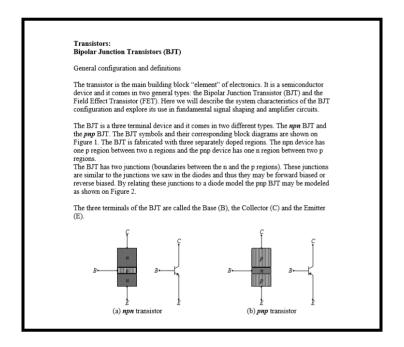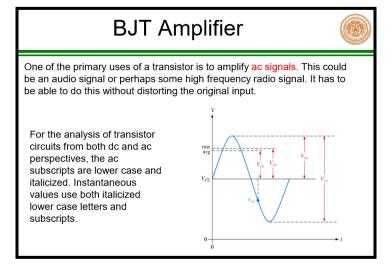# Interactive Lectures Based on Collaborative Learning:

- ## **Prior Sharing of the topics and reading material**

1. The reading and learning material is shared with students prior to the lecture so that students are aware about the topic to be covered.

2. Example: Bipolar junction Transistor to be covered in Lecture. All the notes, books and video lectures are shared prior.

Transistors:
Bipolar Junction Transistors (BJT)

General configuration and definitions

The transistor is the main building block "element" of electronics. It is a semiconductor device and it comes in two general types: the Bipolar Junction Transistor (BJT) and the Field Effect Transistor (FET). Here we will describe the system characteristics of the BJT configuration and explore its use in fundamental signal shaping and amplifier circuits.

The BJT is a three terminal device and it comes in two different types. The *npn* BJT and the *pnp* BJT. The BJT symbols and their corresponding block diagrams are shown on Figure 1. The BJT is fabricated with three separately doped regions. The npn device has one p region between two n regions and the pnp device has one n region between two p regions.
The BJT has two junctions (boundaries between the n and the p regions). These junctions are similar to the junctions we saw in the diodes and thus they may be forward biased or reverse biased. By relating these junctions to a diode model the pnp BJT may be modeled as shown on Figure 2.

The three terminals of the BJT are called the Base (B), the Collector (C) and the Emitter (E).

(a) *npn* transistor   (b) *pnp* transistor

BJT Amplifier

One of the primary uses of a transistor is to amplify ac signals. This could be an audio signal or perhaps some high frequency radio signal. It has to be able to do this without distorting the original input.

For the analysis of transistor circuits from both dc and ac perspectives, the ac subscripts are lower case and italicized. Instantaneous values use both italicized lower case letters and subscripts.

- **<u>Discussion during Interactive Class Session (60 min)</u>**

1. Although, there are several methods to conduct interactive Classroom session, for this session the students are divided into groups as per the number of subtopics under BJT.

2. Each group gets one subtopic and they discuss that topic rigorously for 15min.

3. Now students are shuffled in such manner that each group covers the topic.

4. Again, 25 min given to students for discussion of all the sub-topics.

5. Next 20 min is the assessment time having different modes depending upon number of students such as presentation, multiple choice questions and quiz.

Assessment using MCQ at end of the session

ASSESSMENT- Transistors

1. Which of the following condition is true for cut-off mode?
a) The collector current is zero   b) the collector current is proportional to the base current
c) The base current is non-zero   d) All of the mentioned

2. Which of the following is true for the saturation region of BJT transistor?
a) The collector current is inversely proportional to the base current
b) The collector current is proportional to the square root of the collector current
c) The natural logarithm of the collector current is directly proportional to the base current
d) None of the mentioned

3. Which of the following is true for a pnp transistor in active region?
a) CB junction is reversed bias and the EB junction is forward bias   b) CB junction is forward bias and the EB junction is forward bias
c) CB junction is forward bias and the EB junction is reverse bias   d) CB junction is reversed bias and the EB junction is reverse bias

4. Which of the following is true for a pnp transistor in saturation region?
a) CB junction is reversed bias and the EB junction is forward bias   b) CB junction is forward bias and the EB junction is forward bias
c) CB junction is forward bias and the EB junction is reverse bias   d) CB junction is reversed bias and the EB junction is reverse bias

5. The AC current gain in a common base configuration is_____
a) $-\Delta IC/\Delta IE$ b) $\Delta IC/\Delta IE$ c) $\Delta IE/\Delta IC$ d) $-\Delta IE/\Delta IC$

6. The value of αac for all practical purposes, for commercial transistors range from_____
a) 0.5-0.6   b) 0.7-0.77   c) 0.8-0.88   d) 0.9-0.99

7. A transistor has an IC of 100mA and IB of 0.5mA. What is the value of αdc?
a) 0.787   b) 0.995   c) 0.543   d) 0.659

8. The emitter current IE in a transistor is 3mA. If the leakage current ICBO is 5µA and α=0.98, calculate the collector and base current

Learning Outcomes

1. Time Management

2. Self-study

3. Team work

4. Leadership

5. Presentation skill Enhancement

6. Ownership

7. Group Interaction skill

Improvement in Results

S No.	Roll No.	Name	T1 (30)	T1 %age	T2 (30)	T2 %age	Improvement	Improvement %
1	2K18CSUN01117	Neha Rai	19.5	65	21	70	1.5	5
2	2K18CSUN01118	Nikhil Sharma	6.5	22	7	23	0.5	2
3	2K18CSUN01119	Nishant Sharma	18.5	62	20	67	1.5	5
4	2K18CSUN01120	Nitin Sokhal	10.5	35	12	40	1.5	5
5	2K18CSUN01121	Parikshit Sharma	14	47	16	53	2	7
6	2K18CSUN01122	Piyush Sachdeva	19	63	22	73	3	10
7	2K18CSUN01123	Prince Kaliraman	12	40	14	47	2	7
8	2K18CSUN01124	PULKIT CHOPRA	14.5	48	18	60	3.5	12
9	2K18CSUN01125	RAHUL GARG	11	37	14	47	3	10
10	2K18CSUN01126	Rajat Chauhan	17	57	22	73	5	17
11	2K18CSUN01127	Ravi Prakash	14	47	19	63	5	17
12	2K18CSUN01128	Rishabh Singla	8	27	12	40	4	13
13	2K18CSUN01129	Rohan Duggal	10	33	16	53	6	20
14	2K18CSUN01130	ROHAN KATARIA	15.5	52	25	83	9.5	32
15	2K18CSUN01131	sachin dhull	10.5	35	17	57	6.5	22
16	2K18CSUN01132	Sannskar Gupta	8	27	13	43	5	17
17	2K18CSUN01133	Shiv Kumar	17	57	30	100	13	43
18	2K18CSUN01134	Shivam Shukla	13	43	26	87	13	43
19	2K18CSUN01135	SHUBHAM KUAMAR JHA	12	40	25	83	13	43
20	2K18CSUN01136	SOURAV KUMAR	4	13	12	40	8	27
21	2K18CSUN01137	Tanvi Aggarwal	0	0	10	33	10	33