INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad - 500 043

ELECTRONICS AND COMMUNICATION ENGINEERING

TUTORIAL QUESTION BANK

Course Title	**ANALOG AND PULSE CIRCUITS**				
Course Code	AECB11				
Programme	B.Tech				
Semester	IV	ECE			
Course Type	Core				
Regulation	IARE - R18				
Course Structure	**Theory**			**Practical**	
	Lectures	**Tutorials**	**Credits**	**Practicals**	**Credits**
	3	1	4	3	2
Chief Coordinator	Dr. V Vijay, Associate Professor				
Course Faculty	Mrs. KS Indrani, Assistant Professor, ECE Ms. N Anusha, Assistant Professor, ECE Mr. S Lakshmanachari, Assistant professor, ECE				

COURSE OBJECTIVES:

The course should enable the students to:	
I	Learn the concepts of high frequency analysis of transistors.
II	Understanding of various types of amplifier circuits such as small signal, cascaded, large signal and tuned amplifiers.
III	Familiarize the Concept of feedback in amplifiers so as to differentiate between negative and positive feedback.
IV	Construct various multivibrators using transistors.

COURSE OUTCOMES (COs):

CO 1	Discuss the frequency response and analysis of multistage amplifiers and transistor at high frequency.
CO 2	Analyze the effect of feedback on Amplifier characteristics in feedback amplifiers.
CO 3	Discuss the frequency response of various oscillators and analyze the large signal and tuned amplifiers.
CO 4	Understand the linear wave shaping and different types of sampling gates with operating principles using diodes, transistors.
CO 5	Analysis and Design of Bistable, Monostable, Astable Multivibrators and Schmitt trigger using Transistors.

COURSE LEARNING OUTCOMES (CLOs):

CLO 1	Understand the classification of amplifiers, distortions in amplifiers and different coupling schemes used in amplifiers.
CLO 2	Analyze various multistage amplifiers such as Darlington, Cascade etc.
CLO 3	Understand and remember the concept of Hybrid - model of Common Emitter transistor.
CLO 4	Analyze the importance of positive feedback and negative feedback in connection in electronic circuits.
CLO 5	Analyze various types of feedback amplifiers like voltage series, voltage shunt, current series and current shunt.
CLO 6	Understand the condition for Oscillations and various types of Oscillators.
CLO 7	Design various sinusoidal Oscillators like RC Phase shift, Wien bridge, Hartley and Colpitts oscillator for various frequency ranges.
CLO 8	Design different types of power amplifiers for practical applications of desired specifications like efficiency, output power, distortion, etc.
CLO 9	Design the tuned circuits used in single tuned amplifiers and understand its frequency response.
CLO 10	Analyze the response of high pass RC to different non sinusoidal inputs with different time constants and identify RC circuit’s applications.
CLO 11	Understand the basic operating principle of sampling gates.
CLO 12	Analyze the response of low pass RC circuits to different non sinusoidal inputs with different time constants and identify RC circuit’s applications.
CLO 13	Illustrate the Bistable multivibrator with various triggering methods and apply design procedures to different bistable multivibrator circuits.
CLO 14	Analyze the Monostable, Astable multivibrator circuits with applications and evaluate time, frequency parameters.
CLO 15	Evaluate triggering points, hysteresis width of Schmitt trigger circuit and also design practical Schmitt trigger circuit.

TUTORIAL QUESTION BANK

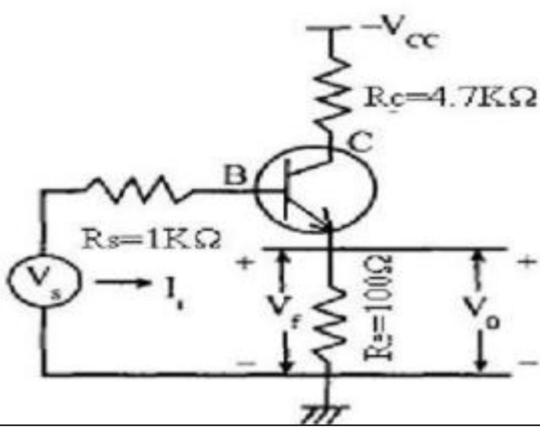
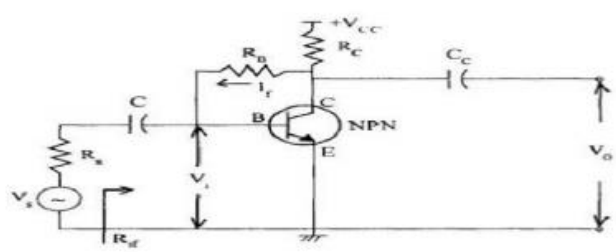
S. No	QUESTION	Blooms Taxonomy Level	Course Outcomes	Course learning Outcome
UNIT-I MULTISTAGE AMPLIFIERS				
PART-A (SHORT ANSWER QUESTIONS)				
1	Calculate the overall lower cut-off frequency of an identical two stage cascade of amplifier with individual lower cut-off frequency given 432 Hz.	Analyze	CO 1	AECB11.01
2	List out the special features of Darlington pair and cascode amplifiers. State the areas where these amplifiers are used?	Remember	CO 1	AECB11.02
3	Distinguish various coupling methods.	Remember	CO 1	AECB11.01
4	In a cascade amplifier, Illustrate is the coupling method which is capable of providing highest gain?	Remember	CO 1	AECB11.01
5	Narrate the significance of Cascading?	Remember	CO 1	AECB11.03
6	Describe the coupling method required to amplify dc signals in a multistage amplifier?	Remember	CO 1	AECB11.01
7	Express the expression for lower 3 – dB frequency of an n – stage amplifier with non – interacting stages.	Remember	CO 1	AECB11.01
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 Calculate the overall gain in decibels.	Remember	CO 1	AECB11.01
9	Interpret the overall gain of multistage amplifier is less than the product of gains of individual stages	Understand	CO 1	AECB11.01
10	Illustrate are the main characteristics of a Darlington amplifier?	Remember	CO 1	AECB11.02
11	Demonstrate the direct coupling is not suitable for amplification of high frequency?	Remember	CO 1	AECB11.03
12	Define Unity Gain Frequency f_T.	Remember	CO 1	AECB11.03
13	Demonstrate the gain of the amplifier decreases with frequency?	Understand	CO 1	AECB11.01
14	Define transition capacitance?	Remember	CO 1	AECB11.03
15	Define Frequency f_α.	Understand	CO 1	AECB11.03
16	Define diffusion capacitance?	Remember	CO 1	AECB11.03
17	Explain about validity of Hybrid model.	Remember	CO 1	AECB11.03
18	Draw the small signal high frequency CE model of a transistor and list its elements?	Understand	CO 1	AECB11.03
19	Define Frequency f_β.	Remember	CO 1	AECB11.03
20	Classify different types distortions possible in amplifier	Understand	CO 1	AECB11.01
PART-B (LONG ANSWER QUESTIONS)				
1	Draw and explain the two stage amplifier with Darlington connection. Give the advantages of this circuit. Illustrate the drawbacks of a Darlington amplifier.	Understand	CO 1	AECB11.02
2	Compare emitter follower and Darlington emitter	Remember	CO 1	AECB11.02

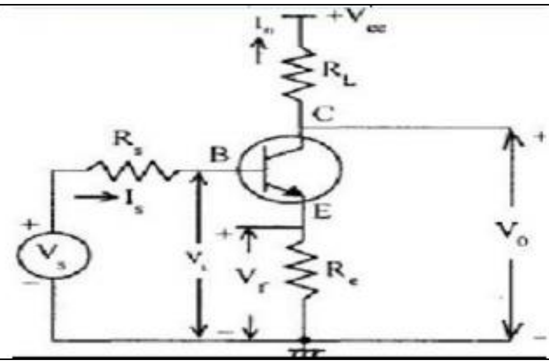
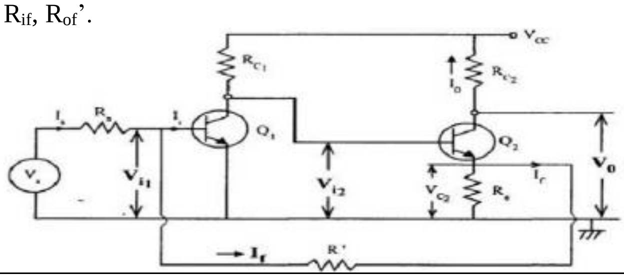
S. No	QUESTION	Blooms Taxonomy Level	Course Outcomes	Course learning Outcome
	follower configurations in respect of i. current gain ii. input impedance iii.voltage gain iv. output impedance			
3	Compare the different types of coupling methods used in multistage amplifiers.	Understand	CO 1	AECB11.01
4	Evaluate the expression for voltage gains at middle frequency and low frequency for two RC-coupled CE transistor stages.	Remember	CO 1	AECB11.01
5	Draw the circuit diagram of cascode amplifier with and without biasing circuit. Illustrate are the advantages of this circuit?	Understand	CO 1	AECB11.02
6	Classify the 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.	Remember	CO 1	AECB11.01
7	Analyze expression for the CE short circuit current gain A_{IS} as a function of frequency?	Understand	CO 1	AECB11.03
8	Analyze high-frequency parameters in terms of low-frequency parameters	Understand	CO 1	AECB11.03
9	Analyze expressions for Trance conductance (g_m), Base spread resistance (rbb')?	Remember	CO 1	AECB11.03
10	Analyze different Hybrid-π Capacitances and derive necessary expressions.	Remember	CO 1	AECB11.03
11	Analyze how f_β and f_T of a BJT can be determined? Obtain the expression for the Gain Bandwidth product of a transistor.	Remember	CO 1	AECB11.03
12	Draw the circuit of cascode amplifier. Explain its working, obtain the overall values of the circuit in terms of h-parameters.	Understand	CO 1	AECB11.02
13	Analyze the expression for CE Current gain with R_L and explain the variation of frequency response with R_L using hybrid-π model.	Understand	CO 1	AECB11.03
14	Describe why the transformer coupling is not used in the initial stage of a multistage amplifier?	Understand	CO 1	AECB11.01
15	Classify the different types of coupling methods used in multistage amplifiers	Understand	CO 1	AECB11.01
16	List out the dependence of hybrid parameters upon collector current, V_{CE} and Temperature.	Remember	CO 1	AECB11.03
17	Analyze expressions for voltage gain at middle and low frequency for two stage RC-coupled amplifier.	Remember	CO 1	AECB11.01
18	Analyze the expression for cut off frequencies f_α, f_β and f_T.	Understand	CO 1	AECB11.03
19	List out the special features of Darlington pair and cascode amplifiers. State the areas where these amplifiers are used?	Remember	CO 1	AECB11.02
20	Illustrate the effect of cascading on bandwidth of multistage amplifiers.	Remember	CO 1	AECB11.01
PART-C (PROBLEM SOLVING AND CRITICAL THINKING QUESTIONS)				
1	A Darlington emitter follower circuit uses two identical transistors having the following h-parameters h_{ie}=1.1K,	Apply	CO 1	AECB11.02

S. No	QUESTION	Blooms Taxonomy Level	Course Outcomes	Course learning Outcome
	h_{re}=2.5*10^{-4}, h_{fe}=60, h_{oe}=20μA/V. R_E=2KΩ, R_S=500Ω Solve overall A $_I$ & A_V, R_i, R_o & R_{ot}.			
2	A Darlington emitter follower circuit uses two identical transistors having the following h-parameters h_{ie}=1.1K, h_{re}=2.2*10^{-4},h_{fe}=50,h_{oe}=20μA/V. R_{E2}=3KΩ , R_S=400Ω, . R_1=90KΩ , R_2=10KΩ. Solve overall A $_I$ & A_V, R_i, R_o & R_{ot} .	Apply	CO 1	AECB11.02
3	A CE-CC Amplifier uses R_S=1KΩ, . R_{C1}= R_{E2}=4KΩ . The h-parameters h_{ie}=1.2K, h_{re}=5*10^{-4}, h_{fe}=50, h_{oe}=25μA/V, h_{ic}=1.2 Ω, h_{rc}=1, h_{fc}=-51, h_{oc}=25μA/V. Obtain individual & overall A_I & A_V, R_i, R_o & R_{ot}.	Apply	CO 1	AECB11.01
4	A CE-CB (cascode) Amplifier uses R_S=1KΩ. R_{C1}=25KΩ, R_E=100Ω, R_3=200KΩ, R_4=10KΩ. The h-parameters h_{ie}=2K, h_{re}=0, h_{fe}=100, h_{oe}=0. Obtain individual & overall A_I & A_V, R_i, R_i', R_o & R_{ot}.	Apply	CO 1	AECB11.02
5	A CE-CE (cascade) Amplifier uses R_S=1KΩ. R_{C1}=15KΩ, R_{E1}=100Ω, R_{C2}=4KΩ , R_{E2}=330Ω, R_1=200KΩ, R_2=10KΩ for the first stage, for second stage R_1=47KΩ, R_2=4.7KΩ. The h-parameters h_{ie}=1.2K, h_{re}=2.5*10^{-4}, h_{fe}=50, h_{oe}=25*10^{-6} A/V. Compute individual & overall A_I & A_V, R_i, R_i', R_o & R_{ot}.	Apply	CO 1	AECB11.01
6	Short circuit CE current gain of a transistor is 25 at a frequency of 2MHz. If f_β = 200KHz, Calculate (i) f_T (ii) h_{fe} (iii) Find $\|A_i\|$ at frequency of 10MHz and 100MHz.	Apply	CO 1	AECB11.03
7	A CE-RC coupled amplifier uses transistor with the following h-parameters: h_{fe}=50, h_{oe}=30x10^{-6} mhos, h_{re}=2.5x10^{-4}.The value of g_m at the operating point is 50m mhos. The biasing resistor R_1 between V_{cc} and base is 100KΩ and R_2 between base and ground is 10KΩ.The load resistor R_C = 5KΩ. let C = 160 pF be the total shunt capacitance in the input circuit and the coupling capacitor C_c=6μF,Calculate for one stage of the amplifier (i) mid-band current gain (ii) mid-band voltage gain.	Apply	CO 1	AECB11.01
8	Determine the hybrid–π parameters of a transistor operating at collector current $I_{C(Q)}$=2mA,$V_{CE(Q)}$=20V and $I_{B(Q)}$=20μA. Transistor specifications are β_0=100, unity gain frequency f_T=50MHz, C_{OB}=3pF, h_{ie}=1.4KΩ, h_{re}=2.5*10^{-4}, h_{oe}=25μ mhos. Assume that the operating temperature is 300^0K.	Apply	CO 1	AECB11.03
9	Following measurements of a certain transistor are available at room temperature and with I_c = 5 mA, h_{fe} = 100, h_{ie} = 0.62 KΩ. Short circuit current gain A_{is} = 10 at 10MHz. C_{bc} = 3pF. Calculate f_T and f_β.	Remember	CO 1	AECB11.03
10	List out the special features of Darlington pair, cascade and cascode amplifiers. State the areas where these amplifiers are used?	Remember	CO 1	AECB11.02
UNIT-II FEEDBACK AMPLIFIERS				
PART-A(SHORT ANSWER QUESTIONS)				
1	Illustrate the feedback and Illustrate are the types of feedback amplifiers.	Remember	CO 2	AECB11.04

S. No	QUESTION	Blooms Taxonomy Level	Course Outcomes	Course learning Outcome
2	Explore the positive and negative feedback.	Remember	CO 2	AECB11.04
3	Describe the advantages and disadvantages of negative feedback.	Remember	CO 2	AECB11.05
4	Differentiate between voltage and current feedback sampling in amplifiers.	Remember	CO 2	AECB11.04
5	Define sensitivity.	Understand	CO 2	AECB11.05
6	Define De-sensitivity.	Remember	CO 2	AECB11.04
7	Define feedback factor (or feedback ratio).	Understand	CO 2	AECB11.04
8	Illustrate the advantages of introducing negative feedback?	Apply	CO 2	AECB11.04
9	Illustrate the loop gain or return ratio.	Understand	CO 2	AECB11.04
10	Illustrate is the effect of lower cut-off frequency with negative feedback?	Understand	CO 2	AECB11.05
11	A feedback amplifier has an open loop gain of 600 and feedback factor $\beta = 0.01$. Find the closed loop gain with feedback.	Remember	CO 2	AECB11.04
12	State the barkhausen criterion for stability of feedback amplifiers?	Understand	CO 2	AECB11.04
13	Illustrate the barkhausen criterion for oscillators.	Apply	CO 2	AECB11.05
14	Write down the various characteristics of voltage shunt topology?	Understand	CO 2	AECB11.04
15	Voltage gain of an amplifier without feedback is 60 dB. It decreases to 40 dB with feedback. Calculate the feedback factor.	Understand	CO 2	AECB11.05
16	Illustrate the type of feedback employed in emitter follower amplifier?	Remember	CO 2	AECB11.04
17	List out the various types of distortions in an amplifier?	Understand	CO 2	AECB11.04
18	In which type of amplifier the input impedance increases and the output impedance decreases with negative impedance?	Apply	CO 2	AECB11.05
19	Illustrate the type of feedback is used in electronic amplifiers?	Understand	CO 2	AECB11.04
20	Draw the circuit for Current series feedback amplifier.	Understand	CO 2	AECB11.05
PART-B (LONG ANSWER QUESTIONS)				
1	Explain the concept of feedback as applied to electronic amplifier circuits.	Understand	CO 2	AECB11.05
2	Illustrate are the advantages and disadvantages of positive and negative feedback.	Understand	CO 2	AECB11.04
3	With the help of a general block schematic diagram explain the term feedback.	Understand	CO 2	AECB11.05
4	Illustrate type of feedback is used in electronic amplifiers? Illustrate are the advantages of this type of feedback. Prove each one mathematically.	Understand	CO 2	AECB11.04
5	Explain the relevant information, how the negative feedback improves stability reduce noise and increase input impedance?	Understand	CO 2	AECB11.04
6	Give the equivalent circuits, and characteristics of ideal and practical amplifiers of the following types (i)	Understand	CO 2	AECB11.04

S. No	QUESTION	Blooms Taxonomy Level	Course Outcomes	Course learning Outcome
	Voltage amplifier, (ii) Current amplifiers, (iii) Trans-resistance amplifier, (iv) Trans-conductance amplifier.			
7	Derive the expression for the input resistance with feedback Rif 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	Understand	CO 2	AECB11.05
8	In which type of amplifier the input impedance increases and the output impedance decreases with negative impedance? Prove the same drawing equivalent circuit.	Understand	CO 2	AECB11.04
9	Draw the circuit for Voltage series feedback amplifier and justify the type of feedback.	Understand	CO 2	AECB11.04
10	Derive the expressions for A_v, R_i and R_o for the current series feedback amplifier circuit.	Understand	CO 2	AECB11.05
11	Draw the circuit for Current series amplifier and justify the type of feedback.	Understand	CO 2	AECB11.05
12	Draw the circuit for Current shunt amplifier and justify the type of feedback.	Understand	CO 2	AECB11.05
13	Draw the circuit for Voltage shunt amplifier and justify the type of feedback.	Understand	CO 2	AECB11.04
14	Derive the expressions for A_v, R_i and R_o for the series – shunt feedback amplifier circuit.	Understand	CO 2	AECB11.04
15	Draw the circuit for Current shunt amplifier and justify the type of feedback.	Understand	CO 2	AECB11.05
16	Derive the expressions for A_v, R_i and R_o for series – series feedback amplifier circuit.	Understand	CO 2	AECB11.05
17	Calculate the gain, input impedance, output impedance of voltage series feedback amplifier having A=300, R_i=1.5K, R_O=50K and β =1/12.	Apply	CO 2	AECB11.05
18	An amplifier has mid-band gain of 125 and a bandwidth of 250KHz. i. If 4% negative feedback is introduced, find the new bandwidth and gain ii. If bandwidth is restricted to 1MHz, find the feedback ratio.	Apply	CO 2	AECB11.05
19	An Amplifier has a mid-frequency gain of 100 and a bandwidth of 200KHz. i. Illustrate will be the new bandwidth and gain if 5% negative feedback is introduced? ii. Illustrate should be the amount of negative feedback if the bandwidth is to be restricted to 1MHz?	Apply	CO 2	AECB11.04
20	An RC coupled amplifier has a voltage gain of 1000. f_1=50Hz, f_2=200KHz and a distortion of 5% without feedback. Find the amplifier voltage gain, f_1’, f_2’ and distortion when a negative feedback is applied with feedback ratio of 0.01.	Apply	CO 2	AECB11.05
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	Apply	CO 2	AECB11.04

S. No	QUESTION	Blooms Taxonomy Level	Course Outcomes	Course learning Outcome
	voltage to the amplifier, and type of feedback for (a) β = 0.01, (b) β = - 0.005 (c) β =0 (d) β = 0.01. Also determine the % variation in A_{vl} resulting from 100% increase in A, when β_v = 0.01. When A_v = - 100, A_v' = - 50			
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	Apply	CO 2	AECB11.05
3	An amplifier with open loop voltage gain Av = 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.	Apply	CO 2	AECB11.04
4	An amplifier with Av = - 500, produces 5% harmonic distortion at full output. Illustrate value of β is required to reduce the distortion to 0.1 %? Illustrate is the overall gain?	Apply	CO 2	AECB11.04
5	For a voltage series feedback amplifier Find D, A_{vf}, R_{if}, R_{of}'. 	Apply	CO 2	AECB11.05
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, hre=0, h_{fe}=50, h_{oe}=0 	Apply	CO 2	AECB11.04
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	Apply	CO 2	AECB11.05

S. No	QUESTION	Blooms Taxonomy Level	Course Outcomes	Course learning Outcome
				
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}'. 	Apply	CO 2	AECB11.05
9	a. State three fundamental assumptions which are made in order that the expression $A_f = A/(1+A\beta)$ be satisfied exactly. b. An Amplifier has a value of R_{in}=4.2K, A_V =220 and β=0.01.Determine the value of input resistance of the feedback amplifier. c. The amplifier in part (a) had cut-off frequencies f_1=1.5KHz and f_2=501.5KHz before the feedback path was added. Illustrate are the new cut-off frequencies for the circuit?	Apply	CO 2	AECB11.05
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.	Apply	CO 2	AECB11.04

UNIT-III
OSCILLATORS AND LARGE SIGNAL AMPLIFIERS

PART-A (SHORT ANSWER QUESTIONS)

1	Illustrate is Oscillator circuit?	Remember	CO 3	AECB11.06
2	Illustrate are the classifications of Oscillators.	Remember	CO 3	AECB11.06
3	Illustrate are the types of feedback oscillators.	Remember	CO 3	AECB11.06
4	Define Piezo-electric effect.	Remember	CO 3	AECB11.06
5	Draw the equivalent circuit of crystal oscillator	Understand	CO 3	AECB11.07
6	Illustrate is Miller crystal oscillator? Explain its operation	Understand	CO 3	AECB11.07
7	State the frequency for RC phase shift oscillator.	Remember	CO 3	AECB11.07
8	Give the topology of current amplifier with current shunt	Remember	CO 3	AECB11.08

S. No	QUESTION	Blooms Taxonomy Level	Course Outcomes	Course learning Outcome
	feedback.			
9	Illustrate are gain margin and phase margin.	Understand	CO 3	AECB11.08
10	Illustrate is the minimum value of hfe for the oscillations in transistorized RC Phase shift oscillator.	Remember	CO 3	AECB11.08
11	Illustrate is LC oscillator.	Remember	CO 3	AECB11.08
12	Draw the circuit of Clapp oscillator.	Remember	CO 3	AECB11.09
13	How does an oscillator differ from an amplifier?	Remember	CO 3	AECB11.09
14	Name two low frequency oscillators.	Understand	CO 3	AECB11.09
15	Calculate the frequency of oscillation for the Clapp oscillator with C_1=0.1µf, C_2=1µf, C_3=100pF and L=470µH.	Understand	CO 3	AECB11.09
16	Illustrate are the conditions for sustained oscillator or Illustrate is Barkhausen Criterion.	Remember	CO 3	AECB11.06
PART-B (LONG ANSWER QUESTIONS)				
1	Explain the basic principle of generation of oscillations in LC tank circuits.	Understand	CO 3	AECB11.06
2	Deduce the barkhausen criterion for the generation of sustained oscillations.	Analyze	CO 3	AECB11.06
3	How are the oscillations initiated?	Apply	CO 3	AECB11.07
4	Draw the circuit and explain the principle of operation of RC phase-shift oscillator circuit.	Analyze	CO 3	AECB11.07
5	Derive the expression for the frequency of hartley oscillators.	Understand	CO 3	AECB11.08
6	Derive the expression for the frequency of colpitt’s oscillators.	Apply	CO 3	AECB11.08
7	Derive the expression for the frequency of wein Bridge oscillators.	Analyze	CO 3	AECB11.08
8	Derive the expression for the frequency of crystal oscillators	Analyze	CO 3	AECB11.09
9	Explain how better frequency stability is obtained in crystal oscillator?	Analyze	CO 3	AECB11.09
10	Draw the equivalent circuit for a crystal and explain how oscillations can be generated in electronic circuits, using crystals.	Analyze	CO 3	AECB11.06
11	Reason out the need for three identical R-C sections in R-C phase-shift oscillator circuits?	Apply	CO 3	AECB11.07
PART-C (PROBLEM SOLVING AND CRITICAL THINKING QUESTIONS)				
1	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.	Apply	CO 3	AECB11.6
2	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.	Apply	CO 3	AECB11.7
3	A crystal has L=2H, C=0.01PF and R=2K. Its mounting capacitance is 2pF. Calculate its series and parallel resonating frequency	Apply	CO 3	AECB11.8

S. No	QUESTION	Blooms Taxonomy Level	Course Outcomes	Course learning Outcome
4	Find the capacitor C and hfe for the transistor to provide a resonating frequency of 10KHz of a phase-shift oscillator. Assume R_1=25k, R_2=60k, R_c=40k, R=7.1k and h_{ie}=1.8k.	Apply	CO 3	AECB11.9
5	A crystal has L=0.1H, C=0.01pF, R=10k and C_M=1PF. Find the series resonance and Q-factor.	Apply	CO 3	AECB11.7
6	A quartz crystal has the following constants. L=50mH, C_1=0.02pF, R=500 and C_2=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	Apply	CO 3	AECB11.7
7	Design a class B power amplifier to deliver 30W to a load resistor R_L =40 Ω using a transformer coupling. V_m = 30V = V_{cc}. Assume reasonable data wherever necessary.	Remember	CO 3	AECB11.6
8	A tuned circuit has resonant frequency of 1600 KHz and bandwidth of 10 KHz. Illustrate is the value of its Q-factor?	Remember	CO 3	AECB11.6
9	An inductor of 250µH has Q=300 at 1MHz. Determine Rs and Rp of the inductor. And a parallel resonant circuit has an inductance of 150µH and a capacitance of 100pF. Find the resonant frequency.	Apply	CO 3	AECB11.7
	PART-A(SHORT ANSWER QUESTIONS)			
1	Classify large signal amplifiers based on its operating point.	Remember	CO 3	AECB11.8
2	Illustrate is the origin of crossover distortion and how it can be eliminated?	Remember	CO 3	AECB11.8
3	Define stagger tuning.	Understand	CO 3	AECB11.8
4	Differentiate power amplifier with that of a normal small signal amplifier in the aspects of its construction and applications.	Understand	CO 3	AECB11.8
5	Illustrate are the drawbacks of transformer coupled power amplifiers?	Remember	CO 3	AECB11.8
6	Distinguish large signal amplifiers in terms of the conversion efficiency.	Remember	CO 3	AECB11.8
7	State the need of a heat sink for large signal amplifier and state thermal resistance?	Understand	CO 3	AECB11.8
8	Define the terms collector dissipation and conversion efficiency of class A power amplifier	Understand	CO 3	AECB11.8
9	In a modified class B power amplifier cross over, how distortion can be eliminated.	Remember	CO 3	AECB11.8
10	State the applications of tuned amplifiers.	Analyze	CO 3	AECB11.07
11	State the advantages of push pull class B power amplifier over class B power amplifier	Remember	CO 3	AECB11.8
12	Classify the tuned amplifiers.	Understand	CO 3	AECB11.9
13	List out the requirements of tuned amplifiers.	Understand	CO 3	AECB11.9
14	Compare various power amplifiers with respect to conduction angle, efficiency and distortion	Remember	CO 3	AECB11.8

S. No	QUESTION	Blooms Taxonomy Level	Course Outcomes	Course learning Outcome
15	Illustrate the meaning of tuned amplifier.	Understand	CO 3	AECB11.8
16	Define quality factor (Q).	Remember	CO 3	AECB11.8
17	Mention the salient features of tuned amplifiers	Understand	CO 3	AECB11.09
18	List out the applications of tuned amplifier.	Understand	CO 3	AECB11.09
19	Give the reason for using two tuned circuits are used in double tuned amplifier.	Remember	CO 3	AECB11.09
20	Define the expression for effective bandwidth of cascaded tuned amplifier.	Understand	CO 3	AECB11.09
PART-B (LONG ANSWER QUESTIONS)				
1	Draw and explain working of single tuned amplifier. And derive the expression for quality factor.	Understand	CO 3	AECB11.9
2	Explain the operation and frequency response of stagger tuned amplifier.	Remember	CO 3	AECB11.9
3	Explain the operation and derive the expression for bandwidth of two stage synchronous tuned amplifier.	Understand	CO 3	AECB11.9
4	Derive the general expression for the output power in the case of a class A power amplifier.	Remember	CO 3	AECB11.9
5	Derive the expressions for maximum efficiency for (i) Transformer coupled (ii) Series fed amplifier.	Understand	CO 3	AECB11.9
6	List out the advantages and disadvantages of (i) series fed (ii) transformer coupled class A power amplifier.	Remember	CO 3	AECB11.8
7	Show that class B push pull amplifiers exhibit half wave symmetry.	Remember	CO 3	AECB11.8
8	Derive the expression for maximum theoretical efficiency in the case of class B push pull amplifier. Illustrate its advantages and disadvantages?	Remember	CO 3	AECB11.8
9	If two transistors are employed in a push-pull amplifier with cut-off bias, or in Class-B operation of the amplifier, explain the process of generation of 'crossover distortion' with necessary diagrams and the reasons behind such phenomenon.	Understand	CO 3	AECB11.8
10	Draw a circuit for Class-C amplifier and discuss its working? And Class-C has the maximum efficiency compare to the other power amplifiers but its use is restricted. Give reasons.	Understand	CO 3	AECB11.8
11	Illustrate are the differences between single tuned and synchronously tuned amplifiers?	Remember	CO 3	AECB11.9
12	Show the necessary details of thermal-electrical analogy of power transistor. Explain the function of heat sinks used with power transistors.	Remember	CO 3	AECB11.9
13	Illustrate are the two primary metrics used to describe the performance of a large signal amplifier.	Understand	CO 3	AECB11.9
14	Illustrate the drawback of Class B amplifier? How the drawback is going to overcome using Class AB amplifier, explain.	Remember	CO 3	AECB11.8
15	a. Draw the circuit diagram of a tuned primary amplifier. Derive expression for its voltage gain at resonance and bandwidth. b. Differentiate between single tuned and double tuned amplifiers	Remember	CO 3	AECB11.9

S. No	QUESTION	Blooms Taxonomy Level	Course Outcomes	Course learning Outcome
16	a. Derive the expression for quality factor of a single tuned inductively Coupled amplifier. b. Derive the expression for current gain to the tapped tuned circuit	Understand	CO 3	AECB11.9
17	a. List possible configurations of tuned amplifiers. b. Draw and explain the circuit diagram of a single tuned capacitance coupled amplifier. Explain its operation	Remember	CO 3	AECB11.9
18	Derive the expressions for Bandwidth and Q-factor of single tuned, capacitive coupled amplifiers. List the assumptions made for the derivation.	Remember	CO 3	AECB11.9
19	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	CO 3	AECB11.9
20	Draw the circuit diagram of a tapped single tuned capacitive coupled amplifier and explain its operation and derive A/Ares and plot the frequency response of it	Remember	CO 3	AECB11.9
PART-C (PROBLEM SOLVING AND CRITICAL THINKING QUESTIONS)				
1	A power amplifier supplies 3W to a load of 6K. The zero signal DC collector current in 55 mA and the collector current with signal in 60mA. How much is the percentage in second harmonic distortion.	Remember	CO 3	AECB11.8
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.	Remember	CO 3	AECB11.8
3	In a class B complementary power amplifier V_{cc}=+15V, -V_{cc}=15V and R_L=4Ω. Calculate i. Maximum a.c power which can be developed ii. Collector dissipation while developing maximum a.c power iii. Efficiency iv. Maximum power dissipation per transistor	Understand	CO 3	AECB11.8
4	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 peak. Calculate i. d.c input power ii. a.c output power iii. %efficiency	Understand	CO 3	AECB11.8
5	Illustrate is the junction to ambient thermal resistance for a device dissipating 600 mw into an ambient temperature of 50^0C and operating at a junction temperature of 110^0C?	Remember	CO 3	AECB11.9
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 KΩ.	Understand	CO 3	AECB11.9
7	In complementary - symmetry class-B power amplifier circuit, V_{CC}=25 Volts, R_L=16 and I_{max}=2 Amps. Determine the input power, output power and efficiency	Remember	CO 3	AECB11.8
8	A single tuned RF amplifier uses a transistor with an output resistance of 50KΩ, output capacitance 15pF and	Remember	CO 3	AECB11.9

S. No	QUESTION	Blooms Taxonomy Level	Course Outcomes	Course learning Outcome
	input resistance of next stage is 20KΩ. The tuned circuit consists of 47pF capacitance in parallel with series combination of 1μH inductance and 2Ω resistance. Calculate resonant frequency, effective quality factor, bandwidth of the circuit.			
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.	Remember	CO 3	AECB11.8
10	Design a class A transformer coupled amplifier, using the transistor, to deliver 75 mW of audio power into a 40 load. At the operating point, I_B=250μA, V=16V. The collector dissipation should not exceed 250mW. R=900Ω. Make reasonable approximations wherever necessary.	Remember	CO 3	AECB11.8
UNIT-IV LINEAR WAVE SHAPING AND SAMPLING GATES				
PART-A (SHORT ANSWER QUESTIONS)				
1	Name the signals which are commonly used in pulse circuits and define any five of them.	Understand	CO 4	AECB11.10
2	Define linear wave shaping. Distinguish between the linear and non-linear wave shaping circuits.	Remember	CO 4	AECB11.10
3	Explain the fractional tilt of a high pass RC circuit.	Remember	CO 4	AECB11.10
4	State the lower 3-dB frequency of high-pass circuit.	Remember	CO 4	AECB11.10
5	Show that a high pass circuit with a small time constant acts as a differentiator.	Understand	CO 4	AECB11.10
6	Define rise time. Give the relations between rise time and bandwidth of low pass RC circuit.	Remember	CO 4	AECB11.12
7	Show that a low pass circuit with a high time constant acts as an integrator.	Understand	CO 4	AECB11.12
8	State the output voltage for low pass RC circuit under step input.	Understand	CO 4	AECB11.12
9	Define sampling gate and gating signal.	Remember	CO 4	AECB11.11
10	Describe the other names for sampling gate.	Understand	CO 4	AECB11.11
11	Compare the difference between sampling gate & logic gate.	Understand	CO 4	AECB11.11
12	Discuss different types of sampling gates.	Understand	CO 4	AECB11.11
13	Define uni-directional sampling gate.	Remember	CO 4	AECB11.11
14	Define pedestal of sampling gate.	Remember	CO 4	AECB11.11
15	Define gating signal.	Remember	CO 4	AECB11.11
16	Construct the circuit for uni-directional sampling gate.	Remember	CO 4	AECB11.11
17	Define bi-directional sampling gate.	Understand	CO 4	AECB11.11
18	Compare two diode and four diode sampling gate.	Understand	CO 4	AECB11.11
19	List the drawbacks of two-diode sampling gate.	Understand	CO 4	AECB11.11

S. No	QUESTION	Blooms Taxonomy Level	Course Outcomes	Course learning Outcome
20	How to overcome pedestal in uni-directional sampling gates.	Understand	CO 4	AECB11.11
PART-B (LONG ANSWER QUESTIONS)				
1	Explain the response of RC high pass circuit for the square input, and draw the response with different time constants.	Understand	CO 4	AECB11.10
2	Explain the response of RC high pass circuit for the pulse input, and draw the response with different time constants.	Understand	CO 4	AECB11.10
3	Prove that for any periodic input wave form the average level of the steady state output signal from an RC high pass circuit is always zero.	Understand	CO 4	AECB11.10
4	Compare the relationship between rise time, Bandwidth, and RC time constant of a low pass RC circuit.	Understand	CO 4	AECB11.12
5	Explain the response of RC low pass circuit for the square input, and draw the response with different time constants.	Understand	CO 4	AECB11.12
6	Explain the response of RC low pass circuit for the given step input waveforms.	Understand	CO 4	AECB11.12
7	Explain the operation of four diode bidirectional Sampling gate with neat sketch.	Remember	CO 4	AECB11.11
8	Find the expressions for gain and minimum control voltages of a bidirectional two-diode sampling gate.	Understand	CO 4	AECB11.11
9	Illustrate with neat circuit diagram, the operation of unidirectional sampling gate for multiple inputs.	Remember	CO 4	AECB11.11
10	Discuss the operation of unidirectional sampling gate with different control voltages.	Remember	CO 4	AECB11.11
11	Explain the basic operating principles of sampling gates.	Remember	CO 4	AECB11.11
12	Explain the basic principles of sampling gates using series switch and also give the applications of sampling gate.	Understand	CO 4	AECB11.11
13	Discuss the operation of bidirectional sampling gate using transistor.	Remember	CO 4	AECB11.11
14	Explain the operation of unidirectional sampling gate for multiple gate signals.	Understand	CO 4	AECB11.11
15	Design the circuit of four-diode sampling gate. Derive expressions for its gain and V_{min}.	Understand	CO 4	AECB11.11
16	Explain the effect of control voltage on gate output of unidirectional sampling gate using diode with some example.	Understand	CO 4	AECB11.11
17	How is phase splitting achieved in push-pull topologies that do not use transformers?	Remember	CO 3	AECB11.12
18	Demonstrate the conversion efficiency in a transformer coupled amplifier double that of the RC coupled class A amplifier?	Remember	CO 3	AECB11.12
19	Explain the response of RC high pass circuit for the step input, and draw the response with different time constants.	Understand	CO 3	AECB11.12
20	Illustrate is the effect of cascading n stages of identical single tuned amplifiers (synchronously tuned) on the overall 3db bandwidth?	Remember	CO 3	AECB11.12

S. No	QUESTION	Blooms Taxonomy Level	Course Outcomes	Course learning Outcome
PART-C (PROBLEM SOLVING AND CRITICAL THINKING QUESTIONS)				
1	A pulse of 5 V amplitude and pulse width of 0.5m sec is applied to a high pass RC circuit consisting of R=22 K ohms and C= 0.47µF. Draw the output waveform and determine the percentage tilt in the output.	Understand	CO 4	AECB11.10
2	Draw the RC differentiator circuit for pulses of 1ms repletion and 10V amplitude. The trigger pulses are to have 8V amplitude. The source resistance is 50Ω and load resistance is 500Ω.	Remember	CO 4	AECB11.10
3	A 1KHz square wave output from an amplifier has rise time, tr = 250 ns and tilt = 10%, identify the upper and lower frequencies.	Remember	CO 4	AECB11.10
4	A 10Hz square wave is fed to an amplifier. Identify and sketch the output wave forms under following conditions. The lower 3db frequency is i) 0.3Hz ii) 3Hz iii) 30Hz.	Remember	CO 4	AECB11.12
5	A symmetrical square wave whose peak-to-peak amplitude is 2V and whose average value is zero is applied to on RC integrating circuit. The time constant is equals to half -period of the square wave. Identify the Peak to peak value of the output amplitude.	Understand	CO 4	AECB11.12
6	An ideal pulse of amplitude 10 V is fed to an RC low pass integrator circuit. The width of the pulse is 3 µs. Draw the output waveforms for the following upper 3 dB frequencies: (a) 30 MHz, (b) 3 MHz and (c) 0.3 MHz.	Understand	CO 4	AECB11.12
7	Assume V_s = 20V, R_f = 25Ω, R_L = R_C = 100KΩ. Find, i. Gain (A) ii. Minimum positive control voltage (V_{CP})min iii. Minimum negative control voltage (V_{CN}) min for four diode sampling gate.	Understand	CO 4	AECB11.11
8	Design a transistor shunt gate to sample a signal current having peak amplitude of 2mA. Also calculate the output errors due to $V_{CE(sat)}$ and I_{CO}.	Understand	CO 4	AECB11.11
9	Assume V_S = 40V, R_f = 25Ω, R_L = R_C = 150KΩ. Find i) Gain (A). ii) Minimum positive control voltage $(V_{CP})_{min}$. iii) Minimum negative control voltage $(V_{CN})_{min}$ for two diode sampling gate.	Understand	CO 4	AECB11.11
10	Design a transistor series gate to sample a signal with peak amplitude 4V, and a source resistance of 200Ω. Also calculate the output errors due to $V_{CE(sat)}$ and I_{CO}.	Understand	CO 4	AECB11.11
UNIT-V **MULTIVIBRATORS**				
PART-A (SHORT ANSWER QUESTIONS)				
1	Define Multivibrator. List out the different types of Multivibrator.	Understand	CO 5	AECB11.13
2	Distinguish between Stable state and a Quasi Stable state in a Multivibrator.	Understand	CO 5	AECB11.13
3	List the other names for describing the Bistable Multivibrator.	Understand	CO 5	AECB11.13
4	Define Settling time, transition time in a Bistable Multivibrator.	Remember	CO 5	AECB11.13

S. No	QUESTION	Blooms Taxonomy Level	Course Outcomes	Course learning Outcome
5	Show that the resolving time is the sum of the transition time and the settling time.	Remember	CO 5	AECB11.13
6	Discuss the different methods of Triggering.	Understand	CO 5	AECB11.13
7	Explain the role of Commutating Capacitors.	Remember	CO 5	AECB11.13
8	List the Expression for Maximum frequency of Bistable Multivibrator.	Understand	CO 5	AECB11.13
9	List the other names for the Monostable Multivibrator.	Understand	CO 5	AECB11.14
10	Name any two methods to eliminate the Hysteresis in Schmitt Trigger.	Remember	CO 5	AECB11.14
11	List the expression of pulse width of Monostable Multivibrator.	Remember	CO 5	AECB11.14
12	Define terms UTP and LTP.	Understand	CO 5	AECB11.15
13	List the expression of frequency of Oscillations in Astable Multivibrator.	Understand	CO 5	AECB11.13
14	Show that an Astable Multivibrator is also called square Wave generator.	Remember	CO 5	AECB11.13
15	Explain monostable acts as voltage to time converter.	Remember	CO 5	AECB11.15
16	Illustrate is a harmonic distortion? How even harmonics is eliminated using push-pull circuit?	Remember	CO 4	AECB11.15
17	List the advantages of complementary-symmetry configuration over push pull configuration.	Understand	CO 4	AECB11.15
18	State the features of class AB power amplifier like operating point, conduction angle and power dissipation.	Understand	CO 4	AECB11.15
19	Define conversion efficiency of power amplifier.	Remember	CO 4	AECB11.15
20	For a class B amplifier $V_{CE\,(MIN)}$ =2V,V_{CC} = 15V. Find its overall efficiency.	Remember	CO 4	AECB11.15
PART-B (LONG ANSWER QUESTIONS)				
1	Explain the operation of bistable multivibrator circuit with circuit diagram and waveform.	Remember	CO 5	AECB11.13
2	Explain with the help of neat circuit diagram the principle of operation of monostable multivibrator, and derive an expression for pulse width.	Remember	CO 5	AECB11.14
3	Discuss the operation of Astable multi vibrator using circuit diagram.	Understand	CO 5	AECB11.13
4	Explain the operation of monostable multivibrator using circuit diagram.	Apply	CO 5	AECB11.14
5	Discuss the triggering methods for multivibrators.	Remember	CO 5	AECB11.13
6	Explain the working of a Self bias Bistable multivibrator circuit with the help of waveforms and circuit diagram.	Understand	CO 5	AECB11.13
7	Find the expression for gate width of a Monostable Multivibrator neglecting the reverse saturation current I_{CBO}.	Understand	CO 5	AECB11.14
8	Explain the working of a collector coupled Astable Multivibrator. Obtain the expression for frequency in Astable Multivibrator With the help of neat circuit diagram and waveforms.	Remember	CO 5	AECB11.13
9	Discuss the operation of Schmitt trigger with UTP and LTP.	Understand	CO 5	AECB11.15

S. No	QUESTION	Blooms Taxonomy Level	Course Outcomes	Course learning Outcome
10	Derive the expressions for triggering points for Schmitt trigger.	Remember	CO 5	AECB11.15
11	Derive an Expression for Heaviest load for a fixed bias binary.	Understand	CO 5	AECB11.15
12	Write the Design procedure for fixed bias binary.	Remember	CO 5	AECB11.13
13	Illustrate is a collector catching diodes with neat circuit diagram.	Understand	CO 5	AECB11.13
14	Derive an Expression for pulse width (T) for monostable multivibrator.	Remember	CO 5	AECB11.14
15	Derive an Expression For Monostable multi as voltage to time convertor.	Understand	CO 5	AECB11.14
16	Derive an Expression For Astable multi as voltage to time convertor.	Remember	CO 5	AECB11.13
17	Derive an Expression for T, the period of Oscillations for an Astable multivibrator.	Understand	CO 5	AECB11.13
18	Prove how Astable multi Acts as voltage to frequency convertor.	Remember	CO 5	AECB11.13
19	How to eliminate Hysteresis in Schmitt trigger.	Understand	CO 5	AECB11.15
20	Explain how Schmitt trigger can be used as i) Comparator ii) Squaring circuit.	Remember	CO 5	AECB11.15
PART-C (PROBLEM SOLVING AND CRITICAL THINKING QUESTIONS)				
1	Design a Schmitt trigger circuit using NPN transistors having $h_{FE(MIN)}$=60. V_{BE} cut-off = 0V, $V_{CE(Sat)}$ =0.2V and $V_{BE(Sat)}$ = 0.7V. Given V_{CC}=8V and o/p swing = 6V, UTP = 3.5V, LTP = 1.5V, R_1 =10K Ω & R_2 =2K Ω. Determine R_{C1}, R_{C2} and R_e.	Remember	CO 5	AECB11.15
2	A collector coupled Fixed bias binary uses NPN transistors with h_{FE} =100. The circuit parameters are V_{CC}=12V, V_{BB} = -3V, R_C = 1k Ω, R_1 =5K Ω, and R_2=10 K Ω. Verify that when one transistor is cut-off the other is in saturation. Find the stable state currents and voltages for the circuit. Assume for transistors $V_{CE(sat)}$= 0.3V and $V_{BE(sat)}$=0.7V.	Understand	CO 5	AECB11.13
3	Design a Schmitt trigger circuit using n-p-n silicon transistors to meet the following specifications: V_{CC}=12V, UTP=4V, LTP=2v,h_{fe}=60,I_{C2}=3mA. Use relevant assumptions and the empirical relationships.	Understand	CO 5	AECB11.15
4	Design a collector coupled astable multivibrator to meet the following Specifications: f =10KH Z, V_{CC}=12V, $I_{C(sat)}$=4mA and $h_{FE(min)}$=20. Assume that $V_{CE(sat)}$=0.3V and $V_{BE(sat)}$=0.7V.	Understand	CO 5	AECB11.13
5	Design an astable multivibrator to generate 5kHz square wave with a duty cycle of 40% and if amplitude 12V. Use NPN transistor having h_{FE}=100, V_{BEsat}=0.7V, V_{CEsat} =0.2, I_{Cmax} =100mA. Show the waveforms seen at both the collector and bases.	Understand	CO 5	AECB11.13
6	Silicon transistors with h_{fe}=30 are available. If Vcc = 12V and V_{BB}=6V, design a fixed bias bistable multivibrator.	Understand	CO 5	AECB11.13
7	Consider the Schmitt trigger with germanium transistor having h_{fe}=20. The circuit parameter are V_{CC}=15V,	Understand	CO 5	AECB11.15

S. No	QUESTION	Blooms Taxonomy Level	Course Outcomes	Course learning Outcome
	R_S=2kΩ, Rc1=4kΩ, R1= 1 kΩ= 3 kΩ R2 = 10 kΩ and Re= 6 kΩ.Find LTP and UTP.			
8	Design an astable multivibrator to generate a 5kHz square wave with a duty cycle of 60% and amplitude 12v. Use NPN silicon transistors having hFE(min)= 70, VCE(sat) = 0.3v, VBE(sat) = 0.7v, VBE(cutoff) = 0v and RC = 2K. Draw the waveforms seen at both collectors and bases.	Understand	CO 5	AECB11.13
9	Design a Fixed Bias binary by given fallowing specifications,Vcc=Vbb=12V, hfe(min) = 20, Ic(sat)=4mA Assume npn si-Transistors.	Understand	CO 5	AECB11.14
10	Design Self Bias binary using si transistors. Vcc=6V, hfe(min) =30,Assume appropriate junction voltages for your design.	Remember	CO 5	AECB11.14

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