ELECTRONIC DEVICES & CIRCUITS LABEC-252R20

II/IV B. TECH I-SEM

LABORATORY MANUAL

Prepared By

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Bapatla-522101

INSTITUTION VISION & MISSION

COLLEGE VISION:

BWEC has been established with forethought to organize the growing needs of higher technical education for WOMEN, to provide them a competitive edge and a unique niche in the society. We at BWEC are determined to create a conducive environment with updated technological inputs and latest information to facilitate the students with a pleasant feel in acquiring knowledge and skills required to make them globally competitive technocrats.

COLLEGE MISSION:

Our mission is to impart the quality education on par with global standards to the students from all over India, and particularly those from local and rural areas. We continuously try to maintain high standards to make them technologically competent and ethically strong individuals who shall be able to improve the quality of life and economy of our country.

ELECTRONIC DEVICES & CIRCUITS LAB EC-251 R20

DEPARTMENTOFELECTRONICSANDCOMMUNICATIONENGINEERING

VISION

To produce highly professional and socially responsible women engineers through world class quality technical education and research to meet industry and Society needs in the field of Electronics and Communication Engineering.

MISSION

M1- To inculcate quality education for women through innovative learningpractices with the use of modern tools.

M2- To impart professional ethics and moral values through co-curricular andextra-curricular activities as individual and team member.

M3- Empowering graduates through industrial trainings/on-job training in collaboration with Industries with-a-view to life-long learning.

PROGRAM EDUCATIONAL OBJECTIVES (PEO's)

PEO1: To develop and implementation of Electronics and Communication systems by imparting technical knowledge, professional leadership and communication skills as an individual and team in a multi-disciplinary stream.

PEO2: To train Graduates in solving complex problems, analyzing, designing and imparting research-based knowledge by using modern scientific tools to develop least cost-effective and innovative products.

PEO3: To produce women graduates through life-long learning, who ensure ethical and moral behavior.

PROGRAM SPECIFIC OUTCOMES (PSO's)

PSO1. To understand and analyze basic concepts of electronics and communication in various areas like signal processing, VLSI, embedded systems, communications, digital and analog devices.

PSO2. Ability to design and develop computing systems using concepts of mathematics, electronics engineering and other related inter disciplines to asses and resolve societal, environmental, health safety and cultural issues with professional ethics.

Programme Outcomes (POs)

PO1: Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

- **PO2: Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
- **PO3: Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
- **PO4: Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
- **PO5: Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools prediction and modelling to complex engineering activities with an understanding of the limitations.
- **PO6: The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice
- **PO7: Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and the need for sustainable development.
- **PO8: Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
- **PO9: Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
- **PO10: Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and receive clear instructions.
- **PO11: Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in team, to manage projects and in multidisciplinary environments.
- **PO12: Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

BAPATLA WOMEN'S ENGINEERINGCOLLEGE::BAPATLA
AN ISO 9001-2015 CERTIFIED INSTITUTION

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

SUBJECT: ELECTRONIC DEVICES & CIRCUITS LAB CODE: EC252 (R20)

COURSE OUTCOMES

After the completion of the subject/course, the student should able to learn

CO No.	Course Outcome Statement	Bloom's Taxonomy Level
C251.1	**Study** of CRO for measuring different waveforms and components.	**Understand**
C251.2	**Obtain** the characteristics of devices like P-N Junction diode, ZENER diode.	**Analyze**
C251.3	**Evaluate** the characteristics of BJT in CE, CB, and CC configurations.	**Analyze**
C251.4	**Determine** the characteristics of JFET AND MOSFET.	**Analyze**
C251.5	**Design** a circuit to achieve the specified operating point.	**Create**

MAPPING OF CO'S WITH PO'S AND PSO'S

CO No.	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
C251.1	2	-	-	-	-	-	-	-	-	-	-	1	2	3
C251.2	2	2	2	-	-	-	-	-	-	-	-	2	2	3
C251.3	3	3	2	2	-	-	-	-	-	-	-	2	1	2
C251.4	2	2	2	2	-	-	-	-	-	-	-	2	3	2
C251.5	3	2	-	-	-	-	-	-	-	-	-	2	2	3
AVG	2.4	2.2	2	2	-	-	-	-	-	-	-	1.8	2	2.6

ELECTRONIC DEVICES & CIRCUITS LAB EC-251 R20

EC251 (R20) ELECTRONIC DEVICES AND CIRCUITS LAB	L	T	P	M	C
	0	0	3	100	1.5

1. Study of C.R.O
2. Characteristics of Silicon and Germanium diodes
3. Characteristics of Zener diode and regulator
4. Characteristics of Common Base configuration
5. Characteristics of Common Emitter configuration
6. Characteristics of Emitter follower circuit
7. Drain and Transfer Characteristics of JFET
8. Drain and Transfer Characteristics of Depletion MOSFET
9. Drain and Transfer Characteristics of Enhancement MOSFET
10. Design and verification of Self bias circuit
11. Characteristics of LDR and Thermistor
12. Characteristics of Source follower circuit
13. Characteristics of Photo transistor
14. Design and verification of Collector to Base Bias Circuit
15. Design and verification of Current Source Bias Circuit

NOTE: A minimum of 10(Ten) experiments have to be performed and recorded by the candidate to attain eligibility for University Practical Examination.

LIST OF EXPERIMENTS

CYCLE-I

1. Study of CRO 7
2. Characteristics of Silicon and Germanium diodes 9
3. Characteristics of Zener diode and regulator 14
4. Characteristics of Common Base Configuration 18
5. Characteristics of Common Emitter Configuration 23
6. Characteristics of Emitter Follower circuit 28
7. Drain and Transfer Characteristics of JFET 33

CYCLE-II

8. Drain and Transfer Characteristics of Depletion MOSFET 36
9. Drain and Transfer Characteristics of Enhancement MOSFET 39
10. Design and verification of self-bias 42
11. Characteristics of LDR and Thermistor 45
12. Characteristics of source follower circuit 49
13. Characteristics of photo transistor 53
14. Design and verification of collector to base bias 56
15. Design and verification of current source bias 59

Experiment(s) Beyond The Syllabus:

1. Half wave rectifier with and without filter
2. Full wave rectifier with and without filter

STUDY OF CRO

AIM: To observe front panel control knobs and to find amplitude, time period and frequency for given waveforms.

APPARATUS:

CRO

Function generator and probes

PROCEDURE

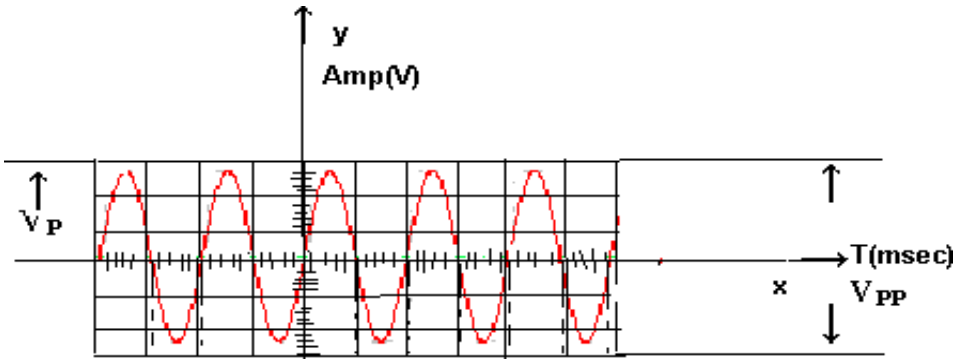
1. Understand the significance of each and every knob on the CRO.
2. From the given function generator feed in a sinusoidal wave and adjust the time base knob and the amplitude knob to observe the waveform as a function of time.
3. Measure the time period and amplitude (peak to peak) of the signal. Find the frequency and verify if the same frequency is given for the function generator.
4. Observe two waveforms simultaneously on the two channels of a CRO.
5. Repeat the above steps for pulse and triangular waveforms.
6. Report the readings and the waveforms taken.

MEASUREMENTS

Amplitude = no. of vertical divisions * Volts/div.

Time period = no. of horizontal divisions*Time/div. Frequency=(1/T)Hz

MODEL GRAPHS:



APPLICATIONS OF CRO:

1. Measurement of current
2. Measurement of voltage
3. Measurement of power
4. Measurement of frequency
5. Measurement of phase angle
6. To see transistor curves
7. To trace and measuring signals of RF, IF and AF in radio and TV.
8. To trace visual display of sine waves.

VIVA-VOCE Questions:

1. How do you measure frequency using the CRO?

2. Can you measure signal phase using the CRO?

3. Suggest a procedure for signal phase measurement using the data from CRO?

4. Can you comment on the wavelength of a signal using CRO?

5. How many channels are there in a CRO?

6. Can you measure DC voltage using a CRO?

2. P-N Junction Diode Characteristics

AIM:- To find out the V-I characteristics of silicon and germanium diodes in Forward and Reverse bias configurations.

APPARATUS:-

P-N Diodes DR25, BY126

Regulated Power supply

(030v)

Resistor 1KΩ

Ammeters (0-200 mA, 0-200μA),

Voltmeter (0-20 V)

Bread board and Connecting wires

THEORY:-

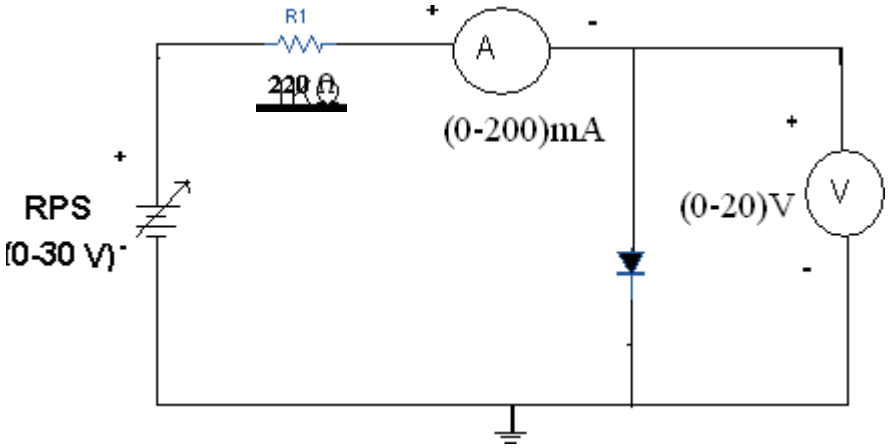
A p-n junction diode conducts only in one direction. The V-I characteristics of the diode are curve between voltage across the diode and current through the diode. When external voltage is zero, circuit is open and the potential barrier does not allow the current to flow. Therefore, the circuit current is zero. When P-type (Anode is connected to +ve terminal and n- type (cathode) is connected to –ve terminal of the supply voltage, is known as forward bias. The potential barrier is reduced when diode is in the forward biased condition. At some forward voltage, the potential barrier altogether eliminated and current starts flowing through the diode and also in the circuit. The diode is said to be in ON state. The current increases with increasing forward voltage.

When N-type (cathode) is connected to +ve terminal and P-type (Anode) is connected to the –ve terminal of the supply voltage is known as reverse bias and the potential barrier across the junction increases. Therefore, the junction resistance becomes very high

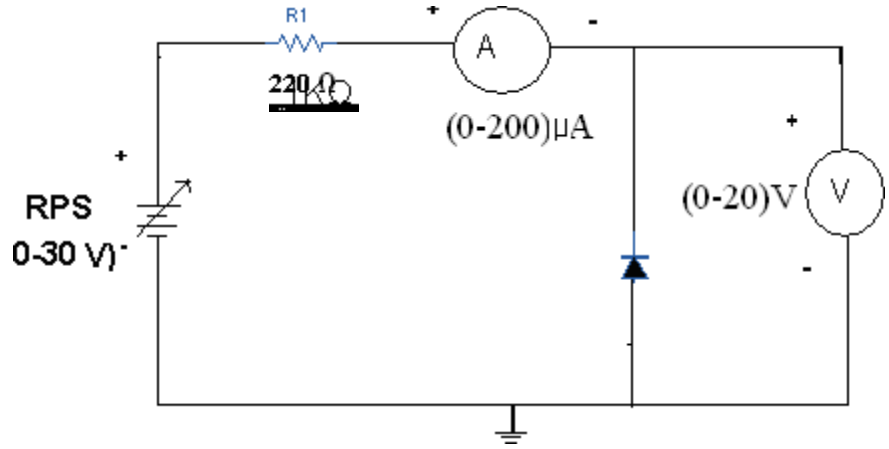
and a very small current (reverse saturation current) flows in the circuit. The diode is said to be in OFF state. The reverse bias current is due to minority charge carriers.

CIRCUITDIAGRAM:-

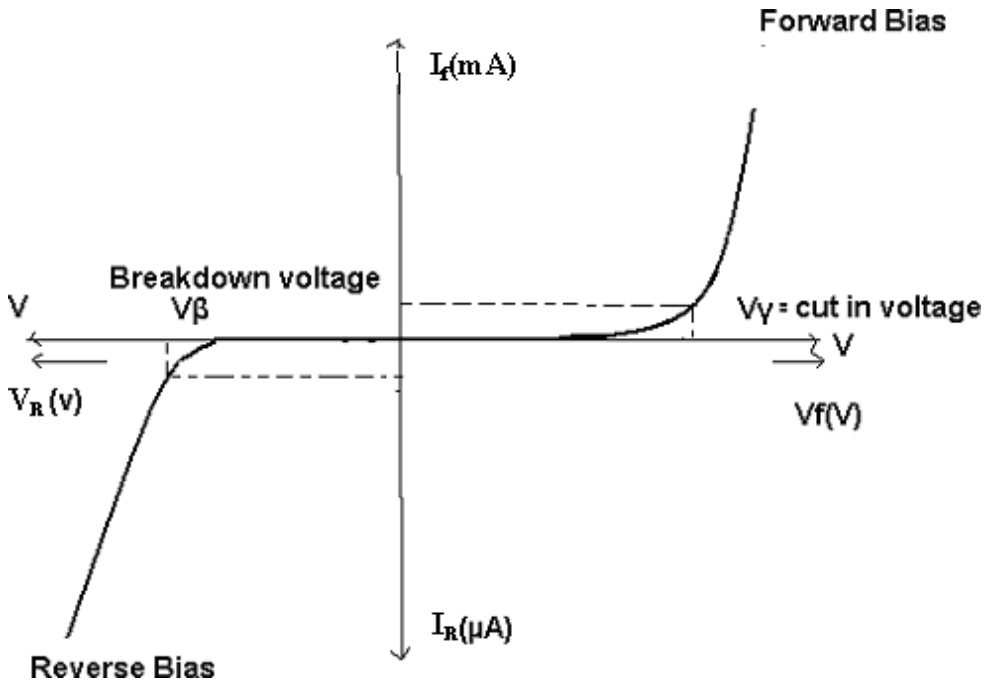
FORWARD BIAS:-



REVERSE BIAS:-



MODEL WAVEFORM:-



PROCEDURE:

FORWARDBS:

1. Connections are made as per the circuit diagram.

2. For forward bias, the RPS +ve is connected to the anode of the silicon diode and RPS –ve is connected to the cathode of the diode.

3. Switch on the power supply and increases the input voltage (supply voltage) insteps.

4. Note down the corresponding current flowing through the diode and voltage across the diode for each and every step of the input voltage.

5. The readings of voltage and current are tabulated and a graph is plotted between voltage and current.

6. Repeat the above procedure for Germanium diode also and tabulate the results.

OBSERVATION:-

S.NO	APPLIED VOLTAGE (V)	VOLTAGE ACROSS DIODE (V)	DIODE CURRENT (mA)

PROCEDURE:-

REVERSEBIAS:-

1. Connections are made as per the circuit diagram

2 . For reverse bias, the RPS +ve is connected to the cathode of the silicon diode and RPS – ve is connected to the anode of the diode.

3. Switch on the power supply and increase the input voltage (supply voltage) insteps.

4. Note down the corresponding current flowing through the diode voltage across the diode for each and every step of the input voltage.

5. The readings of voltage and current are tabulated and graph is plotted between voltage and current.

6. Repeat the above procedure for the given Germanium diode also and tabulate the results obtained.

OBSEVATION:-

S.NO	APPLIED VOLTAGE (V)	VOLTAGE ACROSS DIODE (V)	DIODE CURRENT (μA)

PRECAUTIONS:-

1. All the connections should be correct.
2. Parallax error should be avoided while taking the readings from the Analog meters.

VIVA-VOCE Questions:

1. Define depletion region of a diode?
2. What is meant by transition & space charge capacitance of a 0diode?
3. Is the V-I relationship of a diode Linear or Exponential?
4. Define cut-in voltage of a diode and specify the values for Si and Ge diodes?
5. What are the applications of a p-n diode?
6. Draw the ideal characteristics of P-N junction diode?
7. What is the diode equation?
8. What is PIV?
9. What is the break down voltage?
10. What is the effect of temperature on PN junction diodes?

3. ZENER DIODE CHARACTERISTICS

AIM: - To observe and draw the V-I characteristics of a Zener diode

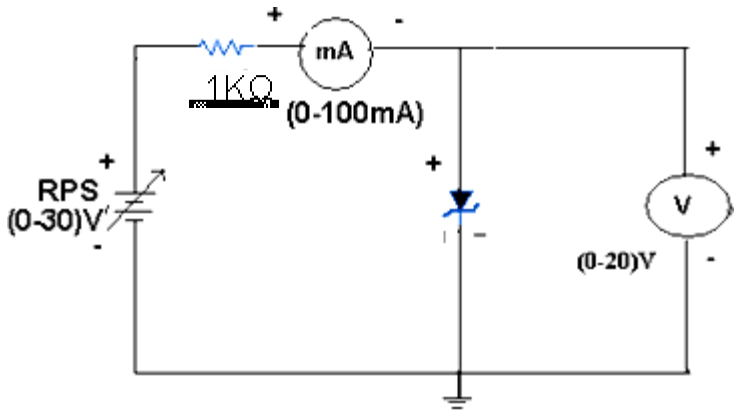
APPARATUS:- Zener diode (IZ5.1 or IZ9.1)

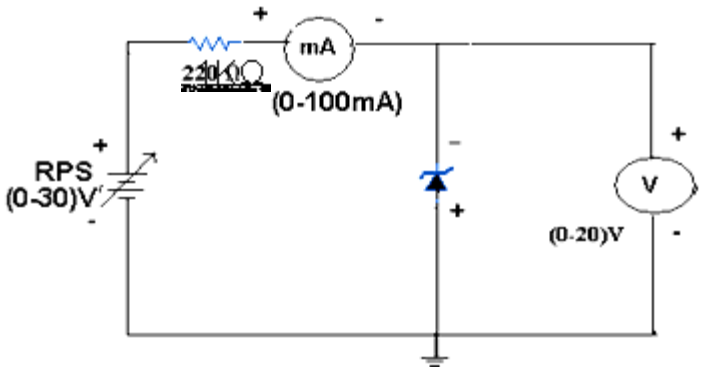
Regulated Power Supply (0-30v).

Voltmeter (0-20v) Ammeter (0-100mA) Resistors(1Kohm)

Bread Board and Connecting wires

CIRCUIT DIAGRAM:-





THEORY:-

A Zener diode is heavily doped p-n junction diode, specially made to operate in the break down region. A p-n junction diode normally does not conduct when reverse biased. But if the reverse bias is increased, at a particular voltage it starts conducting heavily. This voltage is called Break down Voltage. High current through the diode can permanently damage the device

To avoid high current, we connect a resistor in series with Zener diode. Once the diode starts conducting it maintains almost constant voltage across the terminals whatever may be the current through it, i.e., it has very low dynamic resistance. It is used in voltage regulators.

PROCEDURE:-

Static characteristics:-

1. Connections are made as per the circuit diagram.
2. The Regulated power supply voltage is increased insteps.
3. The Zener current (lz), and the Zener voltage (Vz.) are observed and then noted in the tabular form.
4. A graph is plotted between Zener current (Iz) and Zener voltage(Vz).
5. Do the above steps for forward as well as reverse bias connections as shown in the circuit diagrams.

Regulation characteristics:-

1. Connections are made as per the circuit diagram
2. The load resistance is fixed to known value and the zener voltage (V_z), and Zener current (l_z), are measured.
3. The load resistance is varied in steps and the corresponding values are noted down for each load resistance value.
4. All the readings are tabulated.

OBSERVATIONS:-

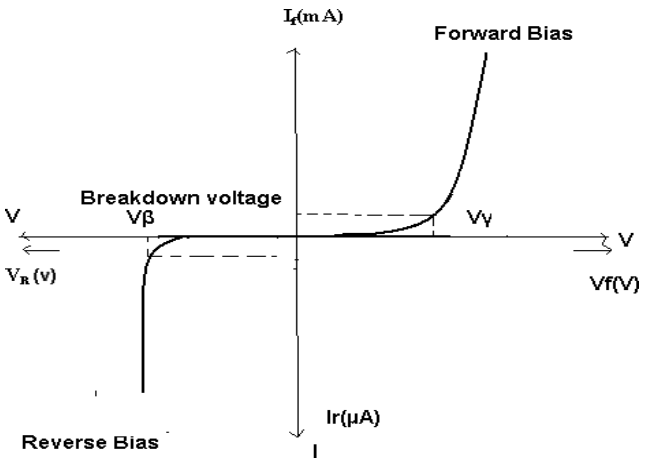
Static characteristics:-

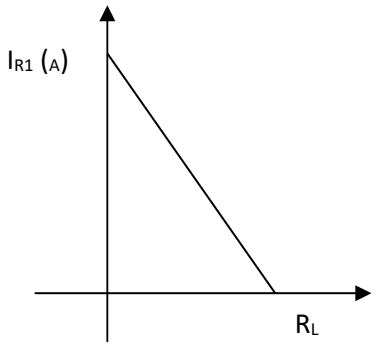
S.NO	ZENER VOLTAGE(V_Z)	ZENER CURRENT(I_Z)

Regulation characteristics:-

S.N0	V_Z(VOLTS)	I_{R1} (amperes)	R_L (Ω)

MODEL WAVEFORMS:-





PRECAUTIONS:-

1. The terminals of the zener diode should be properly identified.
2. Should be ensured that the applied voltages & currents do not exceed the diode ratings.

VIVA-VOCE Questions:

1. What type of temperature Coefficient does the zener diode have?
2. If the impurity concentration is increased, how the depletion width effected?
3. Does the dynamic impendence of a zener diode vary?
4. Explain briefly about avalanche and zener breakdowns?
5. Draw the zener equivalent circuit?
6. Differentiate between line regulation & load regulation?
7. In which region zener diode can be used as a regulator?
8. How the breakdown voltage of a particular diode can be controlled?
9. What type of temperature coefficient does the Avalanche breakdown has?

4. TRANSISTOR COMMON - BASE CONFIGURATION

AIM:1.To observe and draw the input and output characteristics of a transistor connected in common base configuration.

APPARATUS: Transistor (BC107 orSL100)

Regulated power supply (0-30V,

1A) Voltmeter (0-20V)

Ammeters (0-200mA)

Resistors, 100Ω, 1KΩ

Bread board and connecting wires

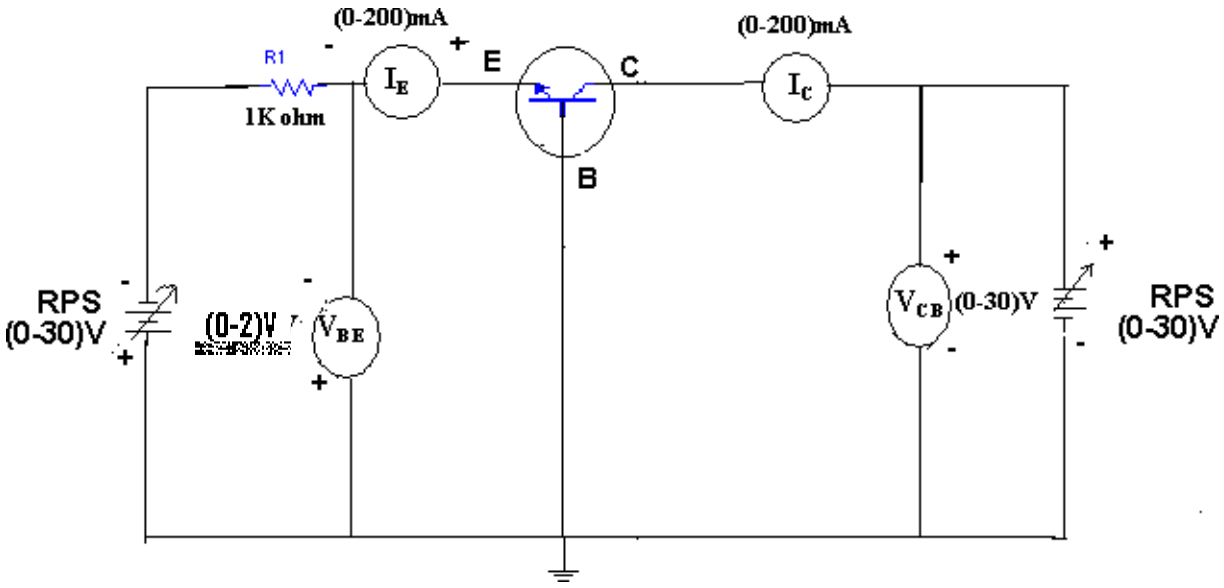
THEORY:

A transistor is a three terminal active device. T he terminals are emitter, base, collector. In CB configuration, the base is common to both input (emitter) and output (collector). For normal operation, the E-B junction is forward biased and C-B junction is reverse biased.

With an increasing the reverse collector voltage, the space-charge width at the output junction increases and the effective base width 'W' decreases. This phenomenon is known as "Early effect". Then, there will be less chance for recombination within the base region. With increase of charge gradient within the base region, the current of minority carriers injected across the emitter junction increases. The current amplification factor of CB configuration is given by,

$$\alpha = \Delta I_C / \Delta I_E$$

CIRCUIT DIAGRAM



PROCEDURE:

INPUT CHARACTERISTICS:

1. Connections are made as per the circuit diagram.
2. For plotting the input characteristics, the output voltage V_{CE} is kept constant at 0V and for different values of V_{EB} note down the values of I_E.
3. Repeat the above step keeping V_{CB} at 2V, 4V, and 6V.All the readings are tabulated.
4. A graph is drawn between V_{EB} and I_E for constant V_{CB}.

OUTPUT CHARACTERISTICS:

1. Connections are made as per the circuit diagram.
2. For plotting the output characteristics, the input I_E is kept constant at 10m A and for different values of V_{CB}, note down the values of I_C.

3. Repeat the above step for the values of I_E at 20 mA, 40 mA, and 60 mA, all the readings are tabulated.
4. A graph is drawn between V_{CB} and Ic for constant I_E

OBSERVATIONS:

INPUT CHARACTERISTICS:

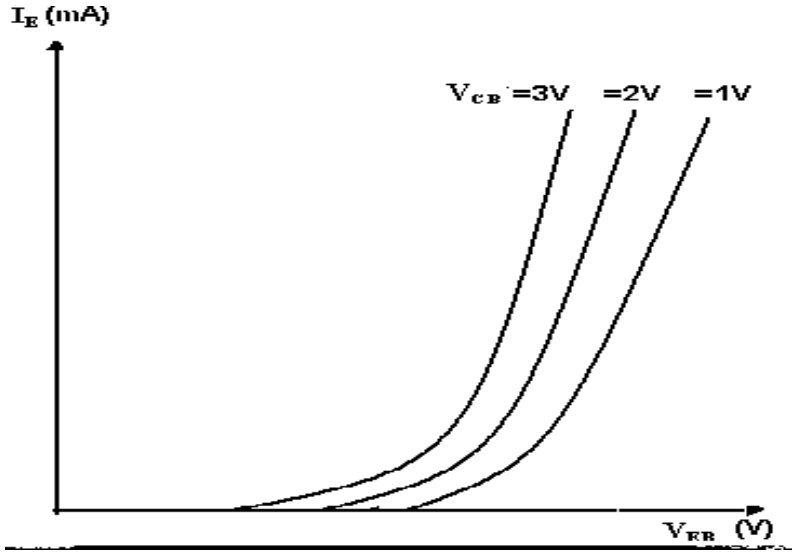
S.No	V_{CB}=0V		V_{CB}=1V		V_{CB}=2V	
	V_{EB}(V)	I_E(mA)	V_{EB}(V)	I_E(mA)	V_{EB}(V)	I_E(mA)

OUTPUT CHARACTERISTICS:

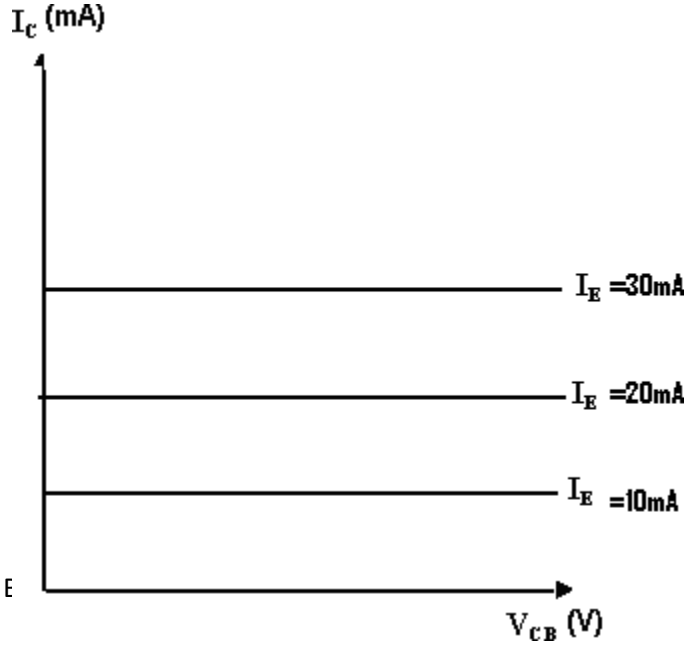
S.No	I_E=10mA		I_E=20mA		I_E=30mA	
	V_{CB}(V)	I_C(mA)	V_{CB}(V)	I_C(mA)	V_{CB}(V)	I_C(mA)

MODEL GRAPHS:

INPUT CHARACTERISTICS



OUTPUT CHARACTERISTICS



PRECAUTIONS:

1. The supply voltages should not exceed the rating of thetransistor.
2. Meters should be connected properly according to theirpolarities.

VIVA-VOCE Questions:

1. What is the range of α for the transistor?
2. Draw the input and output characteristics of the transistor in CB configuration?
3. Identify various regions in output characteristics?
4. What is the relation between α and β?
5. What are the applications of CB configuration?
6. What are the input and output impedances of CB configuration?
7. Define α (alpha)?
8. What is EARLY effect?
9. Draw diagram of CB configuration for PNP transistor?
10. What is the power gain of CB configuration?

5. TRANSISTOR CE CHARACTERSTICS

AIM: To draw the input and output characteristics of transistor connected in CE configuration

APPARATUS:

Transistor (SL100 or BC107)

R.P.S (O-30V) 2Nos

Voltmeters (0-20V) 2Nos

Ammeters (0-200mA)

Resistors 100Kohm, 100ohm

Bread board and connecting wires

THEORY:

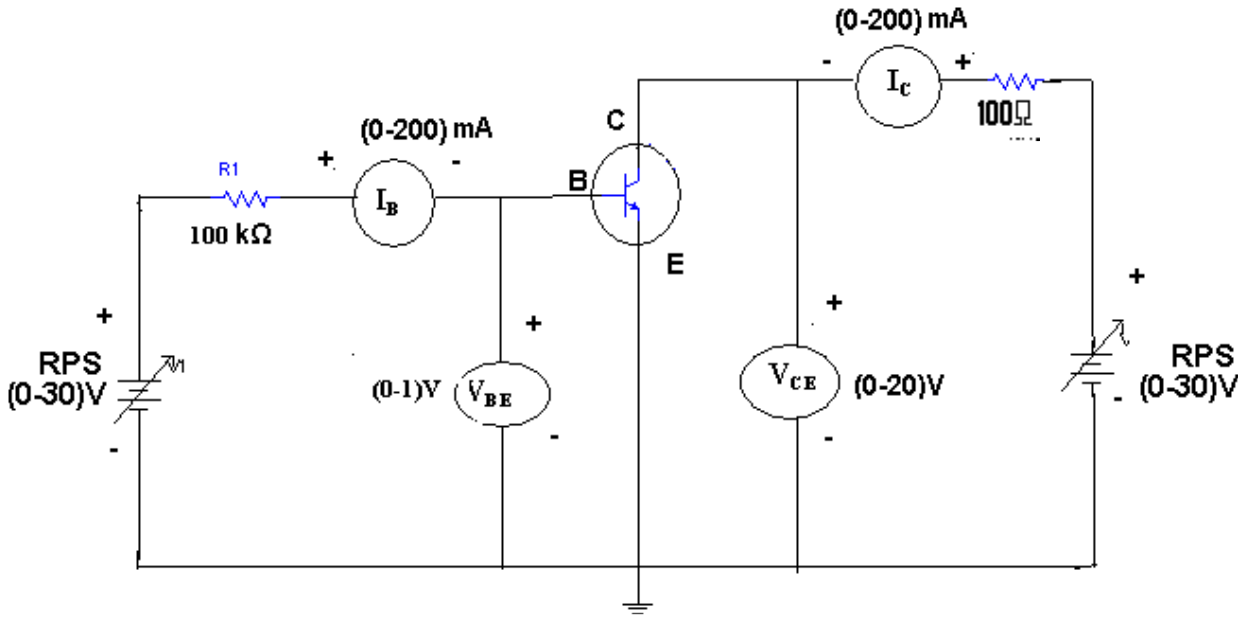
A transistor is a three terminal device. The terminals are emitter, base, collector. In common emitter configuration, input voltage is applied between base and emitter terminals and output is taken across the collector and emitter terminals.

Therefore the emitter terminal is common to both input and output.

The input characteristics resemble that of a forward biased diode curve. This is expected since the Base-Emitter junction of the transistor is forward biased. As compared to CB arrangement I_B increases less rapidly with $V_{BE.}$ Therefore input resistance of CE circuit is higher than that of CB circuit.

The output characteristics are drawn between I_c and V_{CE} at constant $I_{B.}$ the collector current varies with V_{CE} unto few volts only. After this the collector current becomes almost constant, and independent of $V_{CE.}$ The value of V_{CE} up to which the collector current changes with V_{CE} is known as Knee voltage. The transistor always operated in the region above Knee voltage, I_C is always constant and is approximately equal to $I_{B.}$

CIRCUIT DIAGRAM:



PROCEDURE:

INPUT CHARECTERSTICS:

1. Connect the circuit as per the circuit diagram.
2. For plotting the input characteristics the output voltage V_{CE} is kept constant at 1V and for different values of V_{BE} . Note down the values of I_C
3. Repeat the above step by keeping V_{CE} at 2V and4V.
4. Tabulate all the readings.
5. plot the graph between V_{BE} and I_B for constant V_{CE}

OUTPUT CHARACTERSTICS:

1. Connect the circuit as per the circuit diagram
2. for plotting the output characteristics the input current I_B is kept constant at 10μA and for different values of V_{CE} note down the values of I_C

3. repeat the above step by keeping IB at 75 µA 100µA
4. tabulate the all the readings
5. plot the graph between V_{CE} and I_C for constant I_B

OBSERVATIONS:

INPUT CHARACTERISTICS:

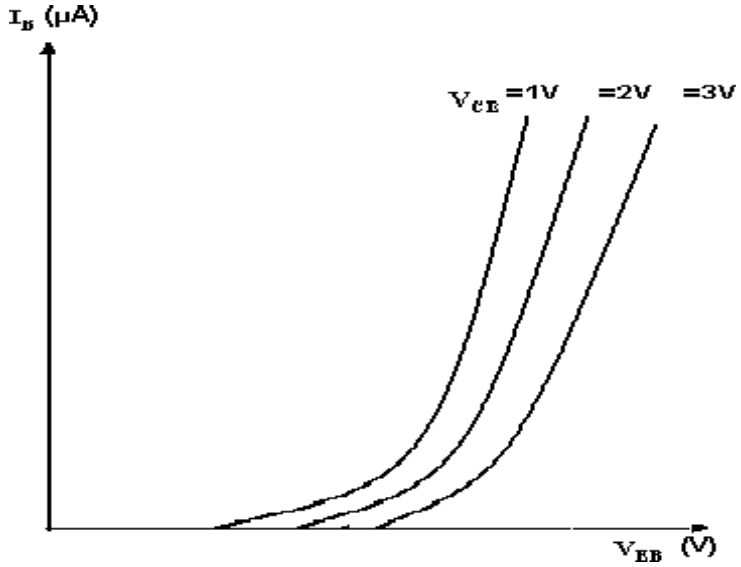
S.NO	V_{CE} = 1V		V_{CE} = 2V		V_{CE} = 4V	
	V_{BE}(V)	I_B(µA)	V_{BE}(V)	I_B(µA)	V_{BE}(V)	I_B(µA)

OUT PUT CHAREACTARISTICS:

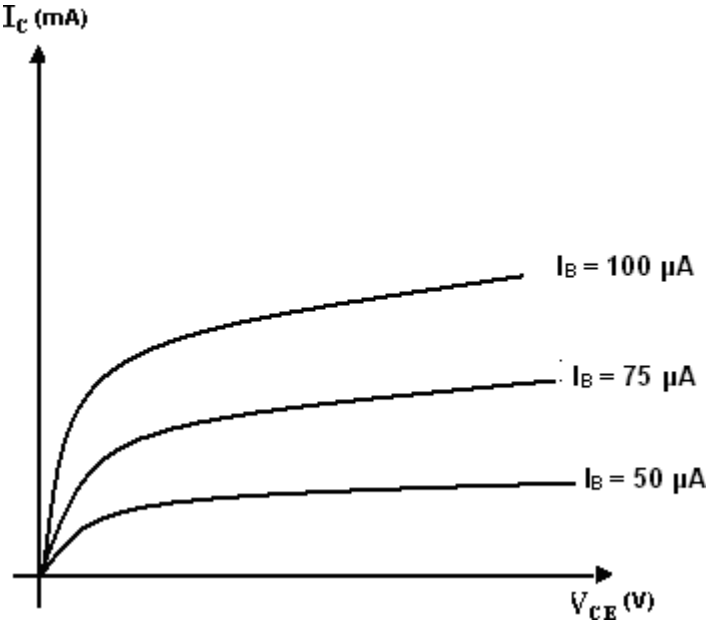
S.NO	I_B = 50 µA		I_B = 75 µA		I_B = 100 µA	
	V_{CE}(V)	I_C(mA)	V_{CE}(V)	I_CmA)	V_{CE}(V)	I_C(mA)

MODEL GRAPHS:

INPUT CHARACTERSTICS:



OUTPUT CHARECTERSTICS:



PRECAUTIONS:

1. The supply voltage should not exceed the rating of the transistor
2. Meters should be connected properly according to their polarities

VIVA-VOCE Questions:

1. What is the range of □ for the transistor?
2. Identify various regions in the output characteristics?
3. what is the relation between □ *and*□
4. Define current gain in CE configuration?
5. Why CE configuration is preferred for amplification?
6. What is the phase relation between input and output?
7. Draw diagram of CE configuration for PNP transistor?
8. What is the power gain of CE configuration?
9. What are the applications of CE configuration?

6. CHARACTERSTICS OF EMITTER FOLLOWER CIRCUIT

AIM: To draw the input and output characteristics of transistor connected in CC (Common Collector) or Emitter follower configuration.

APPARATUS:

Transistor (SL100 or BC107)

R.P.S (O-30V) 2Nos

Voltmeters (0-20V) 2Nos

Ammeters (0-200μA)

(0-200mA)

Resistors 100Kohm

Bread board and connecting wires

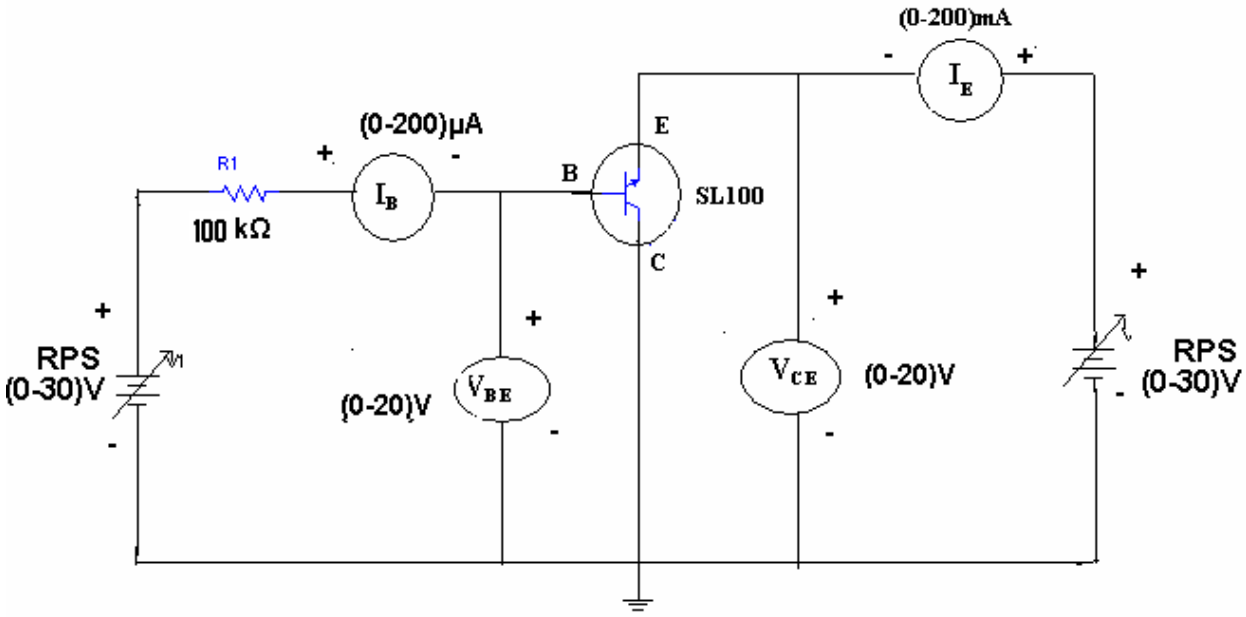
THEORY:

A transistor is a three terminal device. The terminals are emitter, base, collector. In emitter follower configuration, input voltage is applied between base and ground terminals and out put is taken across the emitter and collector terminals.

The input characteristics resemble that of a forward biased diode curve. This is expected since the Base-Emitter junction of the transistor is forward biased.

The output characteristics are drawn between I_E and V_{CE} at constant I_B. the emitter current varies with V_{CE} unto few volts only. After this the emitter current becomes almost constant, and independent of V_{CE}. The value of V_{CE} up to which the collector current changes with V_{CE} is known as Knee voltage. The transistor always operated in the region above Knee voltage, I_E is always constant and is approximately equal to I_B.

CIRCUIT DIAGRAM:



PROCEDURE:

INPUT CHARECTERSTICS:

1. Connect the circuit as per the circuit diagram.
2. For plotting the input characteristics the output voltage V_{CE} is kept constant at 2V and note down values of V_{CB} for each value ofI_B
3. Change V_{CE} to 10 V and repeat the above step.
4. Disconnect the voltmeter from input circuit.
5. plot the graph between V_{CB} and I_B for constant V_{CE}

OUTPUT CHARACTERSTICS:

1. Connect the circuit as per the circuit diagram
2. With I_B set at 0μA, vary V_{CE} and note down the corresponding I_E value.

3. Set I_B at 40μA, 80μA and repeat the above step.
4. Plot the output characteristics between V_{CE} and I_E for constant I_B.

OBSERVATIONS:

INPUT CHARACTERISTICS:

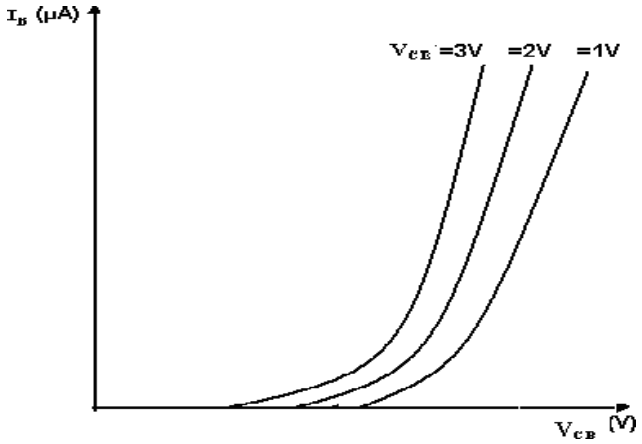
S.NO	**V_{CE} = 2V**		**V_{CE} = 4V**		**V_{CE} = 10 V**	
	V_{CB}(V)	**I_B(μA)**	**V_{CB}(V)**	**I_B(μA)**	**V_{CB}(V)**	**I_B(μA)**

OUT PUT CHAREACTARISTICS:

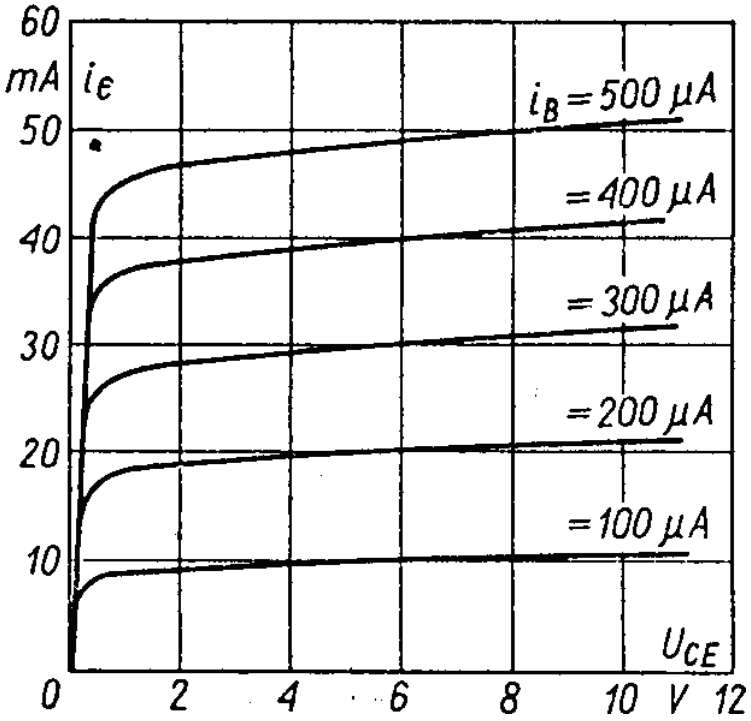
S.NO	**I_B = 0 μA**		**I_B = 30 μA**		**I_B = 40 μA**	
	V_{CE}(V)	**I_E(mA)**	**V_{CE}(V)**	**I_E(mA)**	**V_{CE}(V)**	**I_E(mA)**

MODEL GRAPHS:

INPUT CHARACTERSTICS:



OUTPUT CHARECTERSTICS:



PRECAUTIONS:

1. The supply voltage should not exceed the rating of the transistor
2. Meters should be connected properly according to their polarities

VIVA-VOCE Questions:

i. What are the input and output impedances of CC configuration?
ii. Identify various regions in the output characteristics?
iii. Why CC configuration is preferred for buffering?
iv. What is the phase relation between input and output?
v. Draw diagram of CC configuration for PNP transistor?
vi. What are the applications of CC configuration?

7.Drain and Transfer Characteristics of JFET

AIM: 1. To obtain the drain and transfer characteristics of the given JFET transistor.

2. To calculate r_d, g_m and μ from the curvesobtained.

APPARATUS:

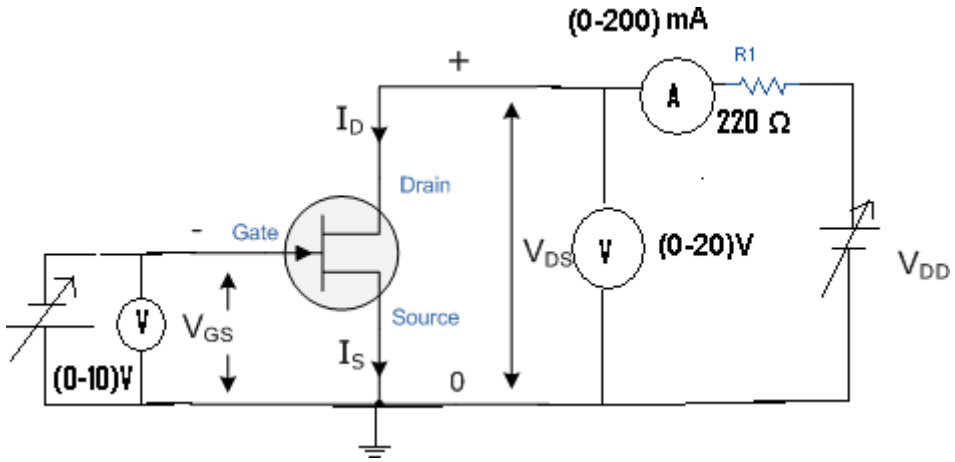
JFET transistor BFW10

R.P.S (O-30V) 2Nos

Resistors 220ohm

Bread board and connecting wires

CIRCUIT DIAGRAM:



PROCEDURE:

a. Connect the circuit as per the circuit diagram.

b. Keeping V_{GS} as 0V, vary V_{DS} in steps of 0.1V from 0 to 1 V and in steps of 2V from 1 to 15V.

c. Note down the drain current Id for each step.

d. Now set V_{GS} to -1V, -2V and -3V and repeat the above steps for each V_{GS} value, record the readings in the table.

e. Keep V_{DS} at 4V and vary V_{GS} in steps of -5V till the drain current I_d is 0. Note I_d value for each value of V_{GS}.

f. With V_{DS} at 8V repeat the above step and record the readings in the table.

g. Plot the drain and transfer characteristics from tabulated readings.

OBSERVATIONS:

Drain Characteristics:

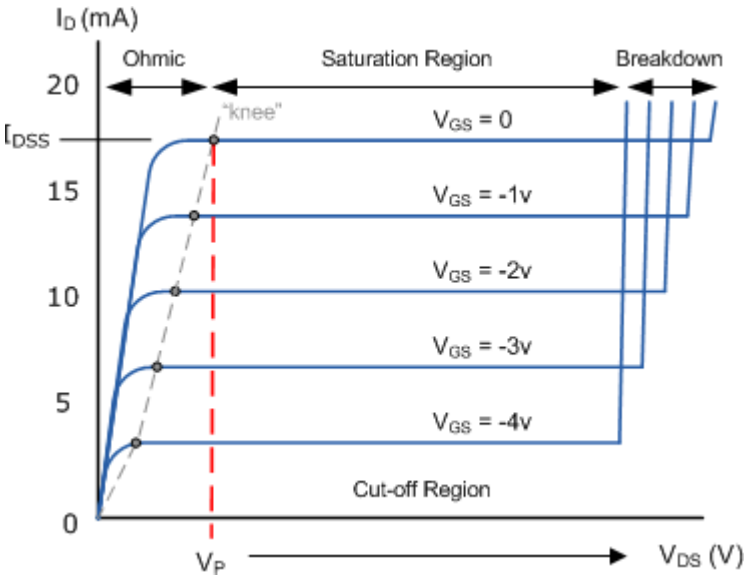
V_{DS}	I_D (V_{GS}=0V)	I_D (V_{GS}=-1V)	I_D (V_{GS}=-2V)

Transfer Characteristics:

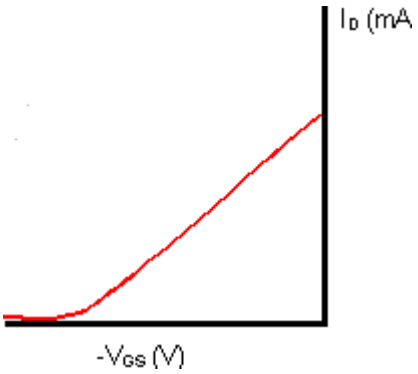
V_{GS}	I_D (V_{DS}=4V)	I_D (V_{DS}=8V)

MODEL GRAPHS:

Drain Characteristics:



Transfer Characteristics:



PRECAUTIONS:

1. The supply voltage should not exceed the rating of the FET.
2. Connections must be tight.

VIVA-VOCE Questions:

1. What are the advantages of FET over transistor?
2. Is FET a current controlled device? Explain?
3. What is the operation of a N-channel JFET?
4. Can you compare JFET and a MOSFET?

8. Drain and Transfer characteristics of Depletion MOSFET

AIM: To study transfer and output characteristics of an n-channel depletion Metal Oxide Semiconductor field effect Transistor (MOSFET) in Common-source configuration

APPARATUS:

Regulated Power Supply (0-30V,1A) - 2Nos

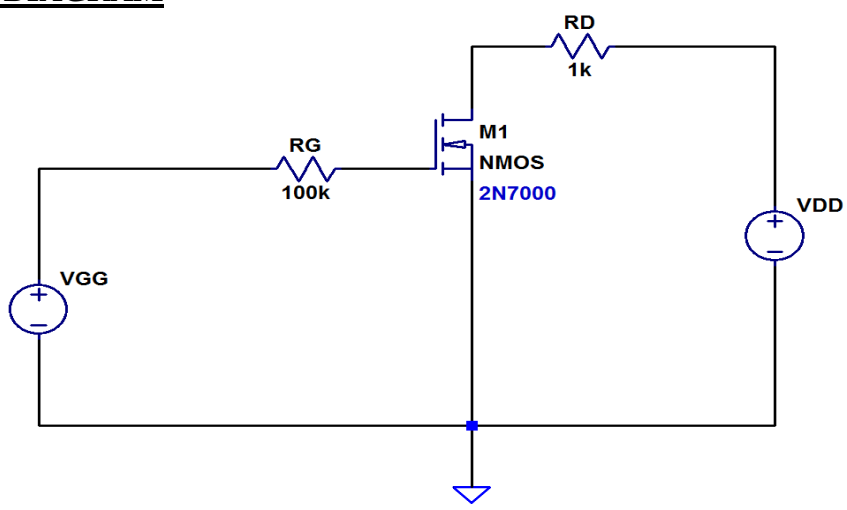
Mosfet

Resistors 1kΩ, 100Ω

Multimeters - 2Nos

Breadboard and connecting Wires

CIRCUIT DIAGRAM



THEORY:

The MOSFET is actually a four-terminal device, whose substrate, or body terminal must be always held at one of the extreme voltage in the circuit, either the most positive for the PMOS or the most negative for the NMOS. One unique property of the MOSFET is that the gate draws no measurable current.

PROCEDURE:

OUTPUT/DRAIN CHARACTERISTICS:

1. Connect the circuit as per given diagram properly.
2. Keep VGS constant at some value say 1.1 V by varying VGG
3. Vary VDS in step of 1V up to 10 volts and measure the drain current ID. Tabulate all the readings.
4. Repeat the above procedure for VGS as 1.2V, 1.3V, 1.4V, 1.5V etc

TRANSFER CHARACTERISTICS:

1. Connect the circuit as per given diagram properly.
2. Set the voltage VDS constant at 10 V.
3. Vary VGS by varying VGG in the step of 0.1 up to 1.55V and note down value of drain current ID. Tabulate all the readings.
4. Plot the output characteristics VDS vs ID and transfer characteristics VGS vs ID.
5. Calculate VT, gm, rd or ro from the graphs and verify it from the data sheet

MODEL GRAPH:

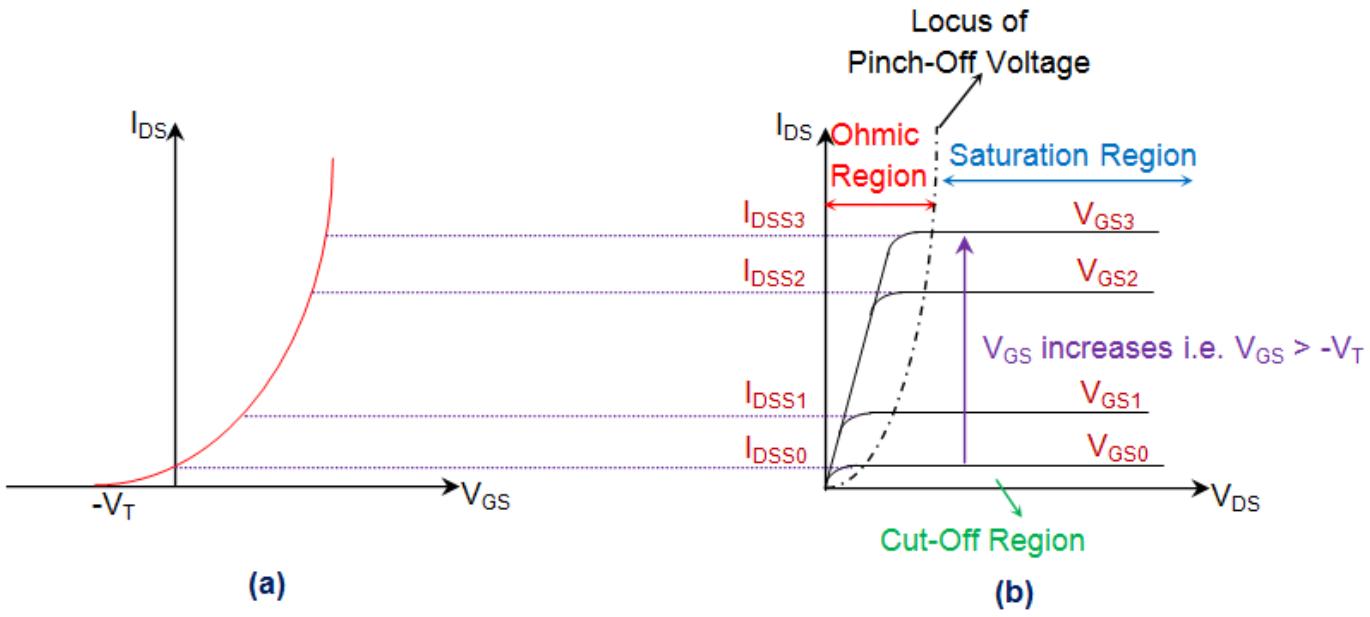


Figure 3 *n*-Channel Depletion type MOSFET (a) Transfer Characteristics (b) Output Characteristics

OBSEVATIONS:

Drain Characteristics:

V_{DS}	I_D (V_{GS}=0V)	I_D (V_{GS}=-1V)	I_D (V_{GS}=-2V)

Transfer Characteristics:

V_{GS}	I_D (V_{DS}=4V)	I_D (V_{DS}=8V)

PRECAUTIONS:

1. The supply voltage should not exceed the rating of the FET.
2. Connections must be tight

VIVA-VOCE Questions:

1. What are the advantages of MOSFET over JFET?
2. To turn NMOS –D, how much voltage is required?

9. Drain and Transfer characteristics of Enhancement MOSFET

AIM: To study transfer and output characteristics of an n-channel Metal Oxide Semiconductor field effect Transistor (MOSFET) in Common-source configuration

APPARATUS:

Regulated Power Supply (0-30V,1A) - 2Nos

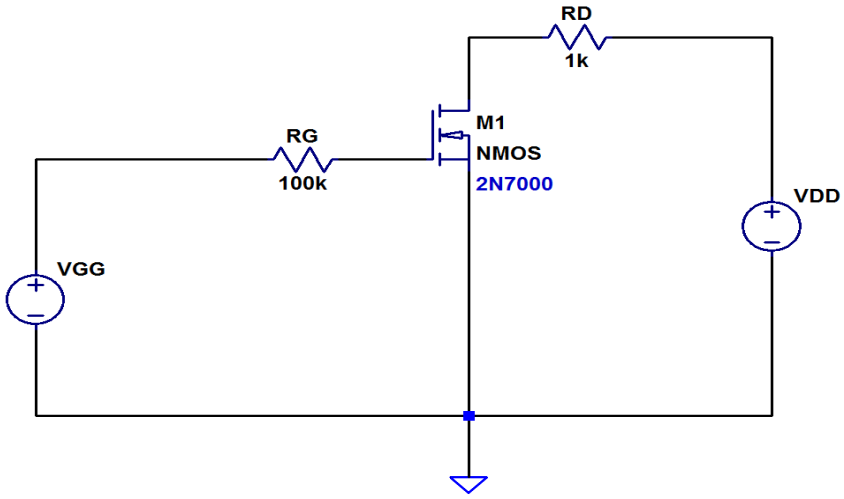
Mosfet

Resistors 1kΩ, 100Ω

Multimeters - 2Nos

Breadboard and connecting Wires

CIRCUIT DIAGRAM



THEORY:

The MOSFET is actually a four-terminal device, whose substrate, or body terminal must be always held at one of the extreme voltage in the circuit, either the most positive for the PMOS or the most negative for the NMOS. One unique property of the MOSFET is that the gate draws no measurable current.

PROCEDURE:

OUTPUT/DRAIN CHARACTERISTICS:

1. Connect the circuit as per given diagram properly.
2. Keep VGS constant at some value say 1.1 V by varying VGG
3. Vary VDS in step of 1V up to 10 volts and measure the drain current ID. Tabulate all the readings.
4. Repeat the above procedure for VGS as 1.2V, 1.3V, 1.4V, 1.5V etc

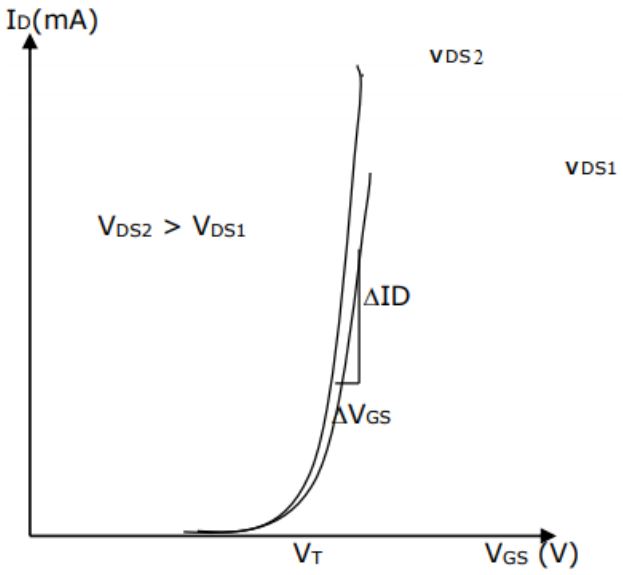
TRANSFER CHARACTERISTICS:

1. Connect the circuit as per given diagram properly.
2. Set the voltage VDS constant at 10 V.
3. Vary VGS by varying VGG in the step of 0.1 up to 1.55V and note down value of drain current ID. Tabulate all the readings.
4. Plot the output characteristics VDS vs ID and transfer characteristics VGS vs ID.
5. Calculate VT, gm, rd or ro from the graphs and verify it from the data sheet

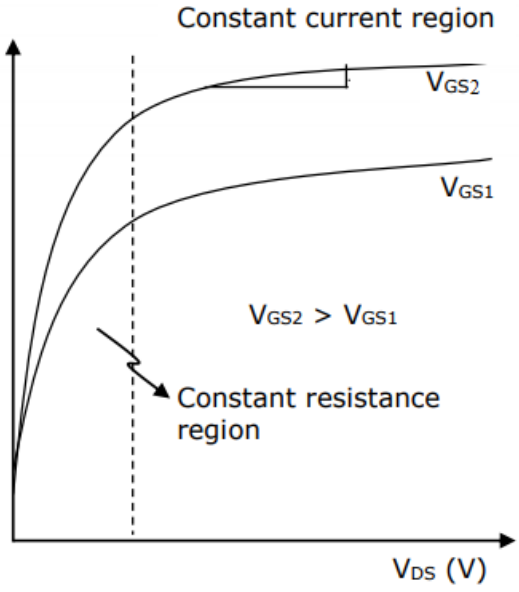
MODEL GRAPH:

Ideal Graph:

Transfer Characteristics:



Drain Characteristics



OBSEVATIONS:

Drain Characteristics:

V_{DS}	I_D (V_{GS}=0V)	I_D (V_{GS}=-1V)	I_D (V_{GS}=-2V)

Transfer Characteristics:

V_{GS}	I_D (V_{DS}=4V)	I_D (V_{DS}=8V)

PRECAUTIONS:

3. The supply voltage should not exceed the rating of the FET.

4. Connections must be tight

VIVA-VOCE Questions:

3. What are the advantages of MOSFET over JFET?
4. To turn NMOS –E, how much voltage is required?
5. Why an input characteristic of MOSFET is not drawn?

10. Design and Verification of Transistor Self bias circuit

AIM: To design a self bias circuit and observe stability by changing β of the transistor.

APPARATUS:

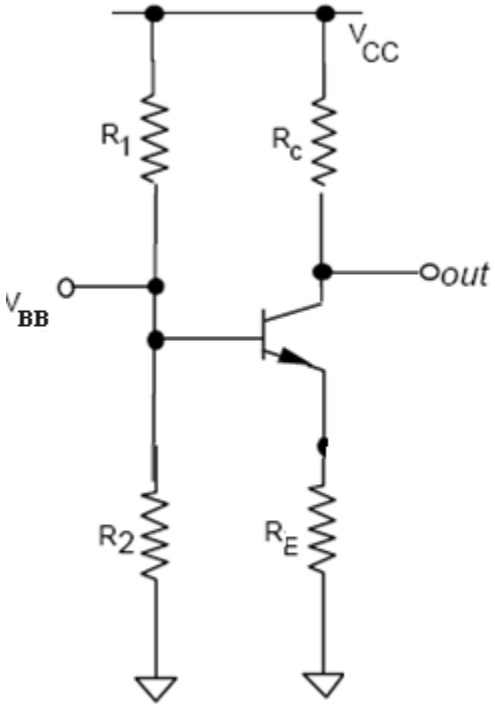
Transistors with different β values (SL100)

R.P.S(O-30V) 2Nos

Resistors (according to design values)

Bread board and connecting wires

CIRCUIT DIAGRAM:



THEORY:

A self bias circuit stabilizes the bias point more appropriately than a fixed bias circuit. In this experiment CE configuration is used and a self bias circuit is designed and verified.

CALCULATIONS:

Given V_{CC}=10V, R_E=220 ohm I_C=4mA V_{CE}=6V V_{BE}=0.6V

h_{fe}=229 $R_C=(V_{CC}-V_{CE})/I_C$

$I_B=I_C/\beta$

$R_B=\beta*R_E/10$

$V_{BB}=I_B*R_B+V_{BE}$

$+(I_B+I_C)R_E$

$R_1=(V_{CC}/V_{BB})*R_B$

$R_2=R_B/(1-V_{BB}/V_{CC})$

PROCEDURE:

1. Assemble the circuit on a bread board with designed values of resistors and transistor.
2. Apply Vcc and measure VCE, VBE and VEE and record the readings in tableI.
3. Without changing the values of biasing resistors, change the transistor with other β values and repeat the above steps and record the readings in the table.

OBSERVATIONS:

β value	**V_{CE}**	**V_{BE}**	**V_{EE}**	**$I_C=(V_{CC}-V_{CE})/R_C$**	**$I_E=V_{EE}/R_E$**

PRECAUTIONS:

1. The supply voltage should not exceed the rating of the transistor
2. Connections must betight.

VIVA-VOCE Questions:

1. What are the advantages of self bias?
2. What are the various other configurations available for bias?

11.Characteristics of thermistor

AIM

1. To determine physical characteristics of a thermistor A and B.
2. To Calculate the resistance of the thermistor and temperature coefficient at 0, 25, 35, 50 and 75^0C using equation $R=A * e^{(B/T)}$ and A, B values.

APPARATUS: Thermistors RT4201K

Resistors

CIRCUIT DIAGRAM:

Fig 1. Thermistor symbol

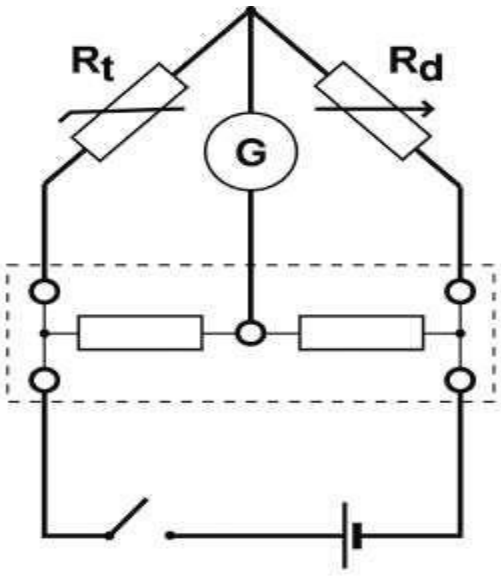


Fig. 2 The diagram of the circuit.

THEORY:

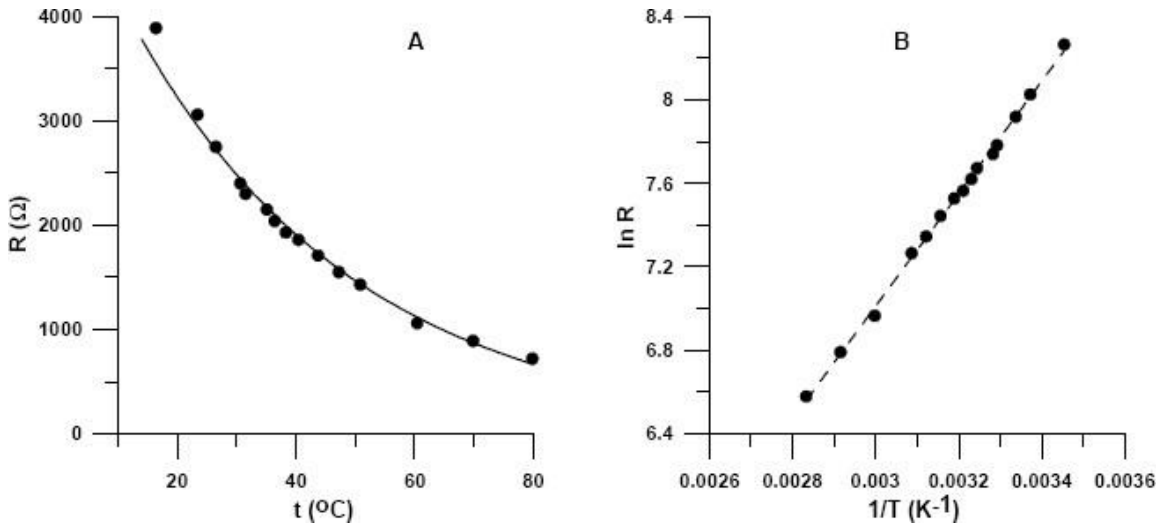
The thermistor is a resistor with a negative temperature coefficient.

$R=A * e^{(B/T)}$. To determine the thermistor characteristics, we need to estimate the A and B values from the V-I characteristics curve of the thermistor. It is mainly used for bridges in instrumentation and measurements.

PROCEDURE:

1. Connect the circuit according the diagram in Fig2.
2. Fill the beaker with cold water (15^0C) and put in the thermistor, thermometer and mixer.
3. The diagram in Fig 2 represents so called Wheatstone bridge used to measure an unknown electrical resistance by balancing two legs of bridge circuit. In the shown diagram one leg includes the thermistor and a known resistor, in the second is the decade resistors box and a second known resistor. The bridge is balanced, when the current through the galvanometer G is zero. Because we use 2 resistors of identical value (one in each leg) at balance, the resistance of decade box is adjustable. So at a given temperature we change the resistance of decade box while no current flows in G. The value adjusted in the decade box directly indicates the resistance of thermistor.
4. Repeat the measurement in 15^0C to 80^0C in steps of 5 degrees, expected total number of cycles is10-12.
5. In order to obtain physical characteristics of thermistor (A and B) calculate 1/T and ln® (See Table1)
6. ln(R)=f(1/T). Join these points. The slope of the straight line represents B and the intercept corresponds to ln(A). Calculate A.
7. Calculate the resistance of the thermistor and temperature coefficient at 0, 25, 35, 50 and 75^0C using equation $R=A * e^{(B/T)}$ and A, B values.
8. Experimental report requires a graphical representation of data. R=f(t) and ln(R)=f(1/T) are as shown in fig1.

MODELGRAPHS:



OBSERVATIONS:

Thermistor Characteristics:

No.	t (°C)	T (K)	1/T (K^{-1})	R (Ω)	ln R
1					
2					
3					
..					
..					
12					

Figure 1: Experimental data

t (°C)	T (K)	$\alpha_{\%}$ (%K^{-1})	R (Ω)
0			
25			
50			
75			

Figure 2: Resistance and temperature coefficient (%) of the thermistor at selected temperatures

PRECAUTIONS:

1. Connections must be tight and these experiments require utmost care.

VIVA-VOCE Questions:

1. What are the applications of thermistor?
2. What are the advantages of thermistor?

12. CHARACTERSTICS OF SOURCE FOLLOWER CIRCUIT

AIM: To draw the input and output characteristics of JFET connected in CD (Common Drain) or source follower configuration.

APPARATUS:

JFET (BFW10)

R.P.S (O-30V) 2Nos

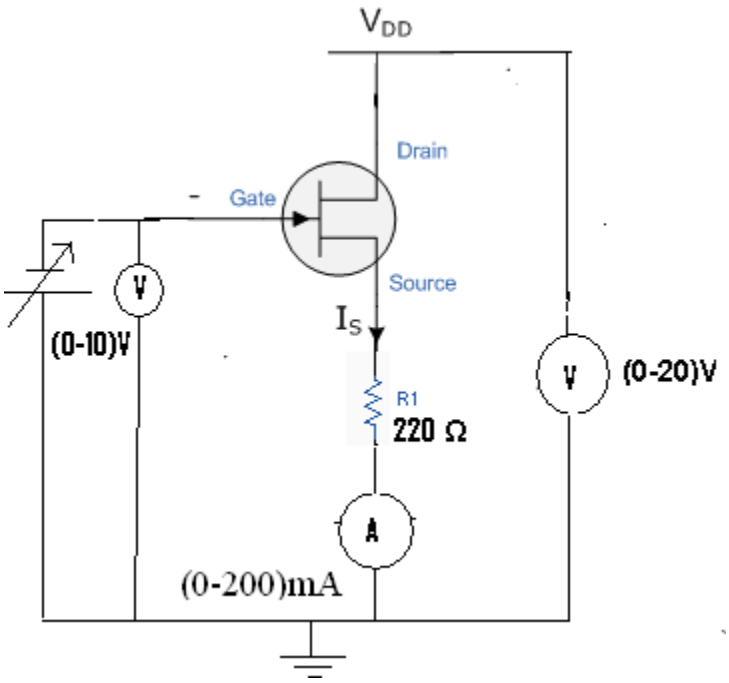
Voltmeters (0-20V) 2Nos

Ammeters (0-200mA)

Resistor 220 ohm

Bread board and connecting wires

CIRCUIT DIAGRAM:



PROCEDURE:

CHARECTERSTICS:

1. Connect the circuit as per the circuit diagram.
2. Keeping gate voltage V_G as 0V, vary V_{DD} in steps of 0.1V from 0 to 1 V and in steps of 2V from 1 to15V.
3. Note down the source current I_s for each step.
4. Now set V_G to -1V, -2V and -3V and repeat the above steps for each V_G value, record the readings in the table.
5. Keep V_{DD} at 4V and vary V_{GS} in steps of -5V till the drain current I_s is 0. Note I_s value for each value of V_G.
6. With V_{DD} at 8V repeat the above step and record the readings in the table.
7. Plot the characteristics from tabulated readings.

OBSERVATIONS:

Input Characteristics:

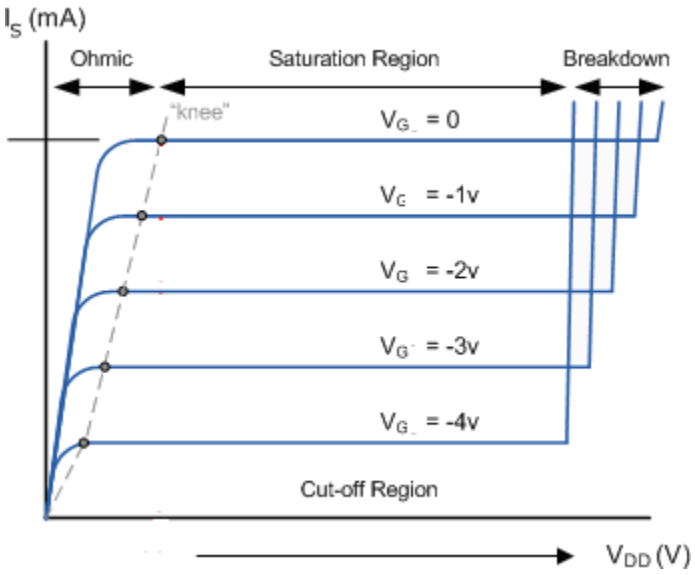
V_{DD}	I_S (V_G=0V)	I_S (V_G=-1V)	I_S(V_G=-2V)

Transfer Characteristics:

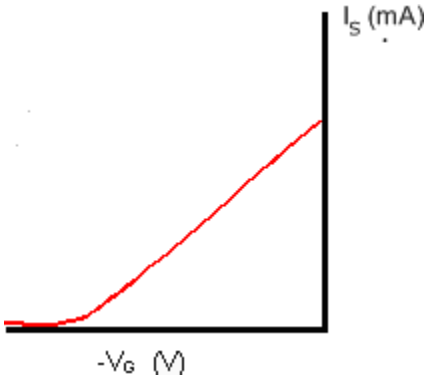
V_G	I_S (V_{DD}=4V)	I_S (V_{DD}=8V)

MODEL GRAPHS:

Drain Characteristics:



Transfer Characteristics:



PRECAUTIONS:

1. The supply voltage should not exceed the rating of the FET.
2. Connections must be tight.

VIVA-VOCE Questions:

1. What are the advantages of CD configuration?
2. What are the applications?
3. Why is it called source follower?
4. Can you name the analogous configuration in transistors?

13. Characteristics of Phototransistor

AIM: To obtain the V-I characteristics of the given photo transistor.

APPARATUS:

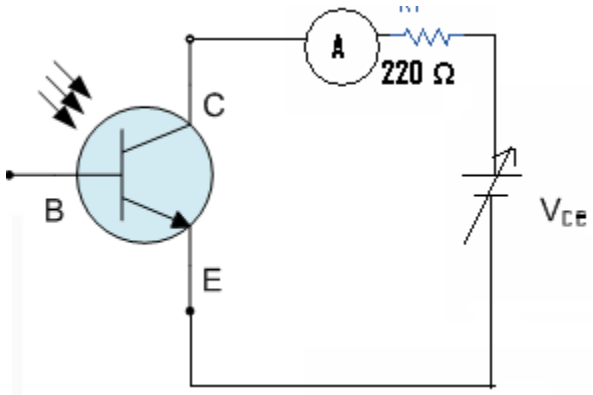
Photo transistor IR 3MM 935NM

R.P.S (O-30V) 2Nos

Resistors 220ohm

Bread board and connecting wires

CIRCUIT DIAGRAM:



THEORY:

The photo transistor is a 3 terminal device which gives an electrical current as output if an input light excitation is provided. It works in reverse bias. When reverse biased along with the reverse bias current I_{CO}, the light current I_L is also added to the total output current. The amount of current flow depends on the input light intensity given as excitation. Phototransistor is basically a photodiode with amplification and operates by exposing its base region to the light source.

Phototransistor light sensors operate the same as photodiodes except that they can provide current gain and are much more sensitive than the photodiode with currents are 50 - 100 times greater than that of the standard photodiode. Phototransistors consist mainlyofbipolar NPN transistor with the collector-base PN-junction reverse-biased. The phototransistor's large base region is left electrically unconnected and uses photons of light to generate a base current which in turn causes a collector to emitter current to flow.

PROCEDURE:

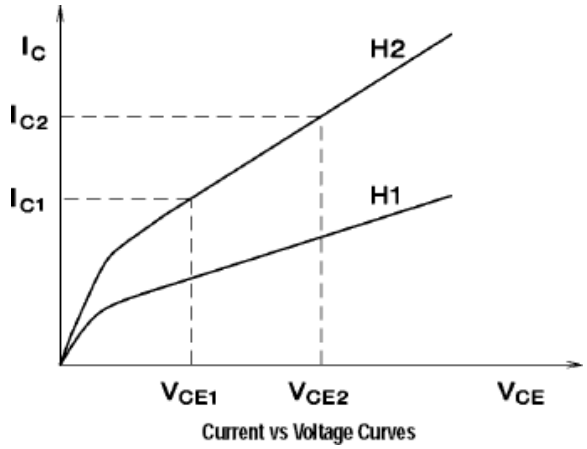
1. Connect the circuit as per the circuit diagram.
2. Keep the input light excitation fixed. Then vary the V_{ce} in steps of 1V till the maximum voltage rating of the transistor is reached and then note down the corresponding values of $I_{c.}$
3. Tabulate the readings. For various values of input excitation record the values of Vce and Ic and plot the characteristics of the phototransistor.

OBSERVATIONS:

Characteristics:

V_{ce} (V)	I_c (mA)

MODEL GRAPH:



Current vs Voltage Curves

PRECAUTIONS:

1. The photo transistor must be given a proper excitation for a reasonable current flow.
2. Connections must be tight.

VIVA-VOCE Questions:

1. What are the applications of phototransistor?
2. When does the photo transistor conduct?
3. What is the input excitation in a phototransistor?

14. DESIGN AND VERIFICATION OF FIXED BIAS AND COLLECTOR TO BASE BIAS CIRCUITS

AIM: 1. To design a fixed bias circuit and observe stability by changing β of the given transistor in CE configuration.

2. To design a collector to base bias circuit and observe stability by changing β of the given transistor in CE configuration.

APPARATUS:

Transistors (BC 107) with different β values

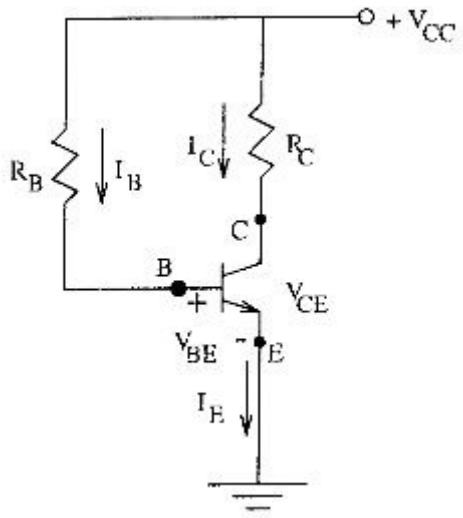
R.P.S (O-30V) 2 No.s

Resistors (from design values)

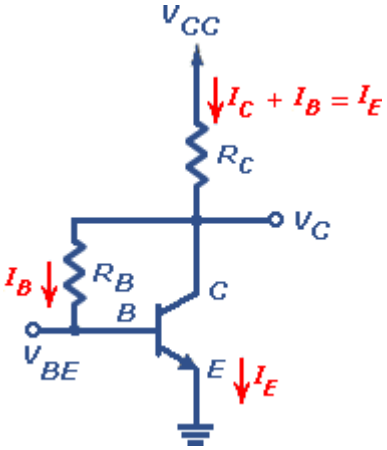
Bread board and connecting wires

CIRCUIT DIAGRAM:

Fixed Bias Circuit



Collector-to-base bias circuit



CALCULATIONS:

Fixed Bias Circuit

Given V_{CC}=10V, I_C=4mA, V_{CE}=6V,

V_{BE}=0.6V $I_C=I_B/\beta$

$R_B=(V_{CC}-$

$V_{BE})/I_BR_C=(V_C$

$_C-V_{CE})/I_C$

Collector-to-base bias circuit

Given V_{CC}=10V, I_C=4mA, V_{CE}=6V,

V_{BE}=0.6V $I_C=I_B/\beta$

$R_C=(V_{CC}-V_{CE})/(I_B+I_C)$

$R_B=\{(V_{CC}-V_{BE}-I_CR_C)\beta\}/I_C - R_C$

PROCEDURE:

1. Assemble the circuit on breadboard with design values of R_C, R_B and β.
2. Apply V_{CC} and measure V_{CE} and V_{BE} and record the readings in thetable.
3. Without changing bias resistors, change the transistors with other β values and repeat the above step.
4. Repeat the above steps using the collector to base bias circuit and tabulate all the readings.

OBSERVATIONS:

Fixed Bias

β value	V_{CE}	V_{BE}	$I_C=(V_{CC}-V_{CE})/R_C$

Collector to base bias

β value	V_{CE}	V_{BE}	$I_C=(V_{CC}-V_{CE})/R_C - I_B$

PRECAUTIONS:

1. The supply voltage should not exceed the rating of thetransistor
2. Meters should be connected properly according to theirpolarities

VIVA-VOCE Questions:

1. What are the applications of fixed biasconfiguration?
2. What are the applications of collector to base biasconfiguration?
3. What are the disadvantages of fixed biasconfiguration?
4. How to overcome the disadvantages of fixed biasconfiguration.

15. DESIGN AND VERIFICATION OF CURRENT SOURCE BIAS CIRCUITS

AIM: 1. To design a current bias circuit and observe stability by changing β of the given transistor in CEconfiguration.

APPARATUS:

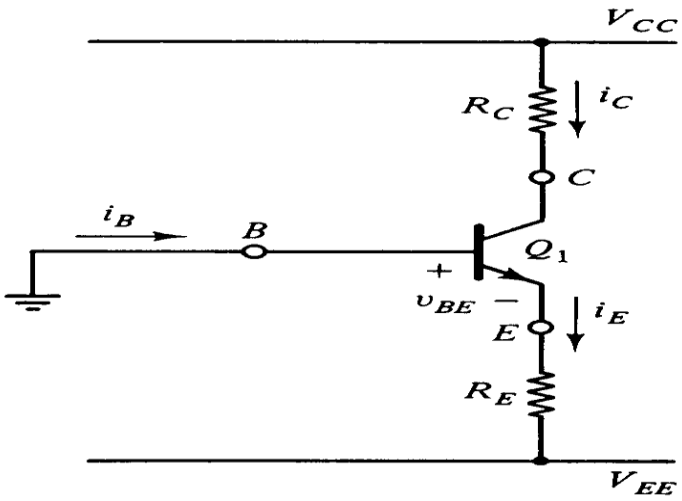
Transistors (BC 107) with different β values

R.P.S(O-30V) 2 No.s

Resistors (from designvalues)

Bread board and connecting wires

CIRCUIT DIAGRAM:



THEORY:

Integrated circuits have transistors which are manufactured simultaneously with the same device parameters (parameters from chip to chip will vary) • As a result, different bias techniques are employed than in discrete designs • One common technique is current source biasing, which allows the designer to take advantage of matched devices •

We will begin by looking at some simple current source circuits • A current source is not a "naturally" occurring device. It can be simulated by a network of transistors and circuit elements

CALCULATIONS:

Given V_{CC}=10V, I_C=4mA, V_{CE}=6V,

V_{BE}=0.6V $I_C=I_B/\beta$

$R_B=(V_{CC}-$

$V_{BE})/I_BR_C=(V_C$

$_C-V_{CE})/I_C$

$I_E = -V_{EE}- V_{BE}/R_E$

PROCEDURE:

1. Assemble the circuit on breadboard with design values of R_C, R_B and β.
2. Apply V_{CC} and measure V_{CE} and V_{BE} and record the readings in the table.
3. Without changing bias resistors, change the transistors with other β values and repeat the above step.
4. Repeat the above steps using the collector to base bias circuit and tabulate all the readings.

OBSERVATIONS:

β value	**V_{CE}**	**V_{BE}**	**$I_C=(V_{CC}-V_{CE})/R_C$**

PRECAUTIONS:

1. The supply voltage should not exceed the rating of the transistor
2. Meters should be connected properly according to their polarities

VIVA-VOCE Questions:

1. What are the applications of current bias configuration?
2. What are the disadvantages of current bias configuration?
3. How to overcome the disadvantages of current bias configuration.

Experiment Beyond The Syllabus

EXPERIMENT-1

HALF-WAVE RECTIFIER WITH AND WITHOUT FILTER

AIM: To examine the input and output waveforms of halfwave Rectifier and also Calculate its load regulation and ripple factor.

1. With Filter
2. Without Filter

APPARATUS:

Digital Multimeter	-1No.
Transformer (6V-0-6V)	-1No.
Diode, 1N4007	-1No.
Capacitor 100µf/470µf	-1No.
Decade Resistance Box	-1No.
Breadboard	
CRO and CRO probes	
Connecting wires	

THEORY:

In Half Wave Rectification, When AC supply is applied at the input, only Positive Half Cycle appears across the load whereas, the negative Half Cycle is suppressed. How this can be explained as follows:

During positive half-cycle of the input voltage, the diode D1 is in forward bias and conducts through the load resistor R_L. Hence the current produces an output voltage across the load resistor R_L, which has the same shape as the +ve half cycle of the input voltage.

During the negative half-cycle of the input voltage, the diode is reverse biased and there is no current through the circuit. i.e., the voltage across R_L is zero. The net result is that only the +ve half cycle of the input voltage appears across the load. The average value of the half wave rectified o/p voltage is the value measured on dc voltmeter.

For practical circuits, transformer coupling is usually provided for two reasons.

1. The voltage can be stepped-up or stepped-down, as needed.
2. The ac source is electrically isolated from the rectifier. Thus preventing shock hazards in the secondary circuit.

The efficiency of the Half Wave Rectifier is40.6%

Theoretical calculations for Ripple factor:
Without Filter:

Vrms=Vm/2

Vm = 2Vrms

Vdc = Vm/Π

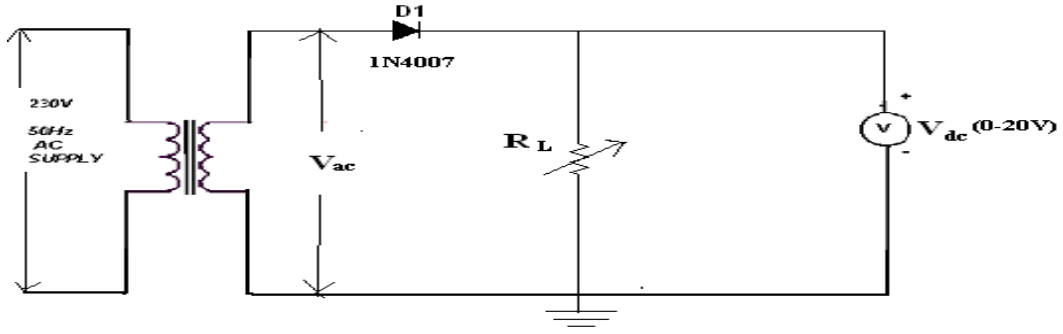
Ripple factorr=$\sqrt{(Vrms/Vdc)^2}$-1=1.21 Ripple

With Filter:

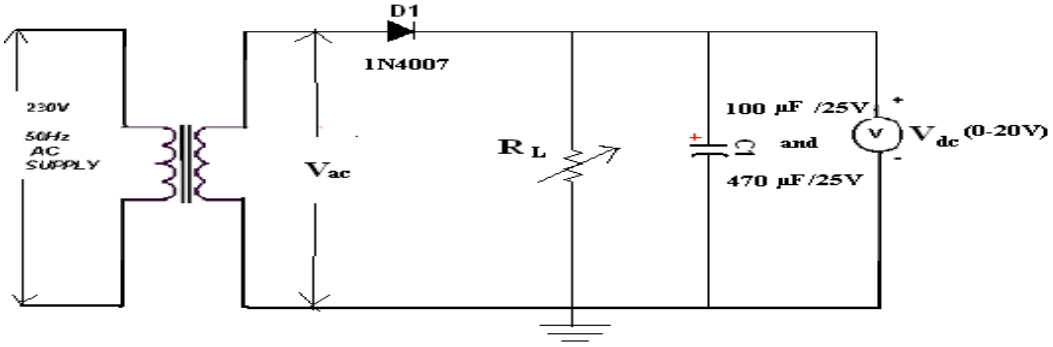
factor, r = 1/ (2√3 f C R)

CIRCUIT DIAGRAM:

A) Half Wave Rectifier Without Filter:

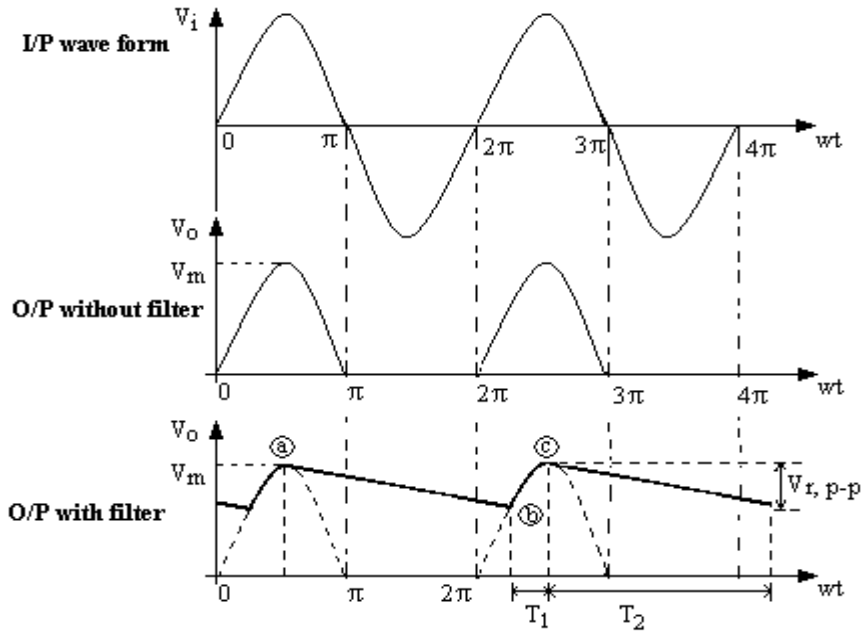


B) <u>Half Wave Rectifier With Filter</u>:



MODELWAVEFORMS:

WAVEFORMS:



Half-wave Rectifier with capacitor filter wave form

PROCEDURE:

1. Connections are made as per the circuit diagram.
2. Connect the primary side of the transformer to ac mains and the secondary side to the rectifier input.
3. By the multi meter, measure the ac input voltage of the rectifier and, ac and dc voltage at the output of the rectifier.
4. Find the theoretical value of dc voltage by using the formula,

   Vdc=Vm/Π

   Where, Vm=2Vrms, (Vrms=output ac voltage.)
5. The Ripple factor is calculated by using the formula r= ac

   output voltage/dc output voltage.

WITHOUT FILTER:

V no load Voltage (Vdc) = V

S.No	Load Resistance R_L kilo-ohms	O/P Voltage (Vo) V_{ac} (V)	O/P Voltage (Vo) V_{dc} (V)	Ripple factor $\left(\gamma = \frac{V_{ac}}{V_{dc}}\right)$	% of Regulation $\left(\frac{V_{NL}-V_{FL}}{V_{NL}} * 100\%\right)$
1	1				
2	2				
3	3				
4	4				
5	5				
6	6				
7	7				
8	8				

WITH CAPACITOR FILTER:

V no load Voltage (Vdc) = V

S.No	Load Resistance R_L kilo-ohms	O/P Voltage (Vo) V_{ac} (V)	O/P Voltage (Vo) V_{dc} (V)	Ripple factor $\left(\gamma = \frac{V_{ac}}{V_{dc}}\right)$	% of Regulation $\left(\frac{V_{NL}-V_{FL}}{V_{NL}} * 100\%\right)$
1	1				
2	2				
3	3				
4	4				
5	5				
6	6				
7	7				
8	8				

REGULATION CHARACTERSTICS:

1. Connections are made as per the circuit diagram.
2. By increasing the value of the rheostat, the voltage across the load and current flowing through the load are measured.
3. The reading is tabulated.
4. From the value of no-load voltages, the % regulation is calculated using the formula,

%Regulation = $[(V_{NL}-V_{FL}) /V_{FL}]*100$

PRECAUTIONS:

1. The primary and secondary side of the transformer should be carefully identified
2. The polarities of all the diodes should be carefully identified.
3. While determining the % regulation, first full load should be applied and then it should be decremented in steps

RESULT:

VIVA-VOCE QUESTIONS:

1. What is the PIV of Half wave rectifier?
2. What is the efficiency of half wave rectifier?
3. What is the rectifier?
4. What is the difference between the half wave rectifier and Full Wave Rectifier?
5. What is the o/p frequency of Bridge Rectifier?
6. What are the ripples?
7. What is the function of the filters?
8. What is TUF?
9. What is the average value of o/p voltage for HWR?
10. What is the peak factor?

EXPERIMENT-2
FULL-WAVERECTIFIER WITH AND WITHOUT FILTER

AIM: To examine the input and output wave forms of Full Wave Rectifier and also calculate its load regulation and ripple factor.

1. With Filter
2. Without Filter

APPARATUS:

Digital multimeters	-1No.
Transformer (6V-0-6V)	-1No.
Diode, 1N4007	-2No.
Capacitor 100µf/470µf	-1No.
Decade Resistance Box	-1No.
Breadboard	
CRO and CRO probes	
Connecting wires	

THEORY:

The circuit of a center-tapped full wave rectifier uses two diodesD1&D2. During positive half cycle of secondary voltage (input voltage), the diode D1 is forward biased and D2 is reverse biased. So the diode D1 conducts and current flows through load resistor R_L.

During negative half cycle, diode D2 becomes forward biased and D1 reverse biased. Now, D2 conducts and current flows through the load resistor R_L in the same direction. There is a continuous current flow through the load resistor R_L, during both the half cycles and will get unidirectional current as show in the model graph. The difference between full wave and half wave rectification is that a full wave rectifier allows unidirectional (one way) current to the load during the entire 360 degrees of the input signal and half-wave rectifier allows this only during one half cycle (180 degree).

THEORITICAL CALCULATIONS:

$V_{rms}=V_m/\sqrt{2}$
$V_m = V_{rms}\sqrt{2}$
$V_{dc} = 2V_m/\Pi$

(i) Without filter:

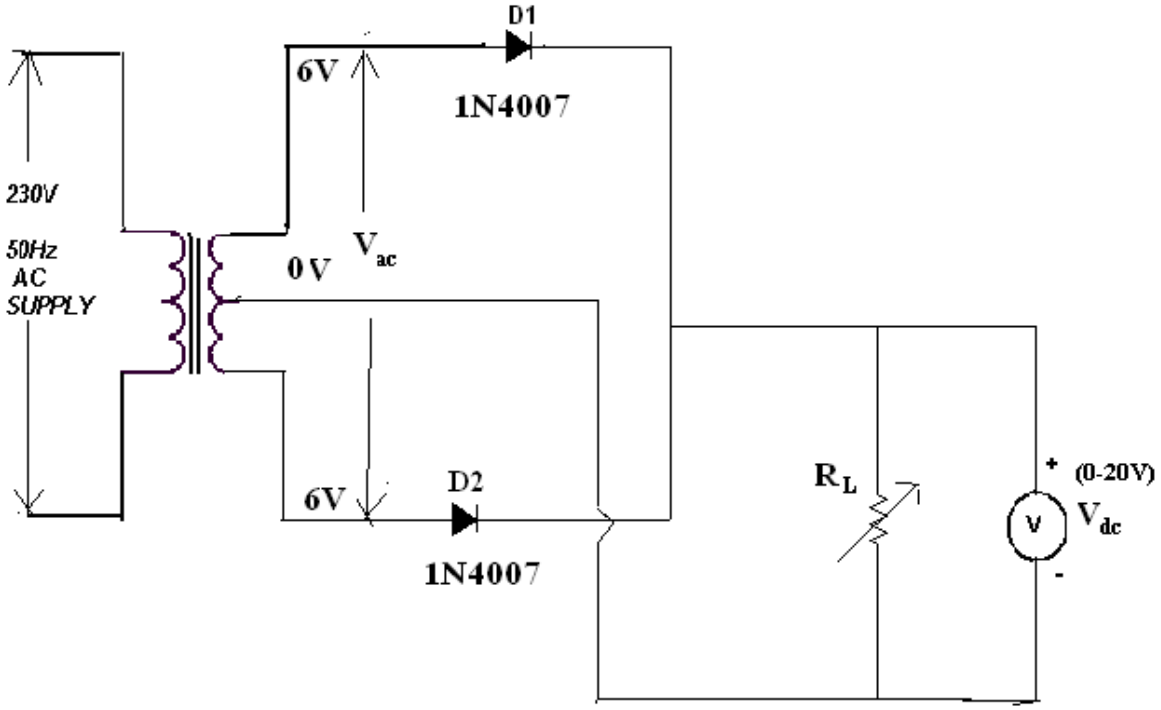
Ripple factor, $r=\sqrt{(V_{rms}/V_{dc})^2-1} = 0.812$

(ii) With filter:

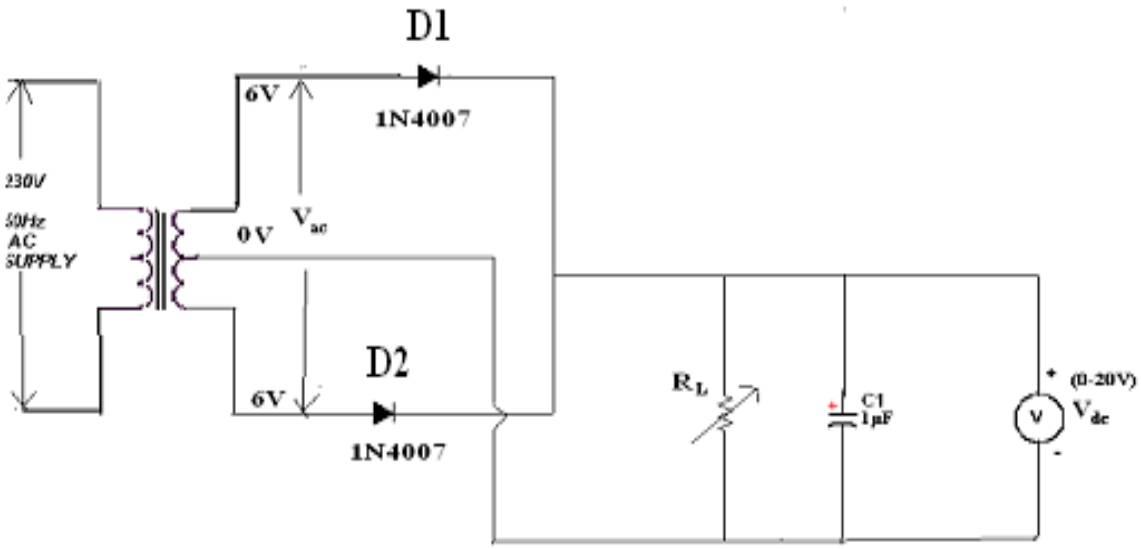
Ripple factor, $r =1/ (4\sqrt{3}fC R_L)$

CIRCUIT DIAGRAM:

A) FULLWAVE RECTIFIER WITH OUT FILTER:

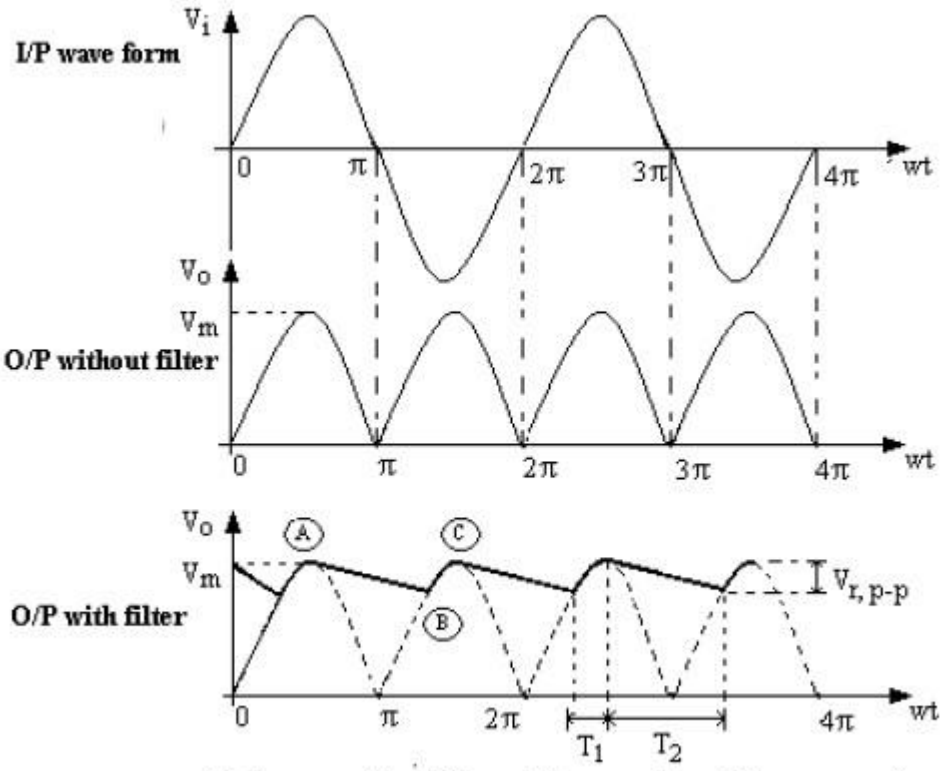


B) FULL WAVE RECTIFIER WITH FILTER:



MODEL WAVE FORMS:

A) WAVEFORMS:



Full-wave Rectifier with capacitor filter wave form

WITHOUT FILTER:

V no load Voltage (Vdc) = V

S.No	Load Resistance R_L kilo-ohms	O/P Voltage (Vo) V_{ac} (V)	O/P Voltage (Vo) V_{dc} (V)	Ripple factor $\left(\gamma = \frac{V_{ac}}{V_{dc}}\right)$	% of Regulation $\left(\frac{V_{NL}-V_{FL}}{V_{NL}} * 100\%\right)$
1	1				
2	2				
3	3				
4	4				
5	5				
6	6				
7	7				
8	8				
	.				

WITH CAPACITOR FILTER:

V no load Voltage (Vdc) = V

S.No	Load Resistance R_L kilo-ohms	O/P Voltage (Vo) V_{ac} (V)	O/P Voltage (Vo) V_{dc} (V)	Ripple factor $\left(\gamma = \frac{V_{ac}}{V_{dc}}\right)$	% of Regulation $\left(\frac{V_{NL}-V_{FL}}{V_{NL}} * 100\%\right)$
1	1				
2	2				
3	3				
4	4				
5	5				
6	6				
7	7				
8	8				
	.				

PROCEDURE:

1. Connections are made as per the circuit diagram.
2. Connect the ac mains to the primary side of the transformer and the secondary side to the rectifier.
3. Measure the ac voltage at the input side of the rectifier.
4. Measure both ac and dc voltages at the output side the rectifier.
5. Find the theoretical value of the dc voltage by using the formula Vdc=2Vm/Π
6. Connect the filter capacitor across the load resistor and measure the values ofVac and Vdc at the output.

7. The theoretical values of Ripple factors with and without capacitor are calculated.
8. From the values of Vac and Vdc practical values of Ripple factors are calculated. The practical values are compared with theoretical values.

PRECAUTIONS:

1. The primary and secondary side of the transformer should be carefully identified.
2. The polarities of all the diodes should be carefully identified.

RESULT:

VIVA-VOCE QUESTIONS:

1. Define regulation of the full wave rectifier?
2. Define peak inverse voltage (PIV)? And write its value for Full-wave rectifier?
3. If one of the diode is changed in its polarities what wave form would you get?
4. Does the process of rectification alter the frequency of the waveform?
5. What is ripple factor of the Full-wave rectifier?
6. What is the necessity of the transformer in the rectifier circuit?
7. What are the applications of a rectifier?
8. What is meant by ripple and define Ripple factor?
9. Explain how capacitor helps to improve the ripple factor?
10. Can a rectifier made in INDIA (V=230v,f=50Hz)be used in USA(V=110v, f=60Hz)?