voltage, feedback voltage, input voltage to the amplifier, and type of feed back for (a) β = 0.01, (b) β = - 0.005 (c) β = 0 (d) β = 0.01. Also determine the % variation in Avl resulting from 100 % increase in A, when βv = 0.01. When Av = - 100 Av' = - 50. | Understand | CAEC004.13 |
| 2 | An amplifier has a mid band gain of 125 and bandwidth of 250 kHz. If 4% negative feedback is introduced, find the new bandwidth and gain. | Understand | CAEC004.13 |
| 3 | An amplifier with open loop voltage gain $A_v$ = 1000 ± 100 is available. It is necessary to have an amplifier where voltage gain varies by not more than ± 0.1 % (a) Find the reverse transmission factor β of the feedback network used. (b) Find the gain with feedback. | Understand | CAEC004.13 |
| 4 | An amplifier with Av = - 500, produces 5% harmonic distortion at full output. What value of β is required to reduce the distortion to 0.1 % ? What is the overall gain? | Understand | CAEC004.13 |
| 5 | For a voltage series feedback amplifier Find D, $A_{vf}$, $R_{if}$, $R_{of}$. | Remember | CAEC004.13 |

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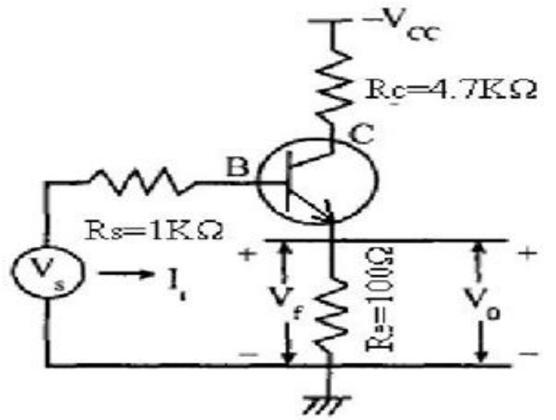
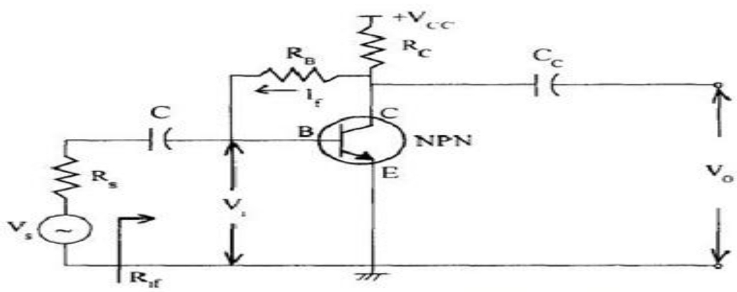
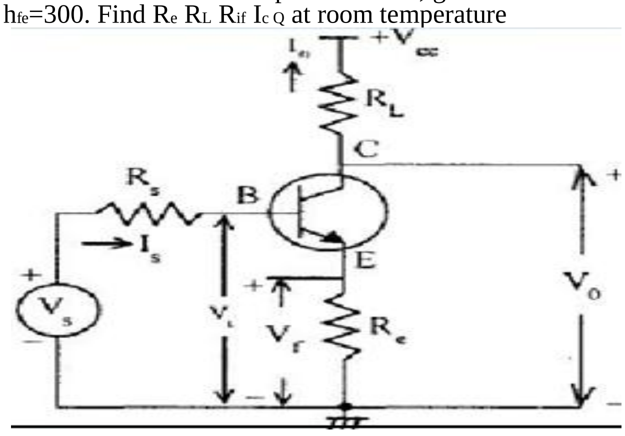
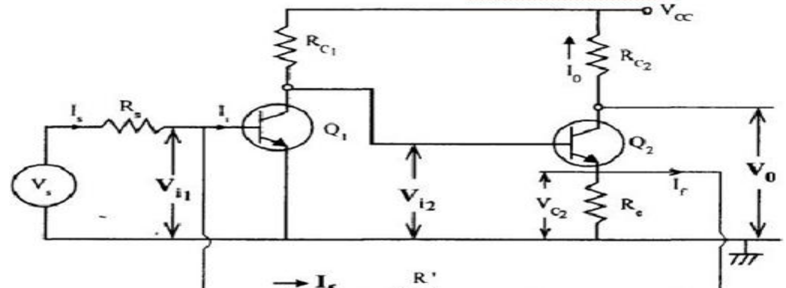
| |   | | |
| 6 | For a voltage shunt feedback amplifier $R_s$=8K,$R_c$=3K, $R_B$=30K,. Find D, $A_{vf}$, $R_{if}$, $R_{of}$ , $R_{mf}$. $h_{ie}$=1K,$h_{re}$=0,$h_{fe}$=50,$h_{oe}$=0.   | Remember | CAEC004.13 |
| 7 | For a current series feedback amplifier $R_s$=1K, $g_{mf}$=-2mA/V. $A_{vf}$=-8 D=60, $h_{fe}$=300. Find $R_e$ $R_L$ $R_{if}$ $I_{c\,Q}$ at room temperature   | Remember | CAEC004.13 |
| 8 | For a current shunt feedback amplifier $R_s$=R'=1K,$R_{c1}$=2.5K, $R_{c2}$=600 Ω, $R_{B}$=82K,$R_{E}$=50Ω. Find D, $A_{vf}$, $R_{if}$, $R_{of}$ .   | Remember | CAEC004.13 |

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| 9 | a. State three fundamental assumptions which are made in order that the expression Af =A/(1+Aβ) be satisfied exactly.<br>b. An Amplifier has a value of Rin=4.2K, AV =220 and β=0.01. Determine the value of input resistance of the feedback amplifier.<br>c. The amplifier in part (a) had cut-off frequencies f1=1.5KHz and f2=501.5KHz before the feedback path was added. What are the new cut-off frequencies for the circuit? | Understand | CAEC004.13 |
| 10 | The gain of an amplifier is decreased to 10,000 with negative feedback from its gain of 60,000. Calculate the feedback factor .Express the amount of negative feedback in dB. | Understand | CAEC004.13 |
| 11 | Calculate the gain, input impedance, output impedance of voltage series feedback amplifier having A=300, Ri=1.5K,RO=50K and β =1/12. | Understand | CAEC004.13 |
| 12 | An amplifier has mid-band gain of 125 and a bandwidth of 250KHz.<br>i. If 4% negative feedback is introduced, find the new bandwidth and gain<br>ii. If bandwidth is restricted to 1MHz, find the feed back ratio. | Understand | CAEC004.13 |
| 13 | . An Amplifier has a mid-frequency gain of 100 and a bandwidth of 200KHz.<br>i. What will be the new bandwidth and gain if 5% negative feedback is introduced?<br>ii. What should be the amount of negative feedback if the bandwidth is to be restricted to 1MHz? | Understand | CAEC004.13 |
| 14 | An RC coupled amplifier has a voltage gain of 1000. f1=50Hz, f2=200KHz and a distortion of 5% without feedback. Find the amplifier voltage gain,f1', f2' and distortion when a negative feedback is applied with feedback ratio of 0.01. | Understand | CAEC004.13 |
| 15 | A Hartley oscillator is designed with L = 20μH and a variable capacitance. Find the Range of capacitance values if the frequency of oscillation is varied between 950 KHz to 2050 KHz. | Understand | CAEC004.11 |
| 16 | In a transistorized Hartley oscillator the two inductances are 2mH and 20Mh while the frequency is to be changed from 950KHZ to 2050KHZ. Calculate the range over which the capacitor is to be varied. | Understand | CAEC004.11 |
| 17 | A crystal has L=2H, C=0.01PF and R=2k. Its mounting capacitance is 2PF. Calculate its series and parallel resonating frequency. | Understand | CAEC004.11 |
| 18 | Find the capacitor C and hfe for the transistor to provide a resonating frequency of 10KHZ of a phase-shift oscillator. Assume R1=25k, R2=60k,Rc=40k, R=7.1k and hie=1.8k. | Understand | CAEC004.11 |
| 19 | A crystal has L=0.1H, C=0.01PF, R=10k and CM=1PF. Find the series resonance and Q-factor. | Understand | CAEC004.11 |
| 20 | A quartz crystal has the following constants. L=50mH, C1=0.02PF, R=500 and C2=12PF. Find the values of series and parallel resonant frequencies. If the external capacitance across the crystal changes from 5PF to 6PF, find the change in frequency of oscillations | Understand | CAEC004.11 |
| **UNIT-V** | | | |
| **LARGE SIGNAL AMPLIFIERS** | | | |
| **PART-A(SHORT ANSWER QUESTIONS)** | | | |
| 1 | Classify large signal amplifiers based on its operating point. Distinguish these amplifiers in terms of the conversion efficiency. | Understand | CAEC004.14 |
| 2 | What is the origin of crossover distortion and how it can be eliminated? | Understand | CAEC004.14 |
| 3 | Derive the expression for the output current in push -pull amplifier with base current as $i_b = I_{bm}$ sinwt | Understand | CAEC004.14 |
| 4 | Differentiate power amplifier with that of a normal small signal amplifier in the aspects of its construction and applications | Understand | CAEC004.14 |
| 5 | What are the drawbacks of transformer coupled power amplifiers? | Understand | CAEC004.15 |
| 6 | What is the origin of crossover distortion and how it can be eliminated? | Understand | CAEC004.15 |
| 7 | State the need of a heat sink for large signal amplifier and state what is a thermal resistance? | Understand | CAEC004.15 |
| 8 | Define the terms collector dissipation and conversion efficiency of class A power amplifier. | Remember | CAEC004.15 |
| 9 | In a modified class B power amplifier cross over, how distortion can be | Understand | CAEC004.15 |

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| | eliminated. | | |
| 10 | Prove that in class A power amplifier if distortion is 10%. power at the load is increased by 1%. | Understand | CAEC004.15 |
| 11 | State the advantages of push pull class B power amplifier over class B power amplifier. | Understand | CAEC004.15 |
| 12 | Calculate the power that can be dissipated by a transistor at an ambient temperature of $T_A$=500C, given $T_j$=2300C and $\theta_{JA}$=1000C/W. | Understand | CAEC004.15 |
| 13 | The thermal resistance of a transistor is 100C/W. It is operated at TA=250C and dissipates 3W of power. Calculate the junction temperature. | Understand | CAEC004.15 |
| 14 | Compare various power amplifiers with respect to conduction angle, efficiency and distortion. | Remember | CAEC004.14 |
| 15 | What is a harmonic distortion? How even harmonics is eliminated using push-pull circuit? | Remember | CAEC004.15 |
| 16 | List the advantages of complementary-symmetry configuration over push pull configuration. | Remember | CAEC004.15 |
| 17 | State different types of heat sinks. | Remember | CAEC004.15 |
| 18 | State the features of class AB power amplifier like operating point, conduction angle and power dissipation. | Remember | CAEC004.15 |
| 19 | If the dissipated power at the junction is 10W, and the junction capacitance is 1250C and TA=250C then find thermal resistance between junction to ambient. | Understand | CAEC004.15 |
| 20 | Define conversion efficiency of power amplifier. | Remember | CAEC004.15 |
| 21 | As the temperature increases, what will happen to the base –emitter voltage of a given Transistor | Remember | CAEC004.15 |
| 22 | For a class B amplifier $V_{CE(MIN)}$ =2V,$V_{CC}$ = 15V. Find its overall efficiency. | Understand | CAEC004.15 |
| 23 | Explain how distortion is reduced in class AB push-pull topology. | Understand | CAEC004.15 |
| 24 | What are the two primary metrics used to describe the performance of a large signal amplifier | Understand | CAEC004.14 |
| 25 | Define the parameters exhibited by a Class AB power amplifier. | Remember | CAEC004.15 |
| 26 | How is phase splitting achieved in push-pull topologies that do not use transformers? | Understand | CAEC004.15 |
| 27 | What is thermal runaway? Show how it can be avoided | Understand | CAEC004.15 |
| 28 | Why the conversion efficiency in a transformer coupled amplifier double that of the RC coupled class A amplifier? | Understand | CAEC004.15 |
| | **PART-B (LONG ANSWER QUESTIONS)** | | |
| 1 | What are the different methods of clarifying electronic amplifiers? How are they classified, based on the type of coupling? Explain. | Understand | CAEC004.15 |
| 2 | Compare the characteristic features of Direct coupled, resistive capacitor coupled, and Transformer coupled amplifiers. | Understand | CAEC004.15 |
| 3 | Distinguish between small signal and large signal amplifiers. How are the<br>power amplifiers classified? Describe their characteristics. | Understand | CAEC004.14 |
| 4 | Derive the general expression for the output power in the case of a class A power amplifier. Draw the circuit and explain the movement of operating point on the load line for a given input signal. | Understand | CAEC004.15 |
| 5 | Derive the expressions for maximum. Theoretical efficiency 'for<br>(i) Transformer coupled<br>(ii) Series fed amplifier what are their advantages and disadvantages. | Understand | CAEC004.15 |
| 6 | Show that in the case of a class A transforms coupled amplifier, with impedance matching, the expression for voltage gain AV is given as<br>$A_V = -\left(\frac{h_{fe}}{2}\right) \cdot \frac{R_L}{h_{ie}} \cdot \frac{N_1}{N_2}$ | Understand | CAEC004.15 |
| 7 | List out the advantages and disadvantages of transformer coupling? | Remember | CAEC004.15 |
| 8 | Show that class B push pull amplifiers exhibit half wave symmetry. | Understand | CAEC004.15 |

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| 9 | Derive the expression for Max. Theoretical efficiency in the case of class B push pull amplifier. Why is it named so ? What are its advantages and disadvantages? | Understand | CAEC004.15 |
| 10 | Explain about heat sinks. Explain the term Thermal Resistance. Give the sketches of heat sinks. | Understand | CAEC004.15 |
| 11 | (a) If two transistors are employed in a push-pull amplifier with cut-off bias, orin Class- B operation of the amplifier, explain the process of generation of 'crossover distortion' with necessary diagrams and the reasons behind such phenomenon.<br>(b) Suggest a suitable circuit for minimizing the above distortion. | Understand | CAEC004.15 |
| **PART-C (PROBLEM SOLVING AND CRITICAL THINKING QUESTIONS)** | | | |
| 1 | A power amplifier supplies 3w to a load of 6K. The zero signal d.c collector current in 55 mA and the collector current with signal in 60mA. How much is the percentage in second harmonic distortion | Understand | CAEC004.15 |
| 2 | A class B, push pull amplifier drives a load on 16, connected to the secondary of the ideal transformer. The supply voltage in 25V. If the turns on the primary in 200 and the No. of turn the secondary in 50, Calculate maximum power o/p, d.c power input, efficiency and maximum power dissipation per transistor. | Understand | CAEC004.15 |
| 3 | In a class B complementary power amplifier $V_{cc}$=+15V, -$V_{cc}$=15V and $R_L$=4Ω. Calculate<br>i. maximum a.c power which can be developed<br>ii. collector dissipation while developing maximum a.c power<br>iii. efficiency<br>iv. maximum power dissipation per transistor | Understand | CAEC004.15 |
| 3 | A series fed class A amplifier uses a supply voltage of 10V and load resistance of 20 Ω. The a.c input voltage results in a base current of 4mA<br>peak. Calculate<br>i. d.c input power<br>ii. a.c output power<br>iii. %efficiency | Understand | CAEC004.15 |
| 5 | What is the Junction to ambient Thermal Resistance for a device dissipating 600 mw into an ambient temperature of 500C and operating at a junction temperature of 1100C? | Understand | CAEC004.15 |
| 6 | Calculate the transformer turns ratio required to match a 8 Ω speaker load to an amplifier so that the effective load resistance is 3.2 K Ω. | Understand | CAEC004.15 |
| 7 | In complementary - symmetry class-B power amplifier circuit, VCC=25 Volts, RL=16 and Imax=2 Amps. Determine the input power, output power and efficiency. | Understand | CAEC004.15 |
| 8 | What is the junction to ambient thermal resistance for a device dissipating 600 m W into an ambient of 60°C and operating at a junction temperature of 120°C. | Understand | CAEC004.15 |
| 9 | Design a class A power amplifier to deliver 5V rms to a load of 8 Ohms using a transformer coupling. Assume that a supply of 12V is available. The resistance of the primary winding of the transformer also should be considered. | Understand | CAEC004.15 |
| 10 | Design a class A transformer coupled amplifier, using the transistor, to deliver 75 m W of audio power into a 40 load. At the operating point, IB = 250 μA, V = 16V. The collector dissipation should not exceed 250 m W. R = 900 Ω. Make reasonable approximations wherever necessary. | Understand | CAEC004.15 |
| 11 | Design a class B power amplifier to deliver 30W to a load resistor RL = 40 Ω using a transformer coupling. V m = 30V = V cc. Assume reasonable data wherever necessary. | Understand | CAEC004.15 |
| 12 | The amplifier shown is made up of an NPN and PNP transistors. The h-parameters of the two transistors are identical and are given as hie=1K, hre=0, hfe=100,hoe=0. Find overall voltage gain Av = VO/ Vi | Understand | CAEC004.15 |

**HOD, ECE**