



MUTHAYAMMAL ENGINEERING COLLEGE

(An Autonomous Institution)

(Approved by AICTE, New Delhi, Accredited by NAAC & Affiliated to Anna University)

Rasipuram - 637 408, Namakkal Dist., Tamil Nadu



MUST KNOW CONCEPTS

MKC

ECE

2021-22

Course Code & Course Name : 19BMC07 & Analog Electronics

Year/Sem/Sec : II/ III

S.No	Term	Notation (Symbol)	Concept/Definition/Meaning/Units/Equation /Expression	Units
UNIT I BJT AMPLIFIERS				
1.	Amplifier	-	An amplifier is an electronic device that increases the voltage, current, or power of a signal	-
2.	Type of Amplifier	-	Common Emitter, Common Base and Common collector amplifiers	-
3.	small-signal model	-	A small-signal model is an AC equivalent circuit in which is nonlinear circuit elements are replaced by linear elements	-
4.	Common Emitter	-	The most common amplifier configuration for an NPN transistor is that of the Common Emitter Amplifier circuit	-
5.	Common Base	-	Common Base Amplifier the input is applied to the emitter terminal while the output is taken from the collector terminal of the BJT transistor	-
6.	Common Collector	-	Common Collector Amplifiers produce an output voltage across its emitter load which is in-phase with the input signal	-
7.	Voltage gain	-	Voltage gain is nothing but the ratio of output voltage and input voltage.	-
8.	input impedance	-	It is also defined as the ratio of voltage across the input terminals to the current flowing through the input terminals.	-
9.	output impedance	-	Measure of the opposition to current flow to the electrical source.	-
10.	Amplification factor	μ	Amplification factor (μ). It is the ratio of change in drain source voltage (V_{DS}) to the change in gate source voltage (V_{GS}) at constant drain current.	-
11.	Differential	-	Type of electronic amplifier that amplifies the difference between two input voltages but	-

	Amplifier		suppresses any voltage common to the two inputs.	
12.	CMRR	-	Ratio of the common-mode gain to differential-mode gain.	-
13.	Darlington Amplifier	-	Circuit consisting of two bipolar transistors with the emitter of one transistor connected to the base of the other	-
14.	Methods to improve input impedance	-	(i) Bootstrap Technique (ii) Darlington Connection	-
15.	Multistage Amplifier	-	Electronic amplifier consisting of two or more single-stage amplifiers connected together.	-
16.	Cascading	-	Process of joining two amplifier stages using a coupling device	-
17.	Types of Coupling	-	Resistance-Capacitance Coupling, Impedance Coupling, Transformer Coupling, Direct Coupling	-
18.	Cascade Amplifier	-	Amplifier using one or more single stage common emitter amplifier	-
19.	Cascode Amplifier	-	Amplifier with CE (common-emitter) as the primary stage as well as CB (common base) as the second stage	-
20.	Large signal Amplifier	-	Also known as power amplifiers are capable of providing large amount of power to the load. They are used as last stage in electronic systems.	-
21.	Class A Amplifier	-	A power amplifier is called Class A amplifier if the transistor used in the circuit conducts for full cycle of the input signal.	-
22.	Class B Amplifier	-	The output power is obtained for one half cycle of input only	-
23.	Class C Amplifier	-	Transistor conducts for less than one half cycle period of the input i.e around 80° to 120° angle.	-
24.	Class C Amplifier Applications	-	Tuned amplifiers, RF amplifiers, oscillators, Booster amplifiers, and High Frequency repeaters.	-
25.	Crossover Distortion	-	Type of distortion which is caused by switching between devices driving a load.	-

UNIT II JFET AND MOSFET AMPLIFIERS				
26.	FET	-	The field-effect transistor is an electronic device which uses an electric field to control the flow of current.	-
27.	Types of FET	-	JFET, MOSFET	-
28.	Features of JFET	-	High input impedance, Low noise, Simple to fabricate	-
29.	Amplification factor	μ	Amplification factor (μ). It is the ratio of change in drain source voltage (V_{DS}) to the change in gate source voltage (V_{GS}) at constant drain current.	-
30.	Transconductance	-	For an FET, transconductance is the ratio of the change in drain current to the change in gate voltage.	-
31.	Types of MOSFET	-	Depletion mode, Enhancement mode MOSFET.	-
32.	I_{DSS} in FET	-	I_{DSS} (referred to as the drain current for zero bias) is the maximum current that flows through a FET transistor, when $V_G=0$.	-
33.	Pinch off voltage	-	Pinch off voltage is the drain to source voltage after which the drain to source current becomes almost constant and JFET enters into saturation region.	-
34.	Drain resistance	r_d	Drain resistance, r_d . It is defined as the ratio of change in drain to source voltage to the change in drain current at a constant gate to source voltage.	-
35.	Application of JFET	-	Electronic switch, phase shift oscillator, RF amplifier in FM tuner, buffer in measuring instruments.	-
36.	Relation between FET parameters	-	Amplification factor = Drain resistance \times Transconductance	-
37.	Application of MOSFET	-	Electronic voltmeters, Logic circuits, Computer memories and phase shift oscillator	-
38.	Normally on MOSFET	-	The depletion mode MOSFET can conduct even if the gate source voltage is zero.	-

39.	Common Gate amplifier	-	a common-gate amplifier is one of three basic single-stage field-effect transistor amplifier topologies, typically used as a current buffer or voltage amplifier.	-
40.	BiCMOS	-	Semiconductor Technology that integrates two separate semiconductor technologies i.e. the bipolar junction transistor and the CMOS (complementary metal-oxide-semiconductor) gate, in a single integrated circuit device.	-
41.	Advantages of BiCMOS	-	High input impedance, Improved speed, lower power dissipation, high performance	-
42.	Operating regions of a JFET	-	1. Ohmic region 2. Pinch-off region 3. Breakdown region	-
43.	FET preferred as a Buffer Amplifier	-	FET is used as a buffer in measuring instruments, receivers since it has high input impedance and low output impedance.	-
44.	Operating modes of MOSFET	-	1. Enhancement mode. 2. Depletion mode	-
45.	Gate Source threshold voltage of a FET	-	The voltage at which the channel is completely cut off and the drain current becomes zero is called as gate source threshold voltage	-
46.	FET is an Unipolar device	-	The operation of FET depends upon the flow of majority carriers only (either holes or electrons) so the FET is said to be an unipolar device.	-
47.	Applications of FET	-	Used as a buffer in measuring instruments, used in RF amplifiers	-
48.	Cascode connection	-	The cascode is a two-stage amplifier composed of a common source amplifier followed by common gate amplifier	-
49.	Input impedance in FET is very high in comparison with BJT	-	JFET have very high input impedance because of the reverse biased Gate-Source pn-junction	-
50.	Darlington connection benefits	-	(i) High Input Impedance (ii) High current gain (iii) Less space to integrate in ICs	-
UNIT III RECTIFIERS AND POWER SUPPLIES				
51.	Rectifier	-	Any electrical device which offers a low resistance to the current in one direction but a high resistance to the current in the opposite	-
52.	Function of Rectifier	-	Rectifier is capable of converting a sinusoidal input waveform. Its average value is zero, into a unidirectional waveform, with a non-zero average component.	-

53.	Half – wave Rectifier	-	The rectifier circuit which converts only the positive half cycle of the AC input voltage into useful DC output voltage	-
54.	Ripple Factor	-	A measure of the purity of the DC output of a rectifier circuit	-
55.	Peak Inverse Voltage	-	The maximum reverse voltage capability of a diode	-
56.	Full-Wave Rectifier	-	A rectifier circuit, which converts both positive and negative half cycle of the input AC voltage into useful DC voltage	-
57.	Full wave Rectifier - Ripple Factor , Efficiency	-	Ripple factor: 0.482 , Efficiency: 81.2%	-
58.	Drawbacks of a Full Wave Rectifier	-	i. centre tapped transformer is required. ii. Diodes having twice the PIV rating are necessary in this rectifier.	-
59.	Filter Circuit	-	Filter circuits are used to reduce the rectifier output ripple. Either bypassing the AC output components around the load by a shunt capacitance or limiting this magnitude to a low value in the load by a series inductance or a combination of these two for more efficient circuits achieves this	-
60.	Different Types Of Filters	-	i. Capacitor filter ii. inductor filter iii. LC filters iv. CLC filter	-
61.	Advantages & Disadvantages of Capacitor Filter	-	The advantages of capacitor filters are, At high loads, i. Small ripple voltage, ii. High output voltage. The disadvantages are, i. Poor regulation. ii. High peak diode current.	-
62.	Subsystems in a Power Supply	-	i. Rectifier. ii. Filter iii. Voltage regulator.	-
63.	Voltage Regulator	-	Device which keeps the output voltage constant irrespective of the variation in load current, line voltage and temperature	-
64.	Load Regulation	-	The ability of the power supply to maintain the constant DC output voltage for a wide variation in load current	-
65.	Line Regulation	-	The ability of the power supply to maintain the constant output voltage for the input supply	-

			fluctuations for a constant load	
66.	Linear Power Supply(LPS)	-	it has the voltage control element (transistor or zener diode), which dissipates the power equal to the voltage difference between an unregulated input voltage and a fixed output - voltage multiplied by the current flowing through it	-
67.	SMPS	-	The SMPS does not use a transformer at the input, but operates directly from mains at a supply frequency of 50Hz. The AC main is directly rectified and filtered and the DC voltage so obtained is then used as an input to a switching type DC-to-DC converter.	-
68.	Bleeder Resistor	-	Bleeder resistor is a fixed resistor connected across the filter output terminals to provide a minimum load across the rectifier. The main job of this resistor is to maintain the minimum current required for optimum inductor operation.	-
69.	Advantages of Zener Regulator	-	i.It is small and light weight. ii. It provides voltage regulation over a wide range of current.	-
70.	Need of Filter in Power Supply	-	Filter can be used to remove unwanted AC ripple component present in the pulsating DC.	-
71.	Characteristic of the Zener Diode for Voltage Regulation	-	The reverse bias characteristic of zener diode is useful in voltage regulation. Since in the reverse biased condition, at the breakdown voltage, its reverse voltage remains constant for a large variation of the reverse current.	-
72.	Advantages of SMPS	-	Efficiency is high because of less heat dissipation. ii. As the transformer size is very small. It will have a compact unit. iii. Isolation from main supply without the need of large main transformer. iv. Very low ripple	-
73.	Rectifier Efficiency	-	Defined as,DC power delivered to the load to AC input power from transformer secondary	-
74.	Advantages of Bridge Rectifier	-	i. The transformer utilization factor is high (0.812) ii. It is suitable for large amount of DC power circuits. iii. The peak inverse voltage across each diode is the peak V_m	-

75.	Disadvantages of Half Wave Rectifier	-	i. Excess ripple ($r=1.21$) ii. Low rectification efficiency (40.6%) iii. Low transformer utilization factor. iv. DC saturation of transformer secondary winding.	-
UNIT IV FEEDBACK AMPLIFIERS				
76.	Feedback Amplifier	-	Feedback Amplifier is a device that is based on the principle of feedback. The process by which some part or fraction of output is combined with the input is known as feedback.	-
77.	Different types of feedbacks used in amplifier circuits	-	1. Positive feedback 2. Negative feedback	-
78.	Advantages of negative feedback	-	<ul style="list-style-type: none"> • Stability of gain is improved • Reduction in distortion • Reduction in noise • Increase in input impedance • Decrease in output impedance 	-
79.	Positive feedback	-	The feedback signal is in phase with input signal, then the net effect of the feedback will increase the input signal given to the amplifier. This type of feedback is said to be positive or regenerative feedback.	-
80.	Negative feedback	-	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.	-
81.	Properties of negative feedback	-	i. Negative feedback reduces the gain ii. Distortion is very much reduced	-
82.	Node sampling	-	When the output voltage is sampled by connecting the feedback network in shunt across the output, the connection is referred to as voltage or node sampling.	-
83.	Loop sampling	-	When the output current is sampled by connecting the feedback network in series with the output, the connection is referred to as current or loop sampling.	-
84.	Sensitivity	-	The ratio of percentage change in voltage gain with feedback to the percentage change in voltage gain without feedback.	-
85.	Loop gain or Return ratio	-	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 $-A\beta$.	
86.	Feedback factor or Feedback ratio.	-	The ratio of the feedback voltage to output voltage	-
87.	Four basic feedback topologies	-	1. Voltage amplifier with voltage series feedback. 2. Transconductance amplifier with current-series feedback. 3. Current amplifier with current-shunt feedback 4. Transresistance amplifier with voltage shunt feedback	-
88.	Gain of an amplifier with feedback	-	$A_{vf} = AV / 1 + AV\beta$	-
89.	Example for voltage-series feedback	-	The Common collector or Emitter follower amplifier.	-
90.	Desensitivity	-	The reciprocal of the sensitivity is called the desensitivity D. it is given as $D = 1 + A\beta$	-
91.	Effect of Negative Feedback on Noise	-	The noise is reduced with the negative feedback	-
92.	Classification of Amplifiers	-	Voltage, Current, Transconductance and Transresistance amplifiers	-
93.	Nyquist Diagram	-	The plot which shows the relationship between gain and phase-shift as a function of frequency	-
94.	Types of Distortions in an Amplifier	-	1.Frequency 2. Noise and non linear	-
95.	Purpose of Mixer Network in Feedback Amplifier	-	The mixer network is used to combine feedback signal and input at input of an amplifier	-
96.	Negative feedback on Bandwidth	-	Bandwidth of amplifier with feedback is greater than bandwidth of amplifier without feedback.	-
97.	Series feedback amplifier	-	In series feedback amplifier the feedback signal is connected in series with the input signal. It increases the input resistance.	-
98.	Shunt feedback amplifier	-	In shunt feedback amplifier the feedback signal is connected in shunt with the input signal. It decreases the input resistance.	-
99.	Three Networks Connected to	-	Mixing Network, Sampling Network, Feedback Network	-

	implement the Feedback Concept			
100.	Effect of Negative Feedback on Non linear Distortion	-	The linear distortion is reduced with the negative feedback.	-
Unit V OSCILLATORS				
101.	Oscillator	-	A circuit with an active device is used to produce an alternating current is called an oscillator circuit.	-
102.	Damped and Undamped Oscillation	-	Damped Oscillation: The electrical Oscillations in which the amplitude decreases with time Undamped Oscillation: The electrical oscillations in which amplitude does not change with time are called as sustained oscillations. It is also called as undamped Oscillation.	-
103.	Barkhausen criterion for an oscillator	-	1. 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 0 or 360 . 2. The magnitude of the product of the open loop gain of the amplifier (A) and the feedback factor β is unity. i.e., $A\beta = 1$.	-
104.	Types of feedback oscillators	-	RC-Phase shift Oscillator, LC-Oscillators	-
105.	Stability of an Oscillator.	-	The frequency stability of an Oscillation is a measure of its ability to maintain the required frequency as precisely constant as possible over a long period of time interval.	-
106.	Advantages of RC phase shift oscillator	-	Simplicity of the circuit. Useful for frequencies in the audio range. A sine wave output can be obtained.	-
107.	Applications of oscillators	-	a) As a local oscillator in radio receivers. b) In T.V receivers. c) In signal generators. d) As clock generation for logic circuits. e) AM and FM transmitters. f) In phase lock loops.	-
108.	Gain requirement in the Wein bridge oscillator	-	The gain requirement for wein bridge oscillator is minimum 3.	-

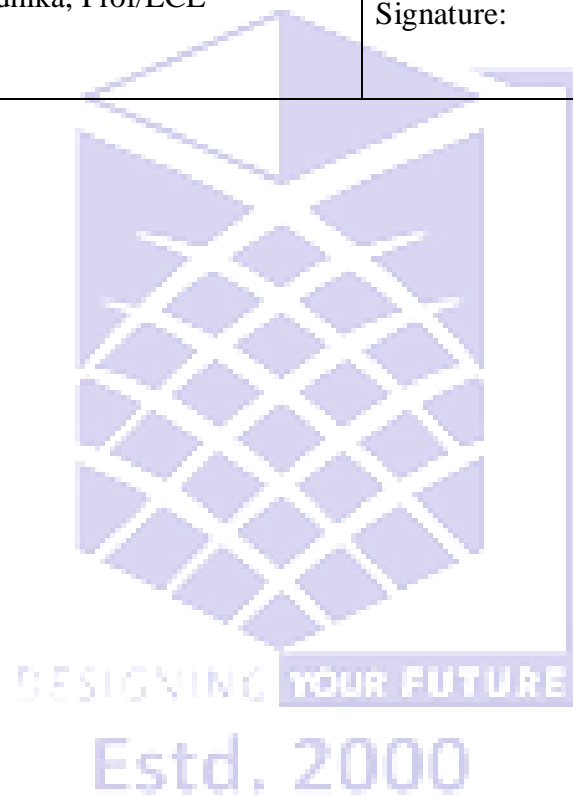
109.	Frequency Sensitive Arms	-	The arms which decide the frequency of oscillations i.e., R1-C1 and R2-C2 are the frequency sensitive arms	-
110.	Electrical equivalent circuit of crystal	-	The crystal actually behaves as a series RLC circuit in parallel with CM. . Because of presence of CM , the crystal has two resonant frequencies.	-
111.	Piezoelectric effect	-	a mechanical stress is applied across one face the electric potential is developed across opposite face and vice versa	-
112.	Principle of a Crystal Oscillator	-	Works based on Piezoelectric effect	-
113.	Conditions for Oscillation	-	The total phase shift of an oscillator should be 360°. For feedback oscillator it should satisfy Barkhausen criterion.	-
114.	Miller crystal oscillator	-	It is nothing but a Hartley oscillator its feedback Network is replaced by a crystal.	-
115.	Frequency for RC phase shift oscillator	-	$F = \frac{1}{2\pi RC} \sqrt{4k+6}$, Where $k=2.639$.	-
116.	Applications of Hartley oscillator	-	a) it is used as local oscillator in radio and TV receivers. b) In the function generator. c) In RF sources	-
117.	Advantages of Colpitt's oscillator	-	a) Simple construction. b) It is possible to obtain oscillations at very high frequencies	-
118.	Advantages of Crystal oscillator	-	a) Very high frequency stability. b) Very low frequency drift due to change in temperature and other parameters. c) It is possible to obtain very high, precise and stable frequency of oscillations. d) The Q is very high.	-
119.	Open loop gain	-	The gain of the amplifier is ratio of output to input when no feedback is used is called open loop gain	-
120.	Closed loop gain	-	The ratio of the output to input, considering the overall effect of the feedback is called closed loop gain.	-
121.	Q factor	-	It is the ratio of reactance to resistance.	-
122.	Hartley oscillator from the basic	-	Using X1 and X2 as inductors and X3 as capacitor, Hartley oscillator from basic form of	-

	form of LC oscillator		LC oscillator is obtained.	
123.	Colpitt's oscillator form basic form of LC oscillator	-	Using X1 and X2 as capacitors and X3 as inductors, colpitt's oscillator from basic form of LC oscillator is obtained.	-
124.	Examples of Crystal oscillator	-	Miller crystal oscillator, pierce crystal oscillator	-
125.	Where starting voltage for the oscillator is derived?	-	Every resistance has some free electrons. Under the influence of room temperature, these free electrons move randomly in various directions. In such a movement of the free electrons generate a voltage called noise voltage, across the resistance. Such noise voltage provides the starting voltage for the oscillator.	-
<u>PLACEMENT ORIENTED QUESTIONS</u>				
126	Electronics	-	Study and use of electrical devices that operate by controlling the flow of electrons or other electrically charged particles.	-
127	Communication	-	Transferring of message from one place to another place	-
128	Types of communications	-	Analog and digital communication.	-
129	Diode	-	Two-terminal device, unidirectional current property	-
130	Transistor	-	Semiconductor device commonly used to amplify or switch electronic signals	-
131	Resistor	-	Two-terminal electronic component that opposes an electric current by producing a voltage drop between its terminals in proportion to the current	-
132	Inductor	-	Inductor is a passive electrical device employed in electrical circuits for its property of inductance.	-
133	Conductor	-	A substance, body, or device that readily conducts heat, electricity, sound, etc. Copper is a good conductor of electricity.	-
134	Semi conductor	-	A semiconductor is a solid material that has electrical conductivity in between that of a conductor and that of an insulator	-
135	Negative feedback and positive feedback	-	-ve feedback is ---Amplifiers And for +ve feedback is Oscillators	-

136	Feedback	-	Process whereby some proportion of the output signal of a system is passed (fed back) to the input.	-
137	Bias	-	The application of electric voltage to a P-N junction is known as Bias.	-
138	Clock	-	A clock is started at noon. By 10 minutes past 5, the hour hand has turned through: Ans : 155°	-
139	Time and Work	-	A can lay railway track between two given stations in 16 days and B can do the same job in 12 days. With help of C, they did the job in 4 days only. Then, C alone can do the job in: Ans : 9 3/5 Days	-
140	Problems on Ages	-	A is two years older than B who is twice as old as C. If the total of the ages of A, B and C be 27, then how old is B Ans : 10	-
141	Problems on Ages	-	The sum of ages of 5 children born at the intervals of 3 years each is 50 years. What is the age of the youngest child? Ans : 4 years	-
142	Profit and Loss	-	In a certain store, the profit is 320% of the cost. If the cost increases by 25% but the selling price remains constant, approximately what percentage of the selling price is the profit? Ans : 70%	-
143	Speed and Distance	-	A boy runs 200 metres in 24 seconds. What is his speed ? Ans : 20 km/hr	-
144	Percentages	-	What percent is 2 minutes 24 seconds of an hour Ans : 4%	-
145	Numbers	-	$(112 \times 5^4) = ?$ Ans : 70000	-
146	Profit and Loss	-	A vendor bought toffees at 6 for a rupee. How many for a rupee must he sell to gain 20% Ans : 5	-
147	Simplification	-	In a regular week, there are 5 working days and for each day, the working hours are 8. A man gets Rs. 2.40 per hour for regular work and Rs. 3.20 per hours for overtime. If he earns Rs. 432 in 4 weeks, then how many hours does he work for ? Ans : 175	-
148	Simplification	-	A man has some hens and cows. If the number of heads be 48 and the number of feet equals	-

			140, then the number of hens will be: Ans : 26	
149	Problems on Trains	-	A train 125 m long passes a man, running at 5 km/hr in the same direction in which the train is going, in 10 seconds. The speed of the train is: Ans : 50 km/hr	-
150	Simple Interest	-	A sum fetched a total simple interest of Rs. 4016.25 at the rate of 9 p.c.p.a. in 5 years. What is the sum? Ans : 8925	-

Faculty Team Prepared	Dr.K. Radhika, Prof/ECE	Signature:
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