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DEPARTMENT OF ELECTRICAL ENGINEERING

PROJECT NAME: Study Of BJT CE Amplifier Circuit

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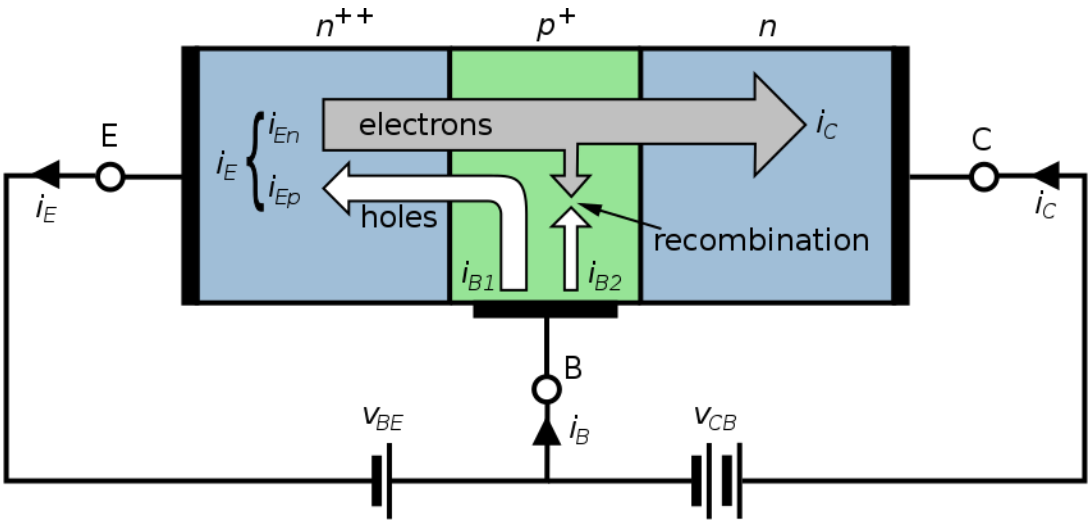
AIM: STUDY OF BJT CE AMPLIFIER CIRCUIT

INTRODUCTION

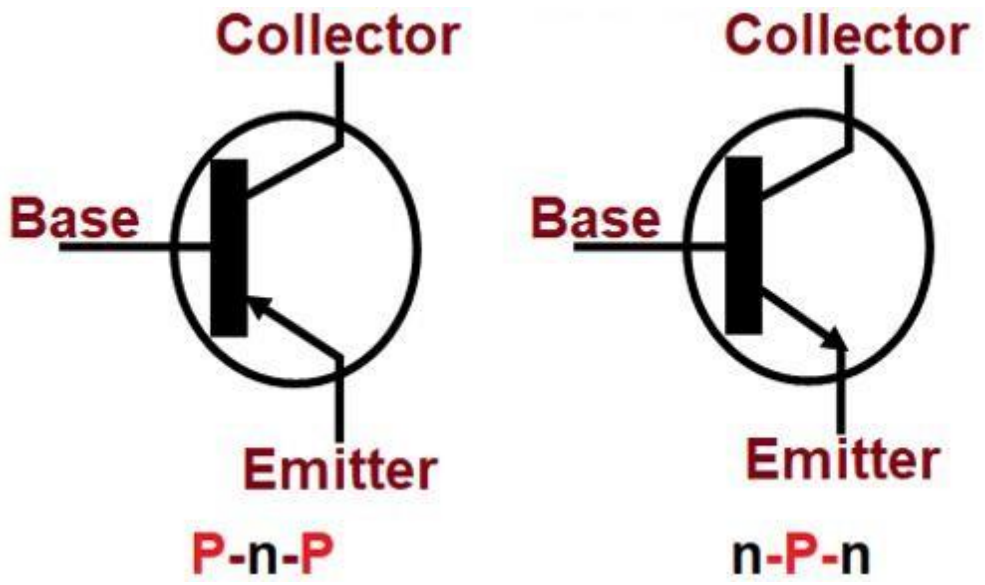
BIPOLAR JUNCTION TRANSISTOR



A BIPOLAR JUNTION TRANSISTOR (BJT) IS A THREE TERMINAL SEMICONDUCTOR DEVICE IN WHICH THE OPERATION DEPENDS ON THE INTERACTION OF BOTH MAJORITY AND MINORITY CARRIERS AND, HENCE THE NAME BIPOLAR. THE BJT IS ANALOGOUS TO A VACUUM TRIODE AND IS COMPARATIVELY SMALLER IN SIZE. IT IS USED IN AMPLIFIER AND OSCILLATOR CIRCUITS, AND AS A SWITCH IN DIGITAL CIRCUITS. IT HAS WIDE APPLICATIONS IN COMPUTERS, SATELLITES AND OTHER MODERN COMMUNICATION SYSTEMS.

CONSTRUCTION

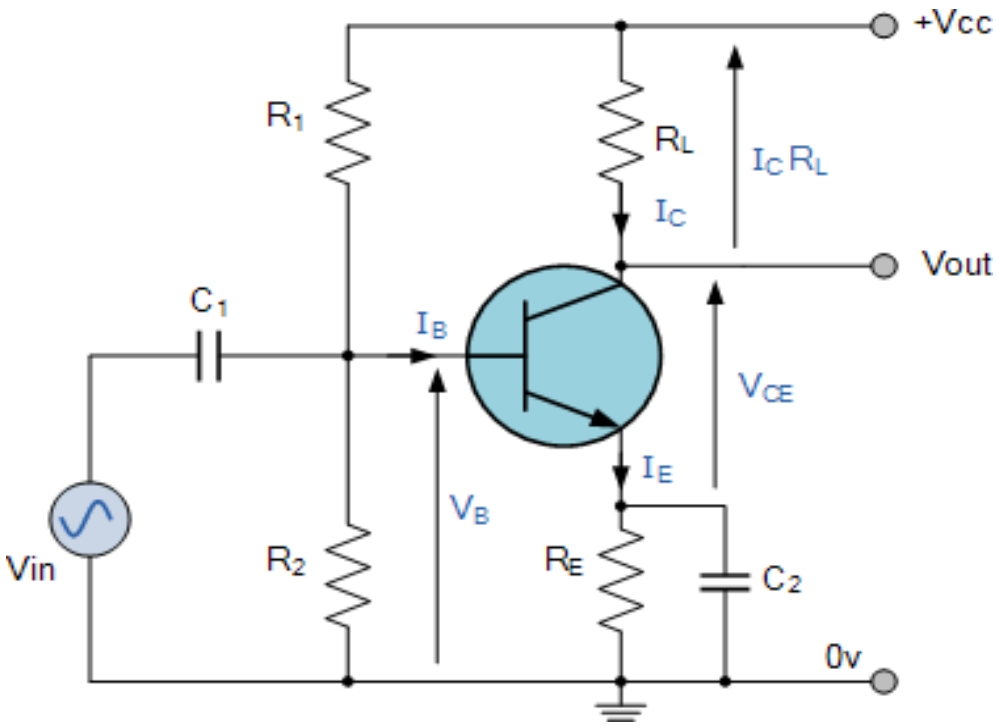
THE BIPOLAR JUNCTION TRANSISTOR (BJT) CONSISTS OF A SILICON (OR GERMANIUM) CRYSTAL IN WHICH A THIN LAYER IF N-TYPE SILICON IS SANDWICHED BETWEEN TWO LAYERS OF P-TYPE SILICON. THIS TRANSISTOR IS REFFERED TO AS PNP. ALTERNATIVELY, IS AN NPN TRANSISTOR, A LAYER OF P-TYPE MATERIAL IS SANDWICHED BETWEEN TWO LAYERS OF N-TYPE MATERIAL. THE SYMBOLIC REPRESENTATION OD BJT.



THE THREE PORTIONS OF THE TRANSISTOR ARE EMITTER, BASE AND COLLECTOR.

TRANSISTOR AS AN AMPLIFIER

CE TRANSISTOR AS AN AMPLIFIER



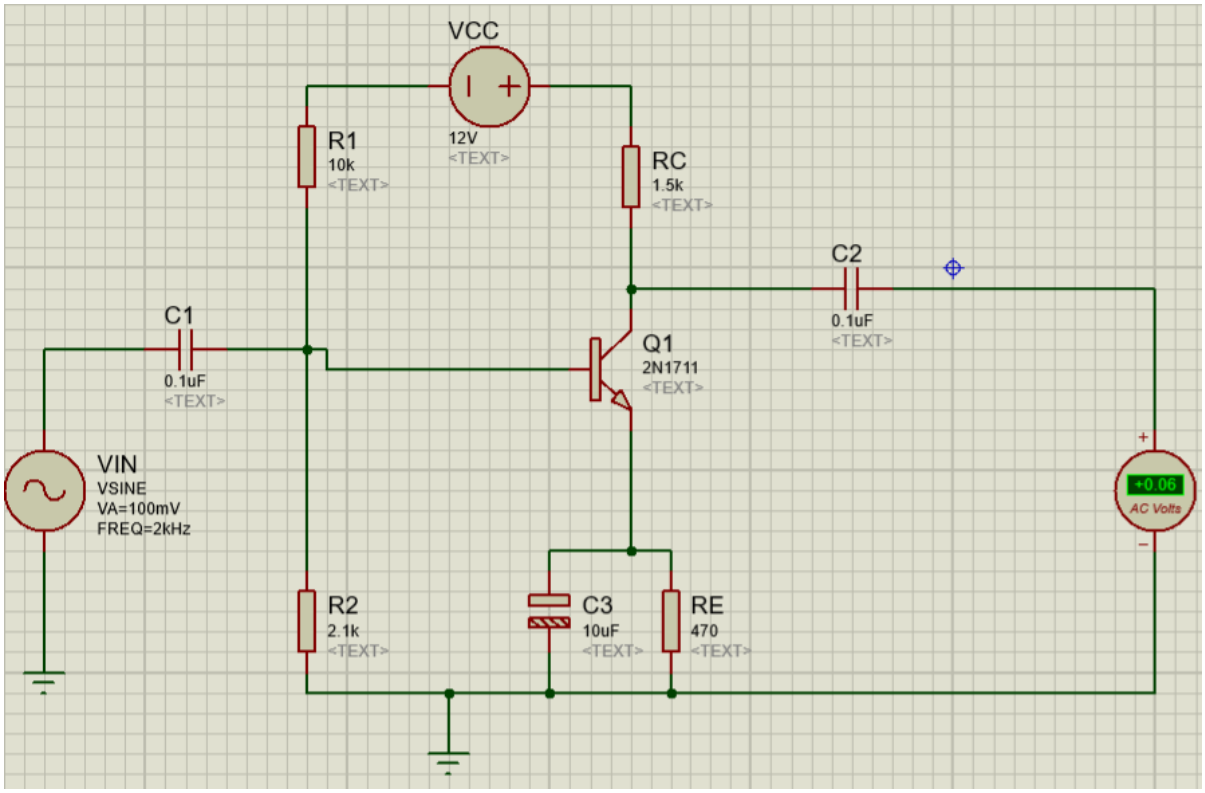
IN THIS CIRCUIT, AN NPN TRANSISTOR IS USED IN CE CONFIGURATION. HERE Vbb SUPPLY WILL FORWARD BIAS THE EMITTER- BASE JUNCTION AND Vcc SUPPLY COLLECTOR-BASE JUNCTION. THIS BIASING ARRANGEMENT MAKES THE TRANSISTOR TO OPERATE INN THE ACTIVE REGION. THE MAGNITUDE OF THE INPUT AC SIGNAL Vi ALWAYS FORWARD BIAS THE EMITTER-BASE JUNCTION REGARDLESS OF THE POLARITY OF THE SIGNAL.

DURING THE POSITIVE HALF CYCLE OF THE IMPUT SIGNAL Vi, THE FORWARD BIAS ACROSS THE EMITTER-BASE JUNCTION IS INCREASED. AS A RESULT, MORE ELECTRONS ARE INJECTED INTO THE BASE AND REACHES THE COLLECTOR, RESULTING IN AN INCREASE IN COLLECTOR CURRENT Ic. THE INCREASE IN COLLECTOR CURRENT PRODUCES A GREATER VOLTAGE DROP ACROSS THE LOAD RESISTANCE Rl.

HOWEVER, DURING THE NEGATIVE HALF CYCLE OF THE IMPUT SIGNAL Vi, THE FORWARD BIAS ACROSS THE EMITTER-BASE JUNCTION IS DECREASED, RESULTING IN A DECREASE IN COLLECTOR CURRENT Ic. THE DECREASE IN COLLECTOR CURRENT PRODUCES A SMALLER VOLTAGE DROP ACROSS THE LOAD RESISTANCE Rl. HENCE, IT IS CLEAR THAT A SMALL CHANGE IN THE INPUT AC SUGNAL IN CE TRANSISTOR AMPLIFIER PRODUCES A LARGE CHANGE AT THE OUTPUT WITH A VOLTAGE GAIN OF AROUND 500 AND A PHASE SHIFT OF 180 DEGREE. HERE, THE VOLTAGE GAIN IS THE RATIO OF OUTPUT VOLTAGE TO INPUT VOLTAGE. COMPARING TO CB AND CC TRANSISTOR CONFIGURATIONS, THIS CE TRANSISTOR CONFIGURATION IS WIDELY USED IN AMPLIFIER CIRCUITS DUE TO ITS HIGH VOLTAGE GAIN.

SOFTWARE USED: PROTEUS

GIVEN CIRCUIT BY PROTEUS APPLICATION



WHERE:

V(in) = INPUT VOLTAGE

V(o) = OUTPUT VOLTAGE

R(c) = CAPACITOR RESISTANCE

R(e) = EMITTER RESISTANCE

C1, C2, C3 ARE THE CAPACITORS

R1, R2 ARE THE RESISTANCES

CONCLUSION

A SINGLE NPN BJT WAS USED TO DRIVE THIS DIFFERENTIAL AMPLIFIER. THE COLLECTOR CURRENT ENTERING THE NPN BJT WILL BE THE CURRENT SOURCE DRIVING THE DIFFERENTIAL AMPLIFIER. THE TRANSISTOR IS GOOD COMPONENT TO GET AMPLIFIED CURRENT USING A VERY SMALL CURRENT. DC CURRENT GAIN INCREASES AS VOLTAGE INCREASES. BUT DC CURRENT GAIN FOR THE SAME VOLTAGE WITH THE DIFFERENT BASE CURRENT IS SAME. EACH PART HAS DIFFERENT BASE CURRENT BUT IF DC CURRENT GAIN IS FOUND FOR SAME VOLTAGE ON DIFFERENT CURVES IT WILL COME OUT TO BE ABOUT THE SAME.