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Fr. C. RODRIGUES INSTITUTE OF TECHNOLOGY

DEPARTMENT: Electronics and Telecommunication Engineering.

LABORATORY CONTINUOUS ASSESSMENT FORMAT

First / ~~Second~~ Half of 2022

Course Name: Principles of Communication Engineering Lab (ECL403)

Name of the Teacher: Prof. Sadhana Pai

Name of the Student: Rishi Raturi

Roll No: 3020148	**Semester: IV**
Batch: 2nd	**Practical No: 1**
Date of Practical: 18-01-2022	**Date of Report Submission: 28-01-2022**

Title: Amplitude modulation

Course Outcome: Perform an experiment to design circuits and demonstrate amplitude modulation and demodulation.

ASSESSMENT

Sr. No.	Parameter for Assessment	Marks	Rubrics		
1.	**Practical Performance / Active Participation (03Marks)**		Above Average (03)	Average (02)	Below Average (01)
2.	**Report Presentation (02 Marks)**		Above Average (02)	Average (01)	Below Average (00)
3.	**Understanding (03 Marks)**		Above Average (03)	Average (02)	Below Average (01)
4.	**Regularity in Submission (02 Marks)**		Timely (02)	Late (01) (≤ 2 Weeks from the date of Practical)	Very Late (00) (> 2 Weeks from the date of Practical)

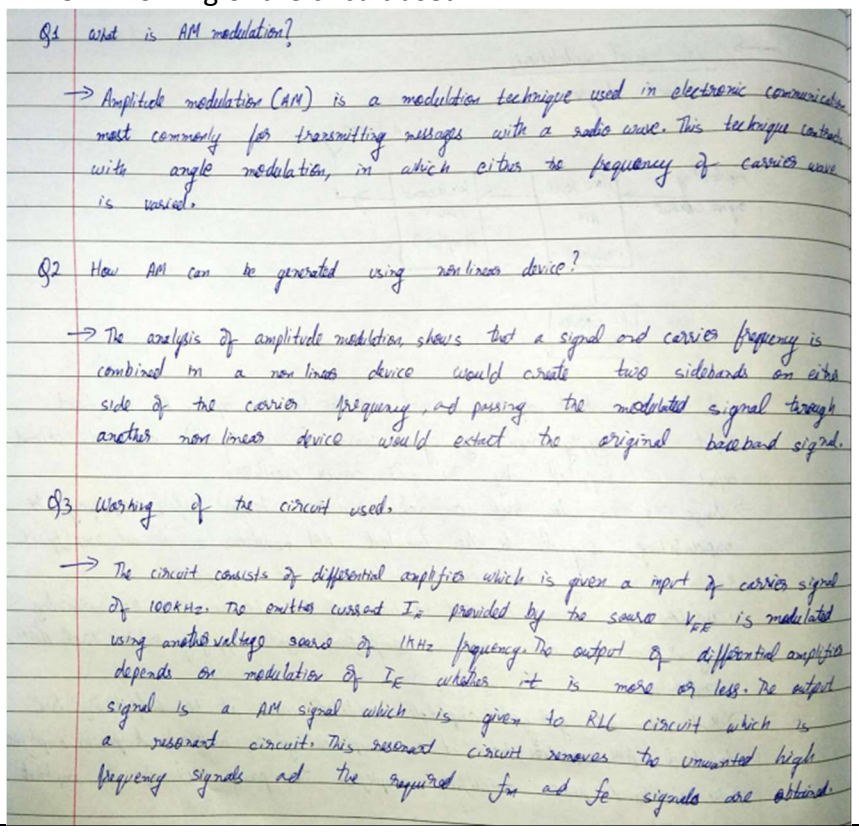
Total Marks (10):

Teacher's Signature: **Date:**

Fr.C.Rodrigues Institute of Technology, Vashi

Dept. of Electronics and Telecommunication Engineering.

IV SEM EXTC

SUBJECT	**PCEL**	**EXPT No.: 1**
TITLE	Amplitude modulation	
AIM	To Simulate amplitude modulation using BJT	
SOFTWARE TOOL	LTSpice software	
THEORY	Write about: 1. What is AM modulation 2. How AM can be generated using nonlinear device 3. Working of the circuit used. 	

Q1 what is AM modulation?

→ Amplitude modulation (AM) is a modulation technique used in electronic communication most commonly for transmitting messages with a radio wave. This technique contrasts with angle modulation, in which either the frequency of carrier wave is varied.

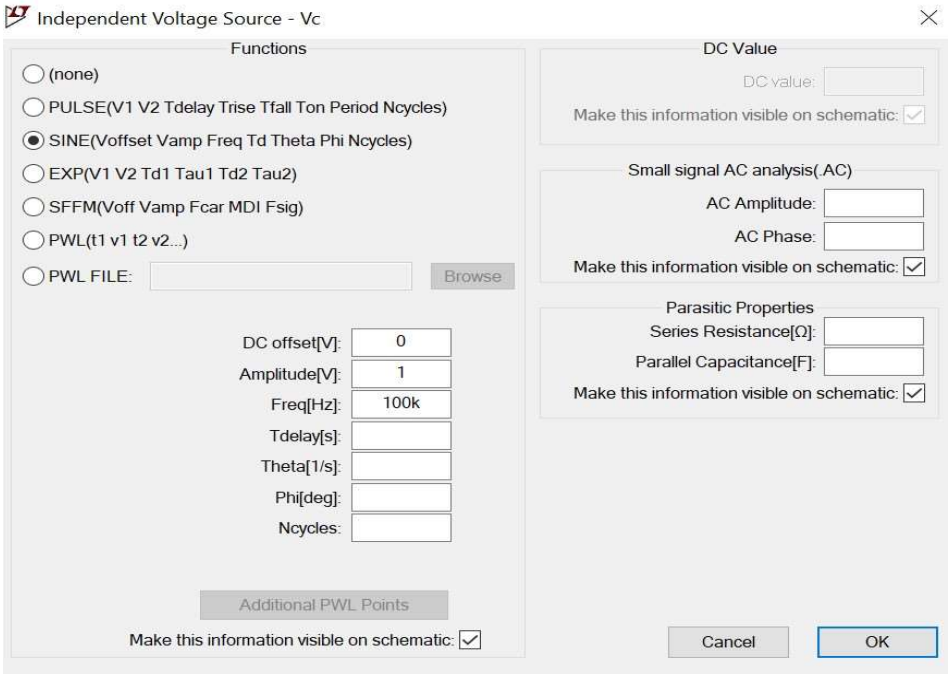
Q2 How AM can be generated using non linear device?

→ The analysis of amplitude modulation shows that a signal and carrier frequency is combined in a non linear device would create two sidebands on either side of the carrier frequency, and passing the modulated signal through another non linear device would extract the original baseband signal.

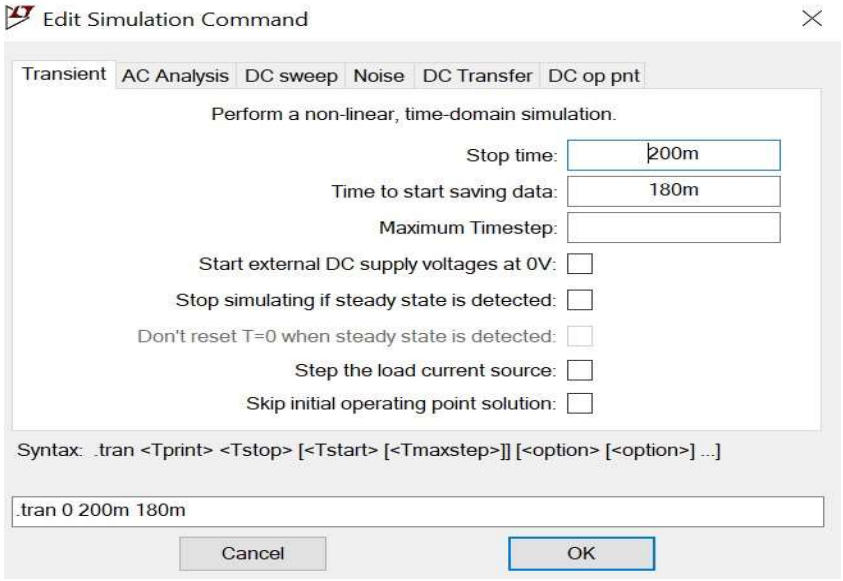
Q3 Working of the circuit used.

→ The circuit consists of differential amplifier which is given a input of carrier signal of 100KHz. The emitter current I_E provided by the source V_{EE} is modulated using another voltage source of 1KHz frequency. The output of differential amplifier depends on modulation of I_E whether it is more or less. The output signal is a AM signal which is given to RLC circuit which is a resonant circuit. This resonant circuit removes the unwanted high frequency signals and the required fm and fc signals are obtained.

PROCEDURE	1. Click on 'File' on menu bar and click on 'New Schematic' to get schematic window. 2. Click on Tool bar and select the required number of resistors, capacitors, inductor and ground as shown in the circuit diagram.  3. For BJT click on 'component '  on Tool bar , scroll down and choose ' npn'. 4. Choose 'voltage' for Vcc and V_{EE} from the same component menu. 5. Place all the components as shown and connect using  on Tool bar. 6. Hover over each component, right click and set the value for all. 7. For carrier Vc and modulating Vm signal generators select 'Advanced' and set as shown below.



8. Simulate using  Run. Following window appears. Click on 'Transient' and set the values as shown.



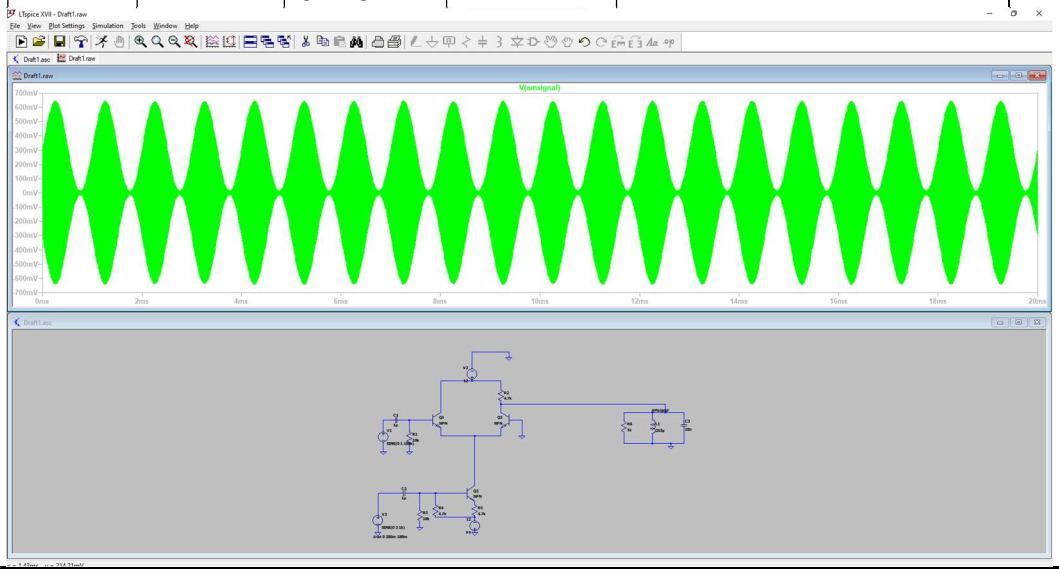
9. Click on 'Run' again. Wait till the output window appears.
10. Click on Schematic window. Place the cursor on output and click to get voltage probe. AM signal appears in the output window.

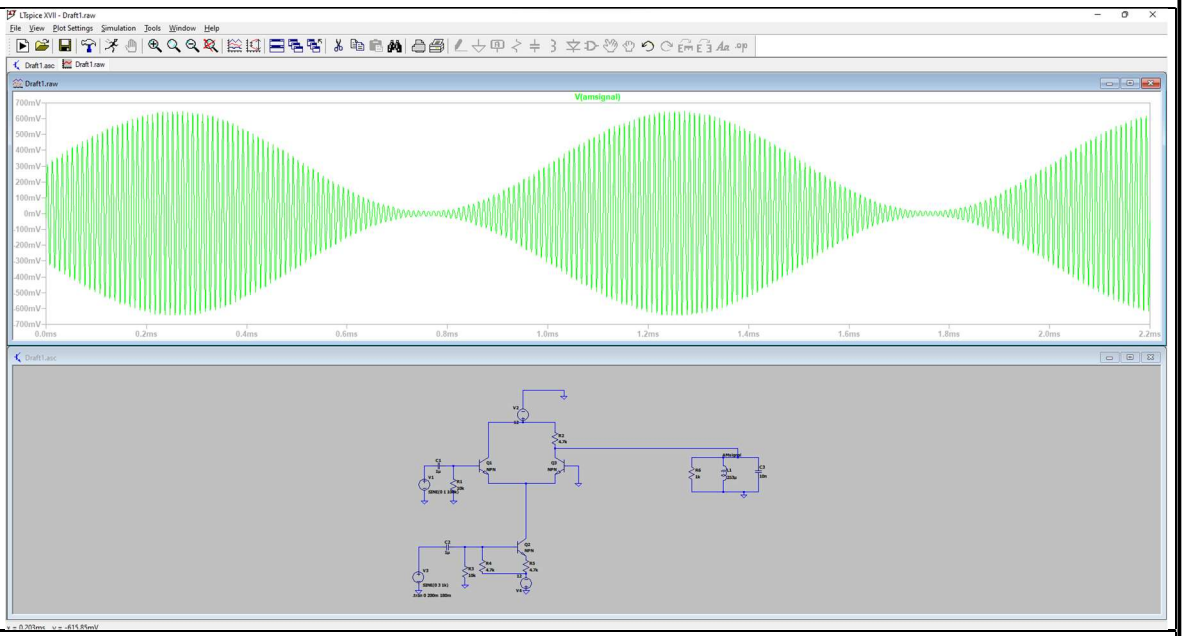
	11. Observe Frequency domain representation of AM signal by selecting ‘View’ on Menu bar and then ‘FFT’.

12. You can also observe carrier and modulating signals in the same window.
13. Right click on output window, add plot panes to observe carrier and modulating signals on different output windows.
14. Measure Vmax and Vmin using cursors and find modulation index for different values of modulating signal amplitude.
15. Click on  on Tool bar to print or save as PDF.

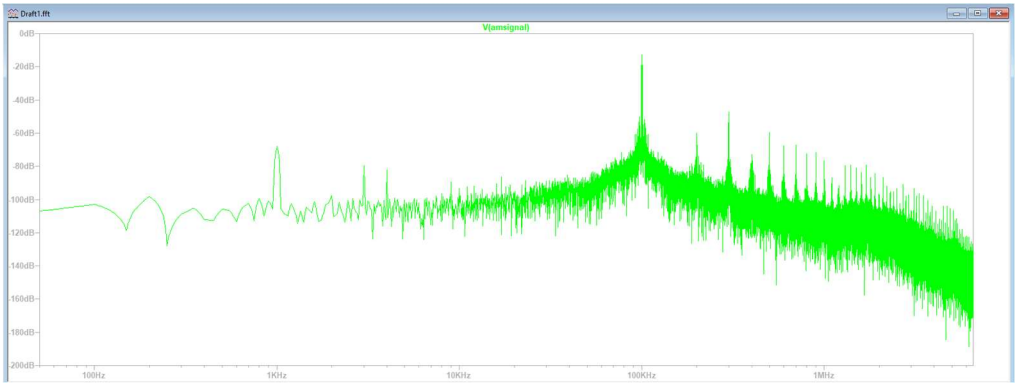
Observation table

Vm	Vc	Vmax	Vmin	M= (Vmax-Vmin)/(Vmax+Vmin)
3	1	650.27mV	15.30mV	0.954
2	1	536.07mV	102.73mV	0.678
3	2	642.62mV	11.48mV	0.964

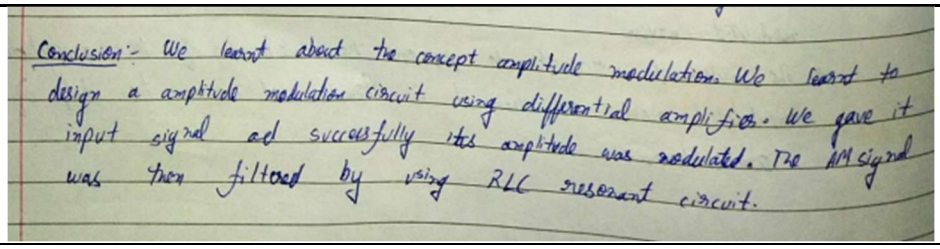




FFT:



Conclusion



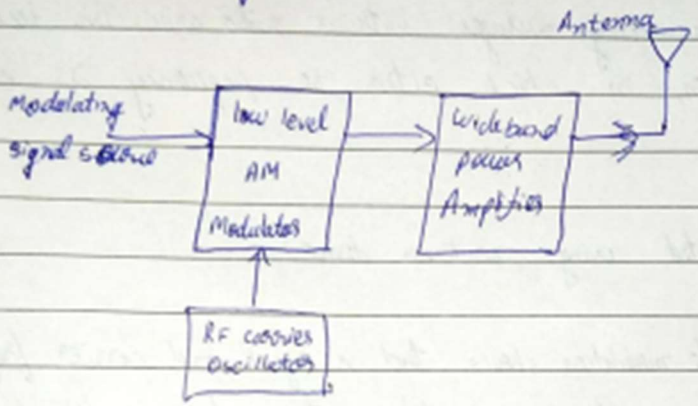
Answer the following Questions.

1. What is Low level and High-level modulation?
2. What are the Disadvantages of AM?

Q: What is low level ad high level modulation?

→ Low level modulation

Block diagram



→ As shown in block diagram low-level modulator has two inputs. At its first input we apply modulating signal source (Garage signal) and its second input is supplied by the RF carrier oscillator.

→ Since it is low level amplitude modulation therefore before applying the modulating signal to the low level AM modulator, we do not amplify it. In the same way, RF carrier is also not amplified.

→ Therefore you observe here that in low level AM modulation, neither the modulating signal nor the RF carrier is amplified before applying to low level AM modulator.

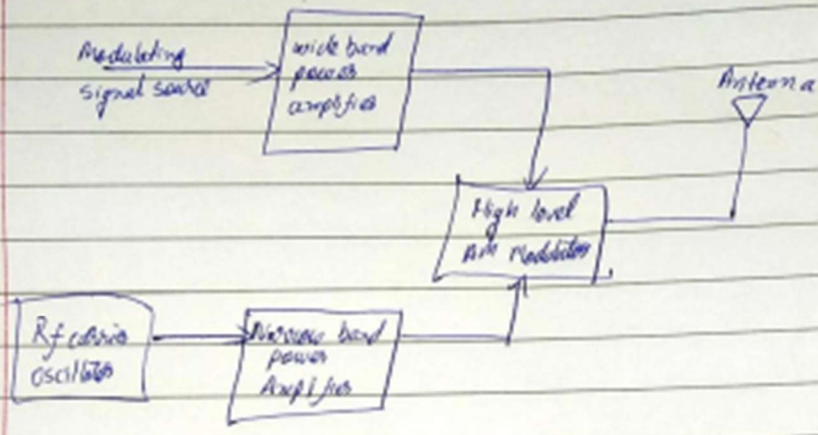
→ But when we get amplitude modulated wave at the output of the low level AM modulator, then it is amplified by the wide band power amplifier.

→ The wideband power amplifier amplifies the power level of the amplitude modulated wave.

→ The wide band is used to preserve the sideband of the amplitude modulated wave and then it is transmitted with the help of an antenna.

High level modulation

Block diagram



→ As this is high level amplitude modulator, therefore it uses a high level AM modulator which operates at high level. Before applying the message signal and the carrier wave to the high level AM modulator, both of these signals are amplified.

→ The modulating signal is power amplified by the wide band power amplifier to preserve the side bands of the modulating signal but the Rf carrier modified by the narrow band power amplifier as the carrier wave has fixed frequency. Therefore narrow band power amplifier is sufficient for its amplification. Now after amplification of both the signals, they are applied to the high level AM modulator. Then this amplitude, modulated signal is transmitted by the antenna.

Q2 what are the disadvantages of AM?

→ Disadvantages of Amplitude modulation

(a) When it comes to power usage AM is not efficient.

(b) Amplitude modulation requires a very high bandwidth that is equivalent to that of the highest audio frequency.

(c) Noise interference is highly noticeable in amplitude modulation.

Circuit Diagram: