


COMSATS Fall 2014 (Rev. 3.0)




Electronics II

Lecture 29
Power Amplifiers III

Muhammad Tilal
Department of Electrical Engineering
CIIT Attock Campus


The theme of this presentation is an inspiration from the one used in S2 Department of Chalmers University of Technology, Gothenburg, Sweden. The COMSATS logo and "COMSATS" is the property of CIIT, Pakistan and subject to the copyrights and ownership of COMSATS. Duplication & distribution of this work for Non Academic or Commercial use without prior permission is prohibited.


COMSATS Electronics II 

Previous Lecture

- Power Amplifiers
 - Class A Power Amplifiers, Power Considerations.
 - Class B Power Amplifiers, Power Considerations.
 - Class AB Power Amplifiers.

1/13/2015 © Muhammad Tilal 2

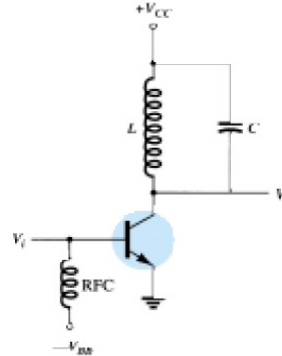
COMSATS		Electronics II	
			
<h1>Session Overview</h1>			
Topic	Power Amplifiers		
Concepts	Class C & D Amplifier, Harmonic Distortion and Total Harmonic Distortion.		
Recommended Reading	Sections 15.5(Partial), 15.6 & 15.8 of [1].		
Keywords	Power Amplifier, Class C, Class D, Push-Pull, Push Pull, Harmonic Distortion, Total Harmonic Distortion.		
1/13/2015		© Muhammad Tilal	
			3

COMSATS		Electronics II	
			
<h1>Amplifier Distortion</h1>			
<ul style="list-style-type: none"> • A pure sinusoidal signal has only one frequency with equal voltage amplitudes in both positive and negative half cycles. • Any sinusoidal signal that varies over less than 360 degrees of cycle is said to have distortion. • Ideally an amplifier must have a single frequency sinusoidal output. But in presence of distortion, the output will not be an exact amplified copy of the input signal. 	<ul style="list-style-type: none"> • Distortion occurs due to device non-linearity and is equally probable in all classes of amplifiers. • A distorted output waveform consists of a fundamental frequency and integer multiples of its fundamental frequency. • These multiples of fundamental frequency are known as harmonics. The frequency that is twice the fundamental frequency is known as 2nd harmonics and so on. 		
<p>Work out Harmonic Distortion (given in Assignment) and Total Harmonic Distortion along with numerical</p>			
1/13/2015		© Muhammad Tilal	
			4



Class C Amplifier

- Class C amplifier provides the output for less than 180 degree of input cycle.
- This class of amplifier can provide the output for complete 360 degrees of input cycle with the help of tuned circuit.
- The above mentioned output is possible only at one specific frequency of tuned circuit and this frequency is termed as the 'resonant frequency'.
- Because of this limitation, Class C amplifiers are used in communication circuits and not in the power amplification circuits.

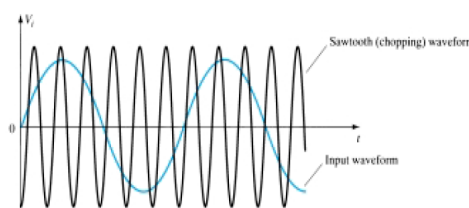


Robert L. Boylestad, *Electronic Devices and Circuit Theory*, 8th Edition, Pearson Education Inc, ISBN: 81-7808-590-9.



Class D Amplifier

- Class D amplifiers are designed to operate with the pulse type signal and their efficiency usually exceed 90%.
- High power efficiency make it the most efficient and most desired among the power amplifiers.
- The signal to be amplified, is converted into the pulse waveform before amplification and the original signal is recovered from the amplified signal pulse waveform.



Robert L. Boylestad, *Electronic Devices and Circuit Theory*, 8th Edition, Pearson Education Inc, ISBN: 81-7808-590-9.

COMSATS Electronics II

Class D Amplifier

- A input signal and a saw tooth or chopping waveform is applied at the inputs of the comparator.
- The signal is converted back to the sinusoidal signal using a low pass filter.

Robert L. Boylestad, *Electronic Devices and Circuit Theory*, 8th Edition, Pearson Education Inc, ISBN: 81-7808-590-9.

1/13/2015 © Muhammad Tital 7

COMSATS Electronics II

Class D Amplifier

Power Amplifier Classes

Class	A	B	C	AB
Conduction Angle	360°	180°	Less than 90°	180 to 360°
Position of the Q-point	Centre Point of the Load Line	Exactly on the X-axis	Below the X-axis	In between the X-axis and the Centre Load Line
Overall Efficiency	Poor, 25 to 30%	Better, 70 to 80%	Higher than 80%	Better than A but less than B 50 to 70%
Signal Distortion	None if Correctly Biased	At the X-axis Crossover Point	Large Amounts	Small Amounts

http://www.electronics-tutorials.ws/amplifier/amp_1.html

1/13/2015 © Muhammad Tital 8

COMSATS	Electronics II	
<h2 data-bbox="678 321 943 369">References</h2> <p data-bbox="365 422 1209 485">[1] Robert L. Boylestad, <i>Electronic Devices and Circuit Theory</i>, 8th Edition, Pearson Education Inc, ISBN: 81-7808-590-9.</p> <p data-bbox="365 531 1209 594">[2] Thomas L. Floyd, <i>Electronic Devices (Conventional Current Version)</i>, 7th Edition, Pearson Education Inc, ISBN: 9780131140806.</p> <p data-bbox="365 640 1209 741">[3] Electronics-Tutorials[Online] <i>Electronic-Tutorials</i> [Cited: December 16, 2013]. <a data-bbox="402 709 1040 741" href="http://www.electronics-tutorials.ws/amplifier/amp_1.html">http://www.electronics-tutorials.ws/amplifier/amp_1.html</p>		
1/13/2015	© Muhammad Tilal	9