EC8452 ELECTRONIC CIRCUITS – II - QUESTION BANK

UNIT-I FEEDBACK AMPLIFIERS

PART A

1.The voltage gain without negative feedback is 40 dB. What is the new voltage gain if 3% negative feedback is introduced? (APRIL/MAY 2015)(NOV /DEC 2017)

Given: 10 log Av = 40dB , AV=10000, β=0.03
We know that, Avf = AV / 1+ AVβ
=10000 /1+ (10000*0.03) = 33.22

2. Why gain bandwidth product remains constant with the introduction of negative feedback? (NOV/DEC 15), (MAY/JUN 16)

Since the bandwidth with negative feedback increases by factor (1+Aβ) and gain decreases by same factor, the gain bandwidth product of an amplifier does not altered, when negative feedback is introduced.

3. List the effects of negative feedback on the noise and bandwidth of an amplifier. (MAY 2016)
The effects of noise decreases and bandwidth increases of an negative feedback amplifier.

4. A voltage series feedback amplifier has a voltage gain with feedback as 83.33 and feedback ratio as 0.01. Calculate the voltage gain of the amplifier without feedback. (MAY 2016) ,(NOV 06)
Given: AVf=83.33, β=0.01
We know that, Avf = AV / 1+ AVβ
AV =83.33 /1+ (83.33*0.01) = 499.88

5. List the properties of negative feedback amplifier. (APRIL/MAY 2015)
- Negative feedback reduces the gain
  - Reduction in noise
- Reduction in non linear distortion
- Bandwidth improvement
- Gain Desensitivity

6. State nyquist stability criterion. (APRIL/MAY 2015),(NOV/DEC 2010)
The plot which shows the relationship between gain and phase-shift as a function of frequency is called as nyquist diagram.
- The amplifier is unstable if the curve encloses the point -1+j0. The system is called as unstable system.
- The amplifier is stable if the curve encloses the point -1+jo. That system is called as stable system.

7. 'Negative feedback stabilizes the gain'-justify the statement. (MAY/JUN 2014)

The gain with negative feedback is given as:

$A_f = A / 1 + A\beta$
If $A\beta >> 1$ Then $A_f = 1/\beta$
Since A_f is dependent on feedback factor β the gain with negative feedback is said to be stabilized.
8. What is the effect of negative feedback on circuit noise? (APRIL/MAY 2017) The effects of noise decreases of an negative feedback amplifier.

9. A feedback amplifier has an open loop gain of 600 and feedback factor $\beta = 0.01$. Find the closed loop gain with Negative feedback. (NOV/DEC 2014)
Given: $A_{vf} = AV/ 1 + AV\beta$
$=600/(1+600*0.01) =85.714.$

10. What is meant by Negative feedback? Mention its advantages. (NOV/DEC 2013) (NOV/DEC 2014) (APRIL/MAY 2015)

If the feedback signal is out of phase with the input signal then the input voltage applied to the basic amplifier is decreased and correspondingly the output is decreased. This type of feedback is known as negative or degenerative feedback.

11. What is the effect on input and output impedance of an amplifier if it employs voltage series negative feedback? (APRIL/MAY 2013)

In voltage series feedback, the input resistance increases and output resistance decreases.

12. Write the expression for the gain of an amplifier with feedback. (NOV/DEC 2013)
$A_{vf} = AV/ 1 + AV\beta$
Where, A_{vf} – feedback voltage gain.
AV – Voltage gain. β - Feedback factor

13. What is loop gain or return ratio. (MAY 11, DEC 11)
A path of a signal from input terminals through basic amplifier, through the feedback network and back to the input terminals forms a loop. The gain of this loop is the product $-A\beta$. This gain is known as loop gain or return ratio.

14. Voltage gain of an amplifier without feedback is 60dB. It decreases to 40dB with feedback.

Calculate the feedback factor.
Solution: Given: Av = 60dB and Avf = 40 dB. We know that,
$A_{vf} = AV / 1 + AV\beta$ $\beta = (AV - Avf) / (AVAvf) = (60-40) / (60*40)$
$\beta = 0.00833$

PART-B

1. Explain how negative feedback acts on loop gain, frequency, distortion, Input Impedance and output Impedance of a circuit. (APR 2010)

2. With block diagram of current series feedback and derive the expression RIF and ROF.(NOV/DEC 2016)

3. Explain Nyquist criterion to analyse the stability of feedback amplifiers. (APR 2010)

4. Draw the circuit of an emitter follower. Identify the type of negative feedback and calculate the gain, input and output resistance with and without feedback. (NOV 2013)

5. Explain the current shunt feedback amplifier with a neat diagram. (APR 2011)

6. Give the schematic representation of a single loop feedback amplifier. (NOV 2012)

7. An amplifier has a midband gain of 125 and a bandwidth of 250Khz. (APR 2010) (i)What will be the new bandwidth and gain, if 4% negative feedback is introduced?

(ii)What should be the amount of feedback, if the bandwidth is to be restricted to 1Mhz? 8. Explain current series and voltage shunt feedback connections. (APR 2010)

10. Sketch the block diagram of a feedback amplifier and derive the expressions for gain with negative feedback and also explain input and output resistance. (NOV 2012)

11. Determine the voltage gain, input impedance and output impedance of transistor based current series feedback amplifier.(NOV 2014)

12. Compare the effects of four feedback topologies on amplifiers.(NOV 2014)

13. Explain the voltage shunt feedback amplifier with a neat diagram. (NOV 2012)

14. The distortion in an amplifier is found to be 3%, when the feedback ratio of negative feedback amplifier is 0.04. When the feedback is removed, the distortion becomes 15%. Find the open and closed loop gain. (APR 2010)

15. Elaborate the methods to identifying the feedback amplifier. (APR 2013)

16. Explain voltage series and current shunt feedback connections. (APR 2010)

UNIT-II OSCILLATORS

PART A

1. State the Barkhausen criterion for an oscillator.(APRIL/MAY 15),(MAY/JUN 14), (NOV/DEC 14) , (MAY/JUN 12) , (NOV/DEC 11) ,(APRIL/MAY 10)

• The total phase shift around a loop, as the signal proceeds from input through amplifier, feedback network back to input again, completing a loop, is precisely 00 or 3600.

• The magnitude of the product of the open loop gain of the amplifier (A) and the feedback factor β is unity. i.e., $A\beta = 1$.

2. What is the major disadvantage of a twin –t oscillator? (MAY/JUN 16)

• Oscillation cannot occur at frequencies above or below because of the negative feedback through the filters.
• At however, there is negligible negative feedback; thus, the positive feedback through the voltage divider and allows the circuit to oscillate.
3. Draw the electrical equivalent circuit of crystal oscillator. (NOV/DEC 13), (MAY/JUN 14), (APRIL/MAY 15)

4. Why LC osclillator is preferred over RC osclillator at radio frequencies? (APRIL/MAY 15)

The LC oscillators are used for high frequency range which is more than 200KHz up to few gigahertz and RC oscillator generate a low frequency range .i.e. 20Hz to 200KHz .so that's why we are preferring high frequency LC oscillator at radio frequencies.

5. In a Hartley oscillator, if L1=0.2 mH, L2=0.3 mH and C=0.003F. Calculate the frequency of its oscillations. (MAY/JUN 12), (NOV/DEC 15),(MAY/JUN 16) Given: L1=0.2 mH, L2=0.3 mH and C=0.003F

$fr = 1/2\pi\sqrt{(L1 + L2)C}$ = 130KHz.
6. Write down the advantages and disadvantages of RC phase shift Oscillator. (MAY/JUNE 16)

Advantages
• Simplicity of the circuit.
• Useful for frequencies in the audiorange.
• A sine wave output can be obtained.

Disadvantages
• Poor frequency stability.
• It is difficult to get a variable frequency output, because to change the frequency, we need to vary all the resistors and capacitors simultaneously which is practically very difficult.

7. How barkhausen conditions are satisfied in twin –t oscillator? (NOV/DEC 15)

The amplifier stage circuit produces 180o and feedback circuit produces another180o .so totally 360o is produced. so this satisfies a barkhausen criteria in twin –t oscillator.

8. What is the necessary condition for a wien bridge oscillator circuit to have sustained oscillations?

(MAY/JUN13)
Necessary condition for a wien bridge oscillator.
Circuits to wave sustained oscillations:
Gains of the amplifier $A \geq 3$.

Feedback factor $\beta = 1/3$. So that $A\beta \geq 1$

9. State Barkhausen criterion. (MAY/JUNE 15) (MAY/JUNE 17)

• The total phase shift around a loop, as the signal proceeds from input through amplifier, feedback network back to input again, completing a loop, is precisely 00 or 3600.

• The magnitude of the product of the open loop gain of the amplifier (A) and the feedback factor β is unity. i.e., $A\beta = 1$.

10. Comparison RC phase shift and wien bridge oscillator. (NOV/DEC 15)

S.No	Parameter	RC Phase shift oscillator	Wein bridge oscillator
1.	Feedback network	Consists of three identical RC sections connected in cascade	Uses wien bridge circuit as feedback network
2.	Phase shift introduced by the feedback network	1800 at frequency of oscillations	00 at frequency of oscillations
6.	minimum value of gain	A>29 for sustained oscillations	A> 3 for sustained oscillations

11. Differentiate oscillator and amplifier. (NOV/DEC 13)

Oscillator	Amplifier
1. They are self generating circuits that generate waveforms like sine, square, triangular of their own, without any input signal.	1. They are not self generating circuits. These circuits increase the level of the input signal that is applied.
2.It has infinite gain	2.It has finite gain
3.It employs positive feedback	3.It employs negative feedback

12. A quartz crystal has L=3H, CS=0.05PF, R=2000Ω and CM=10pf. Calculate the series and parallel resonant frequencies fs and fp of the crystal.(Nov 11)

FS=401.93Khz FP=411.96kHz

13. What is frequency stability of an oscillator? (May 10, Dec 13)

The measure of ability of an oscillator is to maintain the desired frequency as precisely as possible for as long as time as possible.

14. Write down the advantages, disadvantages and applications of Hartley oscillator. Advantages:

• It is easy to tune

• It can operate over a wide frequency typically from few Hz and several MHz. It is easy to change the frequency by means of a variable capacitor.

Disadvantages:

• Poor frequency stability Applications:

• it is used as local oscillator in radio and TV receivers.
• In the function generator.

PART B

1. Sketch the block diagram of a feedback amplifier and derive the expressions for gain with positive and negative feedback. (APR 2011)

2. Briefly explain the Barkhausen criterion for oscillation in feedback oscillator. (NOV 2013)

3. Describe the principles involved in the Twin-T network, hence explain Twin –T oscillator. (APR 2016,NOV 2016)

4. Explain frequency stability of feedback amplifiers.(APR 2016,NOV 2013)

5.Explain RC phase shift oscillator with neat circuit diagram. Derive its frequency of oscillation. Give the amplifier gain and feedback network gain to sustain oscillator operation.(NOV 2013,14)

6. With the help of circuit diagram, Explain the principle of operation of a Colpitt's oscillator. Obtain the equation for the frequency of operation of the circuit. (NOV 2016,14)

7. Draw the circuit diagram and explain the working of Hartley oscillator. Also derive the expression for frequency of oscillation and condition for sustained oscillations.(NOV 2016,13)

8. With the help of circuit diagram, explain Barkhausen conditions are satisfied in wien bridge oscillator using BJT.(NOV 2012)

9. Briefly discuss about the frequency of oscillation of Franklin oscillator. (NOV 2016)

10. Draw the circuit of tuned collector oscillator and state expression for its frequency. (APR 2012)

11. What is the principle of oscillation of crystals? Sketch the equivalent circuit and impedancefrequency graph of crystals and obtain its series and parallel resonant frequency. (NOV 2013,16)

12. In a Colpitts oscillator, the values of the inductors and capacitors in the tank circuit are L=40Mh,C1=100pf,C2=500pf. Find Frequency of oscillation.(APR 2011)

1. If the output voltage is 10v, find the feedback voltage.

2. Find the minimum gain, if the frequency is changed by changing 'L' alone.

3. Find the value of C1 for a gain of 10.

Also, find the new frequency of oscillation.

13. With a neat diagram, explain the operation of a transistor pierce and miller crystal oscillator (NOV 2014)(APR 2012,11)

14. Calculate the frequency of oscillation for the clap oscillator with c1=0.1μf,c2=1μf, C3=100pf and L=470μh. (NOV 2011)

15. In a RC Phase shift oscillator, if R1=R2=R3=200K and C1=C2=C3=100PF, Find the frequency of the oscillator. (APR 2013)

UNIT-III TUNED AMPLIFIERS

PART A

1. What is the effect of Q on the resonance circuit? (MAY/JUNE 16)

- Bandwidth
- General spurious signal
- Oscillator phase noise
- Wide bandwidth

2. What are the different of coil losses? ***(MAY/JUN 16)***

- Copper loss
- Eddy current loss
- Hysteresis loss

3. Draw the ideal response and actual response of tuned amplifiers. (MAY/JUN 16)

4. Define unloaded and loaded Q of tuned circuit.(MAY/JUN 16),(APRIL/MAY 15),(APRIL/MAY 10), (NOV/DEC 10)

- The unloaded Q or QU is the ratio of stored energy to dissipated energy in a reactor or resonator.
- The loaded Q or QL of a resonator is determined by how tightly the resonator is coupled to its terminations

5. What is the need for Neutralization circuits? (MAY/JUN 16),(NOV/DEC 16)(MAY/JUN 13), (NOV/DEC 13)

In tuned RF amplifiers, the inter junction capacitance cb'c of the transistor becomes dominant and therefore its reactance is low enough, it provides the feedback signal from collector to base. If some signal manages to reach the input from the output in a positive manner with proper shift, then the amplifier keeps oscillation. This stability of amplifier gets affected. Hence neutralization is employed.

6. A parallel resonant circuit has an inductance of 150μH and a Capacitance of 100pF.Find the resonant frequency. (NOV/DEC 15) Given: L = 150μH, C=100pF

$\boldsymbol{fr} = \mathbf{1}/\mathbf{2}\boldsymbol{\pi}\sqrt{\boldsymbol{LC}}$ = 1.660 KHz.

7. An inductor of 250μH has θ=300 at 1Mhz. Determine Rs and Rp of inductor. (Apr 2017) RP=461.24K RS=5.23ohm

8. What is narrow band neutralization? (MAY/JUN 15), (NOV/DEC 14), (MAY/JUN 14), (NOV/DEC 13), (APRIL/MAY 11).

The effect of collector to base capacitance of the transistor is neutralized by introducing a signal that cancels the signal coupled through collector base capacitance. This process is called neutralization

9. What is or what do you mean by a tuned amplifier? (NOV/DEC 13), (APRIL/MAY 10)

The amplifier with a circuit that is capable of amplifying a signal over a narrow band of frequencies are called tuned amplifiers tuned amplifiers or The amplifiers which amplify only selected range of frequencies (narrow band of frequencies) with the help of tuned circuits (parallel LC circuit) are called tuned amplifiers.

10. What is a stagger tuned amplifier? What the advantages are of stagger tuned amplifier? (NOV/DEC 14). (MAY/JUN 13),(NOV/DEC 11)

It is a circuit in which two single tuned cascaded amplifiers having certain bandwidth are taken and their resonant frequencies are adjusted that they are separated by an amount equal to the bandwidth of each stage. Since resonant frequencies are displaced it is called stagger tuned amplifier .The advantage of stagger tuned amplifier is to have better flat, wideband characteristics.

11. What is the effect of cascading n stages of identical stages of identical stages tuned amplifiers (synchronously tuned) on the overall 3dB bandwidth? (APRIL/MAY 11)
BWn=BW (21/n-1)2. Where n-no. of stages.

Overall BW decreases as no. of stages decreases.

12. A tuned circuit has resonant frequency of 1600 KHz and bandwidth of 10KHz.What is the value of its Q-factor? (MAY/JUN 12)

Q=fr/BW
=1600 KHz/10KHz=160.

13. What are the various types of tuned amplifiers? (NOV/DEC 13).
1) Small signal tuned amplifiers
a. Single tuned amplifiers
(i) Capacitive coupled
(ii) Inductively coupled (or) Transformer coupled b. Double tuned amplifiers
c. Stagger tuned amplifiers
2) Large signal tuned amplifiers

14. Mention the applications of class C tuned amplifier.(May-2015)
• Class C amplifiers are used primarily in high-power, high-frequency applications such as Radiofrequency transmitters.
• In these applications, the high frequency pulses handled by the amplifier are not themselves the signal, but constitute what is called the Carrier for the signal.
• Amplitude modulation is one such example.
• The principal advantage of class-C amplifier is that it has a higher efficiency than the other amplifiers

PART B

1. Explain the working and frequency response of a capacitive coupled single tuned amplifier circuit. (NOV 2017)(APR 2016,15)

2. Describe briefly about neutralization in tuned amplifiers and explain in detail. (NOV 2017)(APR 2016,15)

3. Draw the Double tuned amplifier and explain the frequency response. Derive the expression for its gain and Bandwidth. (NOV 2012,10)

4. Discuss the effect of cascading single tuned and double tuned amplifier on bandwidth.(NOV 2016)

5. With neat diagram, explain Stagger tuned amplifier. (NOV 2017)(APR 2015) Refer:. S.Salivahanan ,N.Suresh Kumar,A.Vallavaraj, "Electronic Devices and Circuits";Page No.:475

6. Draw the circuit of Class C tuned amplifier and explain its operation with relevant waveforms. (N0V 2016)(APR 2015)

8. Discuss about hazeltine and coil neutralization in detail. .(NOV 2016)

9.Explain the following: (NOV 2017)

1.Synchronously tuned amplifier 2. Stagger tuned amplifier

10. Comparison between Tuned amplifier circuits.

11. Consider the design of an IF amplifier for FM radio receiver. Using two synchronously tuned stages with f0=10.7MHz and 3-dB bandwidth of each stage so that the overall bandwidth is 200kHz. Using 3μH inductors find C and R for each stage.(APR 2015)

UNIT-IV WAVE SHAPING AND MULTIVIBRATOR CIRCUITS

PART A

1. Why do we call astable multivibrator as free running multivibrator? (NOV/DEC 12)

Astable multivibrator is called as free running multivibrator because it generates square wave without any triggering pulse.

2. Differentiate between clipper and clamper circuits. (APRIL/MAY 15)(NOV 2017)

Clipper	Clamper
The circuits which are used to clip off the unwanted portion of the waveform, without distorting the remaining part of the waveform	The circuits which are used to add a dc level as per the requirements to the ac output signal
Applications like TV, FM receivers.	Applications like Radar, sonar system

3. State the role of commutating capacitors in bi-stable multivibrator. (MAY/JUN 16), (APRIL/MAY 15)

The switching characteristics can be improved by passing the high frequency components of the pulses. For this purpose, small capacitances are used in shunt with the coupling resistors R1.Due to this, the transition time reduces considerably without affecting the stable states. The capacitors allow fast rise and fall times. Thus it avoids any distortion in the output waveform. as these capacitors help the multivibrator in making instantaneous transitions between the states, they are known as commutating capacitors, speed-up capacitors or transpose capacitors.

4. A RC low pass circuit has R=1.5KΩ and C=0.2μF.What is the rise rime of the output when excited by a step input. (MAY/JUN 13),(MAY/JUN 16)

Given: R=1.5KΩ and C=0.2μF;
Rise time (tr) = 2.2 RC
= 2.2*1.5K*0.2μ=6.6*10-4s

5. Define the threshold points in a Schmitt trigger circuit. (NOV/DEC 13),(MAY/JUNE 16)

Schmitt trigger is a type of comparator with two different threshold voltage levels on points (UTP or LTP).whenever the input signal goes over the high threshold levels, the output of the comparator is switched high. The output will remain in the same state as long as the input voltage is above the low threshold level. When the input voltage goes below this level, the output will switch. These threshold voltage levels are called threshold points.

6. What are the different methods of generating ramp waveforms? (MAY/JUNE 16)

- Exponential charging
- Constant current charging
- Miller integration

7. Draw the hysteresis characteristics of the Schmitt trigger circuit. (NOV/DEC 15)

8. Define Duty cycle. (NOV/DEC 14), (NOV/DEC 13)

Duty cycle is the percentage of one period in which a signal is active. It is expressed as D = T / P Where,
T- time the signal is active.
P- total period of the signal .

9. How low pass circuit is used as an integrator? (NOV/DEC 14)

The time constant (RC value) of the low pass circuit should be kept large compared to the time period of the input signal. If so, the low pass circuit acts as an integrator.

10. Briefly explain any one type triggering for bistable multivibrator. (MAY/JUN 14)

Unsymmetrical collector triggering of bistable multivibrator:

• In this type, two trigger inputs are employed at the collector terminals of the transistors one to set the circuits in one particular stable state and the other to reset the circuit to opposite state.

• This type of circuit is effective in induced a transition in only one direction. i.e., OFF transistor can be made ON

12.What is meant by clamper circuits? (MAY/JUN 12)

The circuits which are used to add a dc level as per the requirements to the ac output signal are called clamper circuits.

13.Why is monostable multivibrator also called as delay circuit? (NOV/DEC 15)

A monostable multivibrator produces a pulse or a rectangular waveform. The time between the transition from quasi stable state to stable state can be pre determined and hence it can be used to introduce the time delays with the help of fast transition . hence it is also called a time delay circuit.

14.What is Low pass RC circuit? Why it is called low-pass filter?

• A simple circuit consisting of a series resistor and a shunt capacitor is called Low pass RC circuit.

• At very high frequencies the capacitor acts as a virtual short circuit and output falls to zero. Hence this circuit is called low-pass filter

PART B

1. With a neat circuit diagram and necessary wave forms, explain bistable multivibrator operation.(APR 2013,15)

2. Draw the circuit of differentiator and explain the generation of narrow spike from square wave. What are its applications? (APR 2016)

3. With neat circuit diagram, discuss Schmitt Trigger operation in detail. Obtain the expression for UTP and LTP. (N0V 2017)(APR 2016)

5. Design a Schmitt trigger circuit for Vcc=10V, UTP=5V,LTP=3V. Assume hfe=100 and Ic=1mA.(N0V 2012)(MAY 2013)

6. Design a collector coupled astable multivibrator for the following specifications: Output voltage 10V peak, Ic=1mA,hfe=100,ICBO=0,Output to a positive pulse, the duration of which is 20μ sec, the time between the pulse to be 10μsec. (MAY 2016)

7. Draw the circuit of a collector coupled astable Multivibrator. Explain its operation and mention the disadvantages of the circuit. (N0V 2017)

8. Explain transistor switching time in detail. (APR 2011,13)

9. Write short note on diode comparator and speed up capacitor. (NOV 2012)(APR 2013)

10. Discuss about the working principle of Monostable oscillator with neat diagram.(APR 2016)

11. Discuss the working of triggering of Bistable Multivibrator. (NOV 2011,14)

12. Design a monostable multivibrator for the following specifications: Ic=1mA, hfe=100, ICBO=0, Vcc=10V, VBB=6V,VBE=-0.5V, the duration of the output pulse=14msec.

13. Design an astable multivibrator circuit to generate a 1kHz square wave. The supply voltage is

5V and collector current is to be 2mA(Assume hfe=70) .(NOV 2013)