

**NATIONAL BUSINESS AND TECHNICAL EXAMINATIONS BOARD (NABTEB)**

**NATIONAL TECHNICAL CERTIFICATE EXAMINATION**

**ELECTRONICS WORKS (071) ESSAY**

**MARKING SCHEME**

**1(a) Define Semiconductor**

1. A semiconductor is a substance which has resistivity ( $10^{-4}$  to  $0.5\Omega\text{m}$ ) in between conductors and insulators e.g. germanium, silicon, selenium, carbon e.t.c
2. It is a substance which has almost filled valence band and nearly empty conduction band with a very small energy gap (= 1 eV) separating the two.
3. A semiconductor material is one whose electrical properties lie in between those of insulators and good conductors e.g. germanium and silicon
4. A material having volume resistivity less than that of insulators but much greater than that of such good conductors as metals.

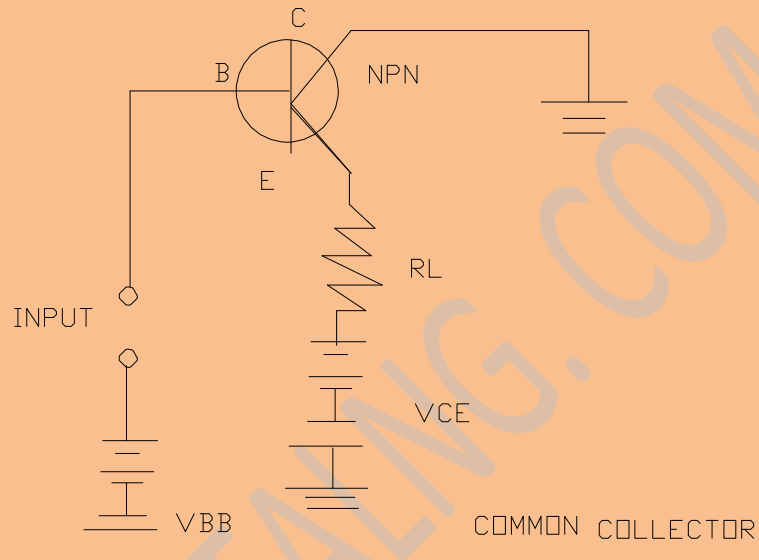
**(b) LIST THREE advantages of semi conductors**

1. Power consumption is low
2. Require less voltage for operation
3. Cheap
4. It generate less heat
5. Long life span
6. Very small size
7. There is little distortion i.e. output wave shape is exactly similar to the input wave shape, though much amplified

(c) Forward biasing is when external voltage applied to the junction is in such a direction that it cancels the potential barrier, thus permitting current flow WHILE Reverse biasing is when the external voltage applied to the junction is in such a direction that potential barrier is increased.

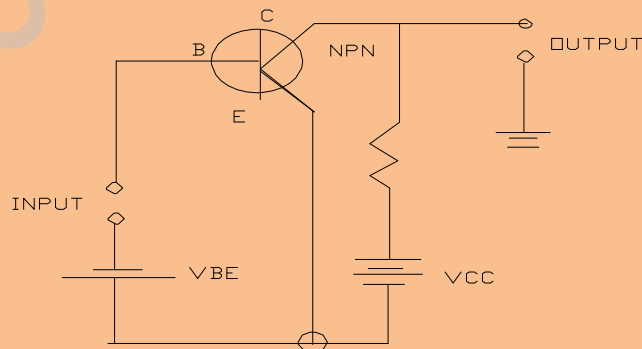
**2(a) LIST THREE methods used in connecting transistor amplifiers**

- Common- emitter circuits
- Common- collector circuits
- Common- base circuits
- Common- emitter circuits



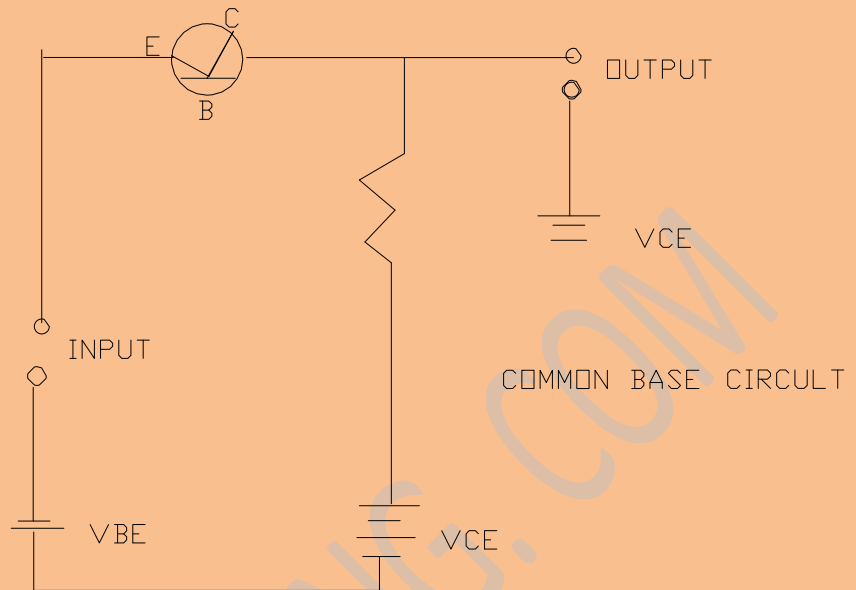
When the emitter of a transistor is connected to a point that is common to the input and output circuits, the configuration is referred to as common- emitter circuit. The common reference point is usually at ground potential. It has the best combination of current gain and voltage gain. The common-emitter configuration is often called a grounded- emitter circuit.

**2. COMMON COLLECTOR CIRCUIT**



When the collector of a transistor is connected to a point that is common to both the input and out put circuit, the configuration is called a common- collector or grounded- collector circuit.

3. COMMON BASE CIRCUIT



When the base of a transistor is connected to a point that common to both the input and output circuit, the configuration is known as a common- base or grounded- base circuit.

3. Explain the importance of the following instruments

(a) multi meter

A multi meter is an electronic instrument which can measure resistances, currents and voltages. It is an indispensable instrument and can be used for measuring D.C. as well as A.C. voltages and currents. Multi meter is the most inexpensive equipment and can make various electrical measurements with reasonable accuracy.

(b) Pattern generator

This pattern generator is capable of producing horizontal bars, vertical bars, neutral pattern squares and sound modulation. It is used for;

1. Checking line and frame time base linearity
2. Checking picture height and width
3. Checking video IF

4. Checking and adjustment of sound IF stages
5. Checking agc section
6. Trouble shooting video amplifier using variable video output
7. Checking audio-amplifier with variable 1000Hz variable output .

**(c) Sine wave generator**

It furnishes current at a known radio frequency, modulated, and to deliver a measured voltage only at the terminals of the generator without appreciable radiation at any other point.

**(d) Cathode ray tube**

It facilitates the production of light when electron beam from the gun strikes the screen. The amount of light depend upon the strength of beam current. The beam can be moved to any point on the screen by using the magnetic field produced by a deflection current.

**(e) Cathode ray Oscilloscope**

1. Is widely used for the visual observation of electrical wave form
2. Displaying wave forms at high amplitude
3. Finds diversified application in many non-electrical industrial and scientific used where physical effects and phenomena are converted into electrical signals.

**4. Describe the effects of the following in the TV receiver**

**1. CONTROL**

For the adjustment of TV signals; colour, sound and picture as desired

**2. BRIGHTNESS**

1. A brightness control will vary the overall illumination
2. It automatically adjusts picture-tube brightness to compensate for different room-ambient lighting conditions
3. It adjust the voltage different between the grid and cathode of the CRT
4. It decides the number of electrons that pass through the grid aperture and ultimately strike the phosphorescent screen

5. Turning it in a clockwise direction increases the screen illumination and vice-versa.

**6. COLOUR TINT**

Also known as Hue, it refers to the actual colour of objects. It can be used to adjust for correct flesh tones of the face.

**7. COLOUR KILLER CIRCUIT**

It is the circuit that shows the stage of the chrominance section that cut off the chroma amplifier during mono chrome broadcasts.

**8. FINE TUNNING**

1. Termination or keeping of the overall noise level as low as possible
2. Ensuring greater stability
3. Avoiding interference
4. Ensuring great selectivity so as to discriminate against unwanted image frequencies or stations on adjacent bands.
5. So that the desire station can be obtained

**5. Explain the possible causes of the following faults in a TV receiver**

1. Picture rolling up or down the screen  
Faulty vertical and horizontal oscillator
2. Pictures divided into segment with diagonal bars  
Faulty horizontal oscillator and AFC
3. Picture drifting to the right or left  
Faulty sync separator, video stage and Automatic Gain Control Stage.
4. No sound but clear picture  
Faulty sound section, e.g. in sound IF, amplifier and loudspeaker.

6(a) Scanning is the process of moving the electron beam horizontally and slightly vertically to cover the picture tube screen in successive horizontal lines WHILE synchronization is the bringing of electrical

actions, voltages, currents, or their phases into such time relation with one another that desired performance or results are obtained, or an in – phase condition is obtained.

1. Scanning is the tracing of the picture from left to right and line by line (from top to bottom) and the conversion of the result into electrical pulses.
2. Synchronization is the process of keeping the transmitter and the receiver in step so that what is being picked up as being reproduced exactly by the receiver at the same time, so that the two will be in phase

(b) Interlaced scanning: This is a scanning method by which the whole picture frame is being divided into two fields, i.e. field 1 & field 2, and each field is being scanned progressively and the two are later combined.

- (i) Vertical hold

Is used to set the oscillator frequency at the point where the sync trigger pulses lock in the oscillator. It prevents the picture from rolling vertically.

(ii) U.H.F (Ultra High Frequency) is to select TV stations or channels in the range of the frequency of 300 - 3000 GHz.

(iii) V.H.F (Very High Frequency) is to select TV stations or channels in the range of the frequency of 30 – 300 GHz.

### **7. State the functions of the following instruments in fault finding**

#### **(i) Colour generator**

1. Used for convergence adjustments for colour picture tube.
2. Used for checking convergence error.
3. Used for checking linearity of the vertical and horizontal scanning.
4. It provides signals for (i) small, white dots in horizontal rows and vertical columns. (ii) a cross hatch pattern of horizontal and vertical white lines. (iii) ten vertical colour bars.
5. It produces a single dot or cross at the exact centre of the picture.
6. Useful in locating the mid screen area for beam landing adjustment.

#### **(ii) Pattern generator**

1. It provides video signals and use for the alignment, testing and servicing of TV receivers.
2. The output signal produces patterns (vertical and horizontal bars, chequer – board, cross – hatch, dots e.tc.) that are used for linearity and video amplifier adjustments.
3. It provides FM sound signal used for aligning sound section of the receiver.

**(iii) Multi meter**

1. Used to get information about the symptoms of a particular fault such as short circuit and open circuit at which a set of voltage readings at critical points in the circuit must be taken. Also, current flowing through a point and the resistance between two points can be measured by multi meter to know the particular fault.

**(iv) Soldering iron**

This is an electrical device used in heating a junction to which solder is being applied. It is also used to melt a soldered joint in order to remove the soldered component.

**(v) TV Analyzer**

2. Used for trouble shooting faults in the receiver
3. It provides all the out puts and essential signals of the television signals in form of patterns.