Measurement of Phase using I.T.B. (Slip-1)

HSC Board Questions Slip (Use of CRO)

a) Apply input to CRO from signal generator and show it to the examiner. Calculate frequency of the observed waveform. **(5)**

b) Given R1 = _____, C1 = _____, f = _____. R2 = _____, C2 = _____, f = _____. Determine phase for each combination using ITB. It must be between 30° and 60°. **(5)**

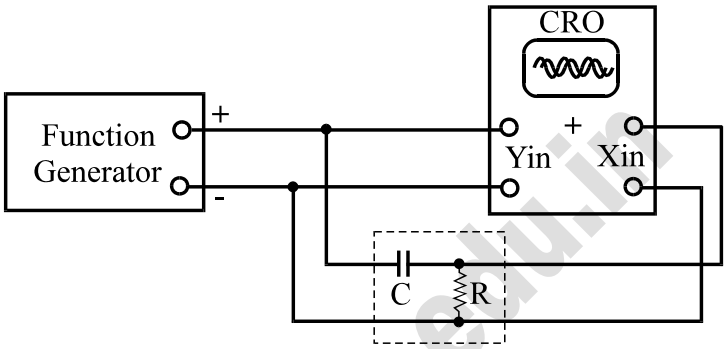
c) Calculate the phase difference between two observed signals. **(5)**

d) Determine the phase difference between two signals by calculations. **(5)**

e) Compare the theoretical and practical values by tabulating them. **(5)**

f) Oral **(5)**

Connection diagram –

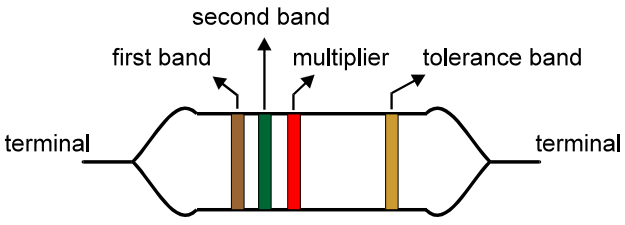


Phase measurement using internal time base

Specifications of components –

Type of component	Specifications
Resistors	1kΩ, 2.2kΩ, 4.7kΩ, or any other resistor values, all ¼W, carbon composition, ±5% tolerance
Capacitor	0.01μF/32V, 0.1μF/32V, all polyester capacitors
CRO	Dual trace CRO
Function generator	Sine wave function generator

Color code configuration of a *carbon* resistor –



Measurement of Phase using Lissajou's figures (Slip-2)

HSC Board Questions Slip (Use of CRO)

a) Apply input to CRO from signal generator and show it to the examiner. Calculate frequency of the observed waveform. **(5)**

b) Given R1 = _____, C1 = _____, f = _____. R2 = _____, C2 = _____, f = _____. Determine phase for each combination using LP. It must be between 30° and 60°. **(5)**

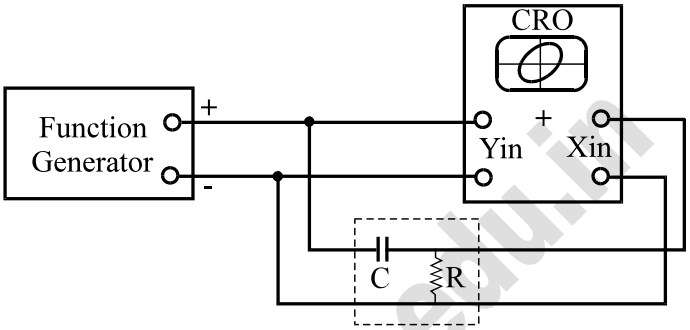
c) Calculate the phase difference between two observed signals. **(5)**

d) Determine the phase difference between two signals by calculations. **(5)**

e) Compare the theoretical and practical values by tabulating them. **(5)**

f) Orals **(5)**

Connection diagram –

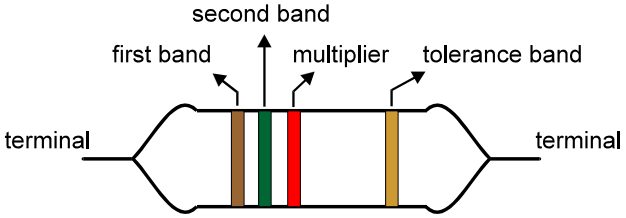


Phase measurement using Lissajou's figures

Specifications of components –

Type of component	Specifications
Resistors	1kΩ, 2.2kΩ, 4.7kΩ, or other resistor values, all ¼W, carbon composition, ±5% tolerance
Capacitor	0.01μF/32V, 0.1μF/32V, all polyester capacitors
CRO	Dual trace CRO
Function generator	Sine wave function generator

Color code configuration of resistor –



Measurement of Phase using I.T.B. & L. F. (Slip-3)

HSC Board Questions Slip (Use of CRO)

a) Apply input to CRO from signal generator and show it to the examiner. Calculate frequency of the observed waveform. **(5)**

b) Given R1 = _____, C1 = _____
Determine phase change for 3 different frequencies using ITB. Between 30° and 60°. **(5)**

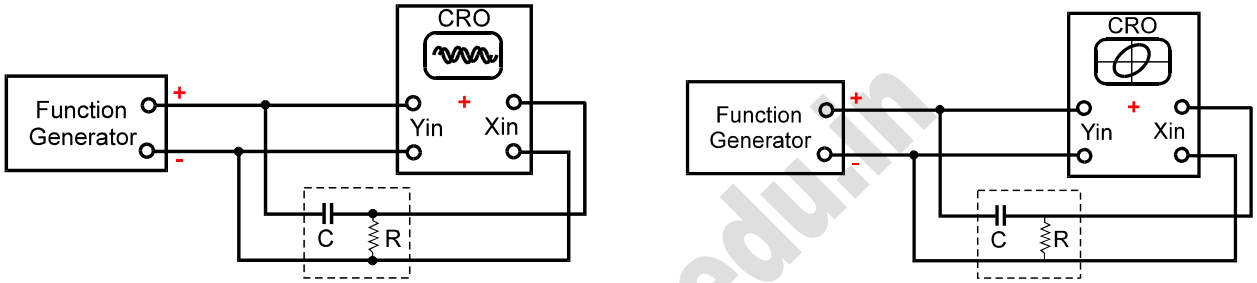
c) Determine phase change for 3 different frequencies by Lissajou's figures. **(5)**

d) Determine the phase difference by calculations. **(5)**

e) Compare the phase difference obtained by Lissajou's figures and ITB. **(5)**

f) Oral **(5)**

Connection diagram –

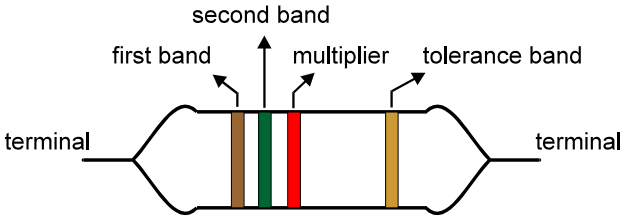


Phase measurement using Lissajou's figure & internal time base

Specifications of components –

Type of component	Specifications
Resistors	1kΩ, 2.2kΩ, 4.7kΩ, or any other resistor values, all ¼W, carbon composition, ±5% tolerance
Capacitor	0.01μF/32V, 0.1μF/32V, all polyester capacitors
CRO	Dual trace CRO
Function generator	Sine wave function generator

Color code configuration of resistor –



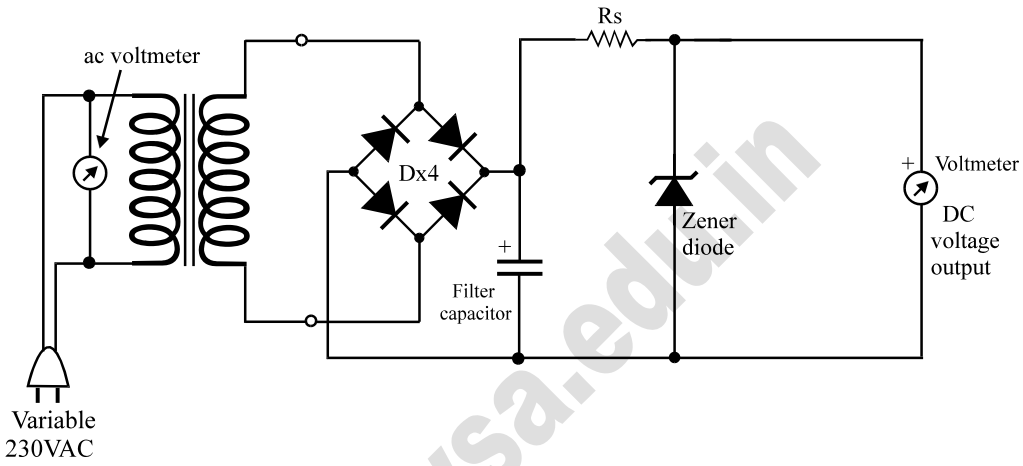
Zener Regulator

Line Regulation (Slip-4)

HSC Board Questions Slip (zener regulator)

a) Draw circuit diagram and assemble the circuit for zener regulator with BR and filter. **(5)**
b) Write the specifications of the components used in the circuit. **(5)**
c) Connect the circuit & measure voltage across zener for different input voltages across filter. **(5)**
d) Plot the graph of input voltage versus output voltage, between (170V to 270V). **(5)**
e) Calculate percentage line regulation. **(5)**
f) Oral **(5)**

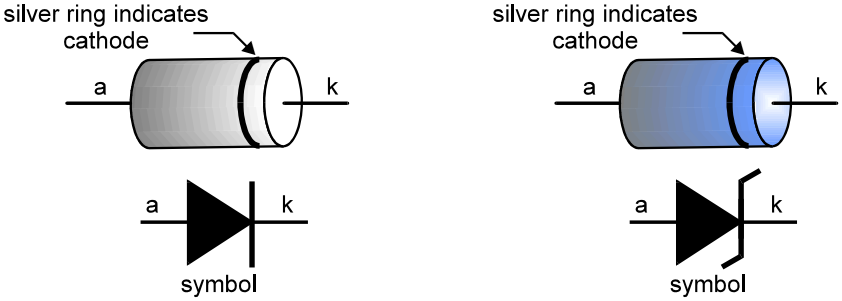
Circuit diagram –



Specifications of components –

Type of component	Specifications
Resistor	47Ω, ¼W, carbon composition, ±5% tolerance
LED	color _____ , VF = _____
Diodes	1N4001 rectifier diode
Zener diode	5.6V, 400mW zener diode
Capacitor	1000μF/25V electrolytic capacitor
Transformer	6V–0V–6V, 500mA secondary transformer
Dimmerstat	170V to 270V variable dimmerstat

Pin configuration –



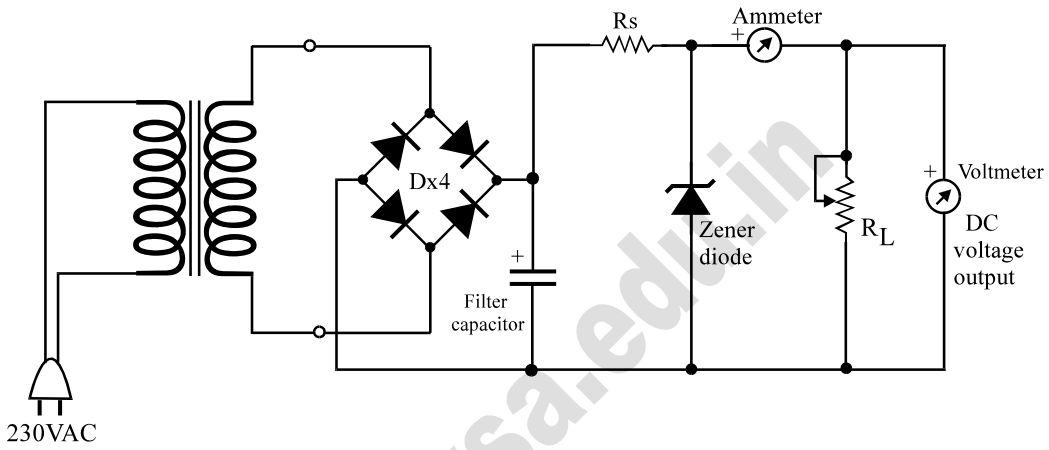
Zener Regulator

Load Regulation (Slip-5)

HSC Board Questions Slip (zener regulator)

a) Draw circuit diagram and assemble the circuit for zener regulator with BR and filter. **(5)**
b) Write the specifications of the components used in the circuit. **(5)**
c) Connect the circuit & measure voltage across zener for different loads. **(5)**
d) Plot the graph of output voltage versus load current. **(5)**
e) Calculate percentage load regulation. **(5)**
f) Oral **(5)**

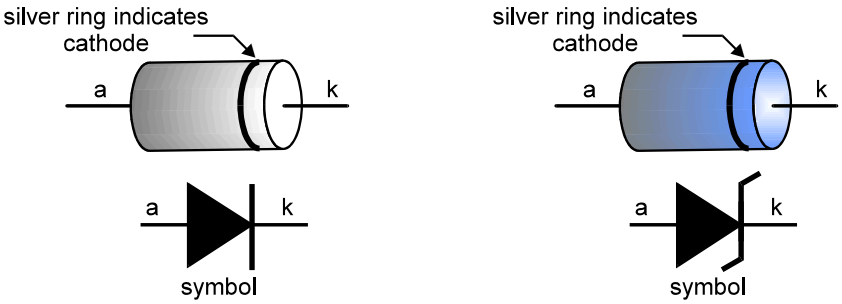
Circuit diagram –



Specifications of components –

Type of component	Specifications
Resistor	47Ω, ¼W, carbon composition, ±5% tolerance
LED	color _____ , VF = _____
Diodes	1N4001 rectifier diode
Zener diode	5.6V, 400mW zener diode
Capacitor	1000μF/25V electrolytic capacitor
Transformer	6V–0V–6V, 500mA secondary transformer
Dimmerstat	170V to 270V variable dimmerstat

Pin configuration –



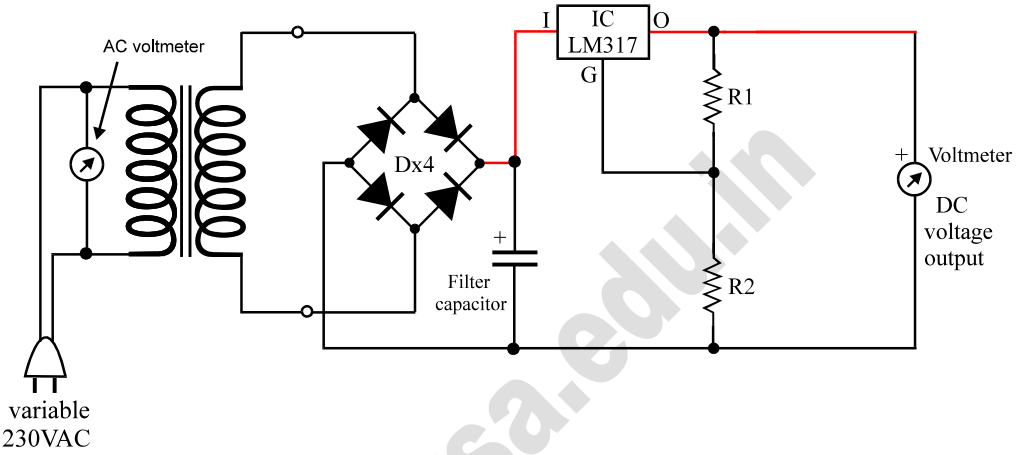
LM317 Regulator
Line Regulation (Slip-6)

High Voltage Experiment

HSC Board Questions Slip (LM317 voltage regulator)

a) Draw circuit diagram and assemble the circuit for LM317 with BR and filter. **(5)**
b) Write the specifications with pin diagram for the components used in the circuit. **(5)**
c) Calculate value of R1 & R2 for Vout = _____ and measure output for various line voltages. **(5)**
d) Plot the graph of input voltage versus output voltage, between (170V to 270V). **(5)**
e) Calculate percentage line regulation. **(5)**
f) Oral **(5)**

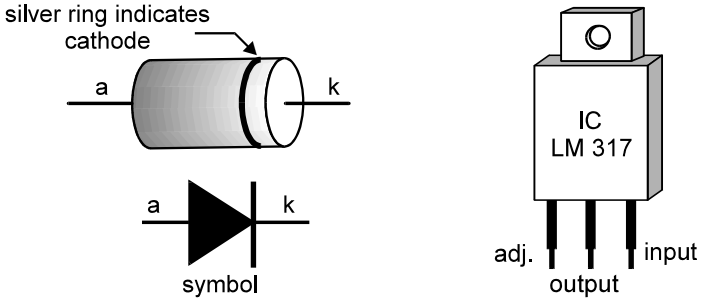
Circuit diagram –



Specifications of components –

Type of component	Specifications
IC LM 317	Adjustable 3–terminal +ve voltage regulator IC, Vo_{min} = 1.2V, Vo_{max} = 37V, I_{Lmax} = 1.5A, SR = 0.01%, LR = 0.1% *(typical values)*, RR = 80dB, internal short circuit protection.
Resistors	R1 = 100Ω, R2 = ____Ω, all ¼W, carbon, ±5% tolerance
Diodes, LED	1N4001 rectifier diode, color _____ , VF = _____
Capacitor	1000μF/25V electrolytic capacitor
Transformer	6V–0V–6V, 500mA secondary transformer
Dimmerstat	170V to 270V variable dimmerstat

Pin configuration –

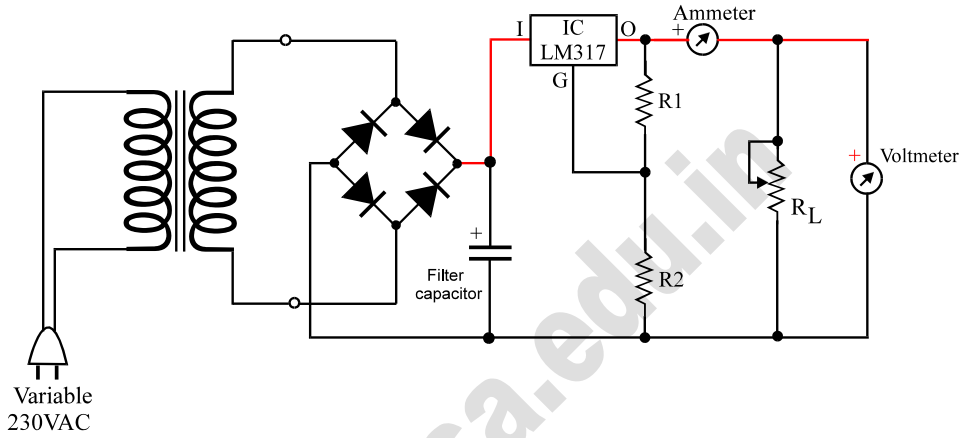


LM317 Regulator
Load Regulation (Slip-7)

HSC Board Questions Slip (LM 317 voltage regulator)

a) Draw circuit diagram and assemble the circuit for LM317 with BR and filter. (5)
b) Write the specifications with pin diagram for the components used in the circuit. (5)
c) Calculate value of R1 & R2 for Vout = _____ and measure output current for various loads. (5)
d) Plot the graph of input voltage versus output voltage. (5)
e) Calculate percentage load regulation. (5)
f) Oral (5)

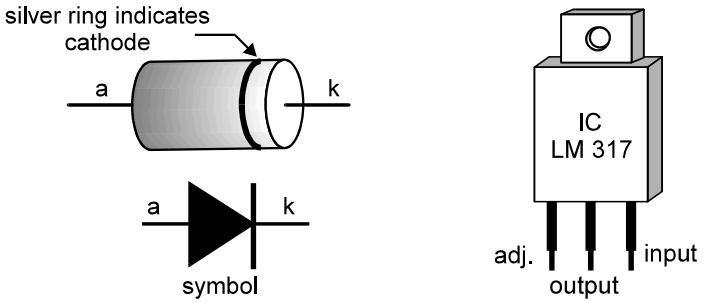
Circuit diagram –



Specifications of components –

Type of component	Specifications
IC LM 317	Adjustable 3–terminal +ve voltage regulator IC, Vo_{min} = 1.2V, Vo_{max} = 37V, I_{Lmax} = 1.5A SR = 0.01%, LR = 0.1% *(typical values)*, RR = 80dB, internal short circuit protection.
Resistors	R1 = 100Ω, R2 = ____Ω, all ¼W, carbon, ±5% tolerance
Diodes, LED	1N4001 rectifier diode, color _____ , VF = _____
Capacitor	1000μF/25V electrolytic capacitor
Transformer	6V–0V–6V, 500mA secondary transformer
Dimmerstat	170V to 270V variable dimmerstat

Pin configuration –

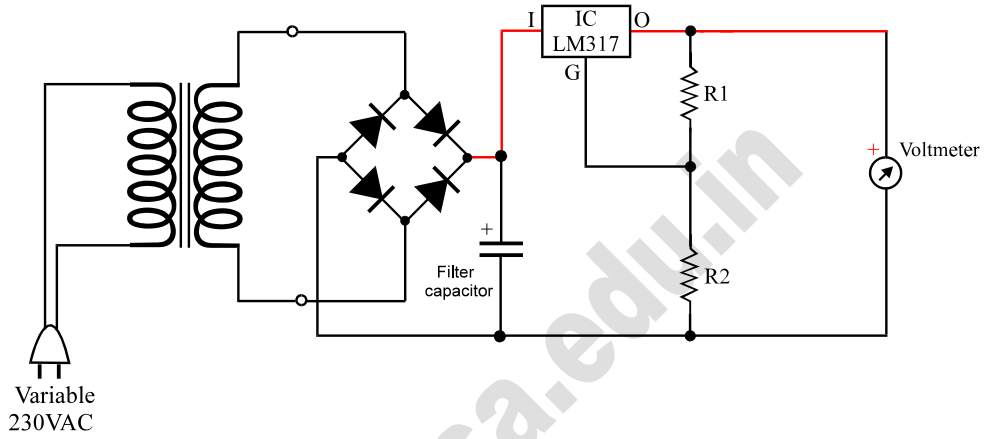


LM317 Regulator
Calculate R_1 & R_2 (Slip-8)

HSC Board Questions Slip (LM 317 voltage regulator)

a) Draw circuit diagram and assemble the circuit for LM317 with BR and filter. **(5)**
b) Write the specifications with pin diagram for the components used in the circuit. **(5)**
c) Calculate output voltage for various combinations of R1 and R2 (at least 5 combinations). **(5)**
d) Measure output voltage for each of the above combinations. **(5)**
e) Compare calculated and observed output voltages and find difference between them. **(5)**
f) Oral **(5)**

Circuit diagram –



Specifications of components –

Type of component	Specifications
IC LM 317	Adjustable 3–terminal +ve voltage regulator IC, Vo_{min} = 1.2V, Vo_{max} = 37V, I_{Lmax} = 1.5A SR = 0.01%, LR = 0.1% *(typical values)*, RR = 80dB, internal short circuit protection.
Resistors	R1 = 100Ω, R2 = ____Ω, all ¼W, carbon, ±5% tolerance
Diodes, LED	1N4001 rectifier diode, color _____ , VF = _____
Capacitor	1000μF/25V electrolytic capacitor
Transformer	6V–0V–6V, 500mA secondary transformer
Dimmerstat	170V to 270V variable dimmerstat

Pin configuration –

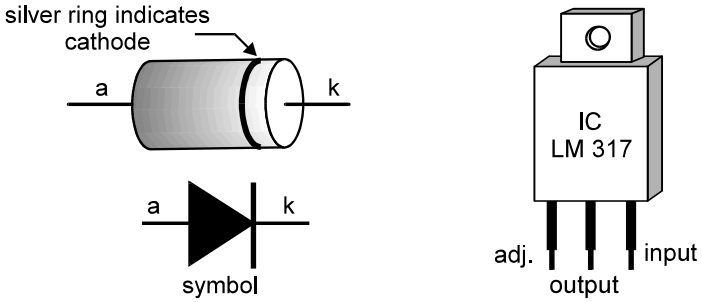


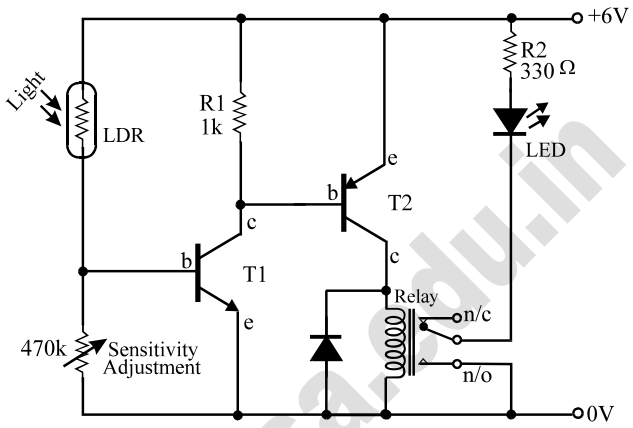
Photo Relay

Measurement of Voltages (Slip-10)

HSC Board Questions Slip (LM 317 voltage regulator)

a) Draw circuit diagram of photo relay. **(5)**
b) Enlist the components used with their specifications. **(5)**
c) Assemble the circuit on a tag board. **(5)**
d) Test the circuit under different light conditions so that relay switches ON & OFF and measure the voltages at base and collector of the transistor used for both conditions. **(5)**
e) From above readings comment whether the transistors are in cut off or active or saturation. **(5)**
f) Oral **(5)**

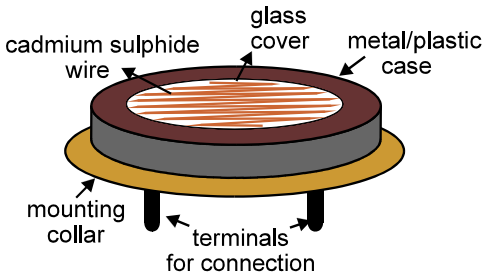
Circuit diagram –

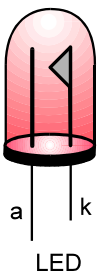


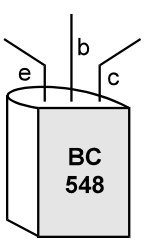
Specifications of components –

Type of the component	Specifications
Diodes	1N4001, silicon rectifier diode
BC 148	Small signal amplifier, silicon NPN transistor, (Gain = 100)
SL 100	Medium power silicon PNP transistor, (Gain = 50)
Capacitor	1000μF/25V electrolytic capacitor
Resistors	1kΩ series resistor, carbon type
LDR	Dark resistance _____Ω, light resistance ____ Ω.
Relay	6V, _____ Ω, single changeover type relay coil
Potentiometer	470kΩ, carbon composition type
Transformer	230V/6V, 500mA step down type

Pin configuration –







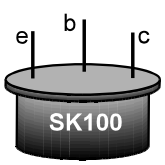


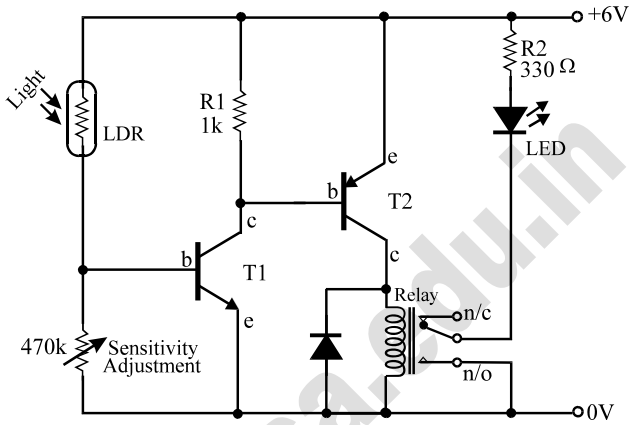
Photo Relay

Measurement of V & I (Slip-11)

HSC Board Questions Slip (LM 317 voltage regulator)

a) Draw circuit diagram of photo relay. **(5)**
b) Enlist the components used with their specifications. **(5)**
c) Assemble the circuit on a tag board. **(5)**
d) Test the circuit under different light conditions so that relay switches ON & OFF and measure the voltages across various points and determine current through various paths. **(10)**
e) Orals **(5)**

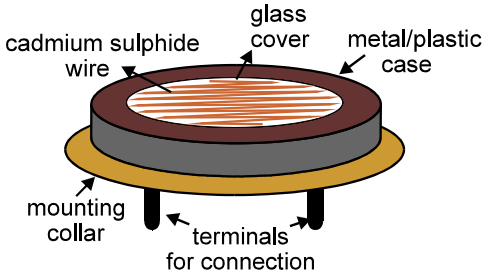
Circuit diagram –

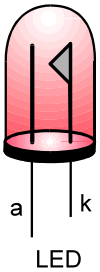


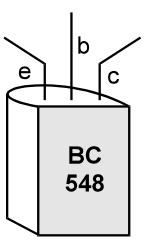
Specifications of components –

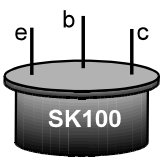
Type of the component	Specifications
Diodes	1N4001, silicon rectifier diode
BC 148	Small signal amplifier, silicon NPN transistor, (Gain = 100)
SL 100	Medium power silicon PNP transistor, (Gain = 50)
Capacitor	1000μF/25V electrolytic capacitor
Resistors	1kΩ series resistor, carbon type
LDR	Dark resistance _____Ω, light resistance ____ Ω.
Relay	6V, _____ Ω, single changeover type relay coil
Potentiometer	470kΩ, carbon composition type
Transformer	230V/6V, 500mA step down type

Pin configuration –







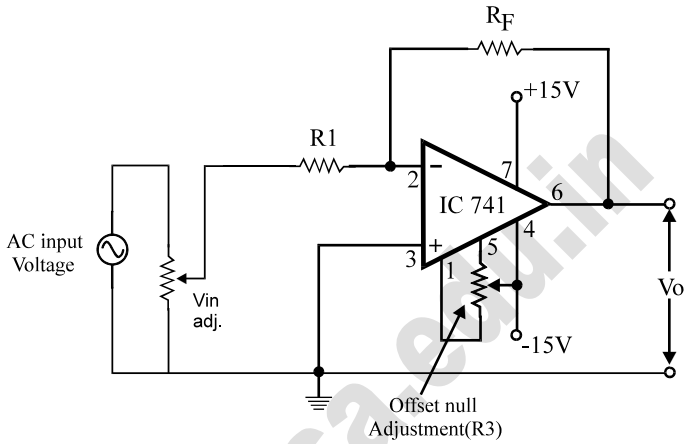


Inverting Amplifier
AC voltages (Slip-13)

HSC Board Questions Slip (Inverting Opamp)

a) Draw the circuit diagram of inverting configuration of opamp. Write typical specifications. **(7)**
b) Do offset nulling. **(3)**
c) Determine Rf and Ri for three different values of gain _____, _____, _____ **(5)**
d) Adjust ac input voltage and measure output voltages and determine the gain. **(5)**
e) Compare the calculated and observed gain in tabular form. **(5)**
f) Orals **(5)**

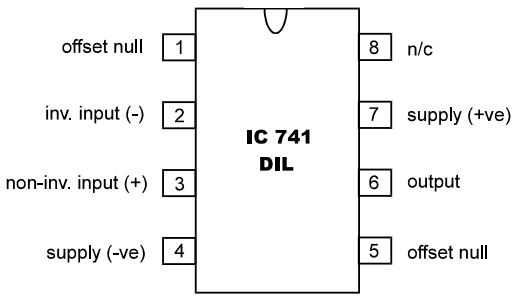
Circuit diagram –

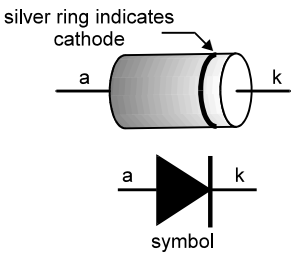


Specifications of components –

Type of the component	Specifications
Diodes	1N4001, silicon rectifier diode
IC 741	Operational amplifier, Supply voltage = ±18Vmax, Input offset voltage = 2mV, input bias current = 80nA, CMRR = 90dB, input impedance = 2MΩ Output impedance = 75Ω, slew rate = 0.5V/μsec.
Capacitor	1000μF/25V electrolytic capacitor
Resistors	10kΩ, 5kΩ, 3.3kΩ, carbon type ±5% tolerance
Potentiometer	10kΩ, carbon composition type
Transformer	230V/6–0–6V, 500mA step down, center tapped

Pin configuration –



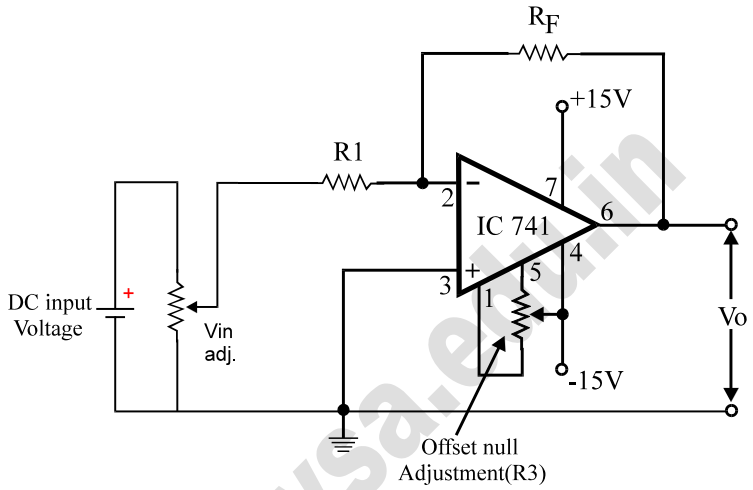


Inverting Amplifier
DC voltages (Slip-14)

HSC Board Questions Slip (Inverting Opamp)

a) Draw the circuit diagram of inverting configuration of opamp. Write typical specifications. (7)
b) Do offset nulling. (3)
c) Determine Rf and Ri for three different values of gain _____, _____, _____ (5)
d) Determine output voltage for at least 3 dc input voltages for each of gain and compare calculated and observed gains. (5)
e) Determine maximum input voltage that can be applied without output getting saturated. (5)
f) Orals (5)

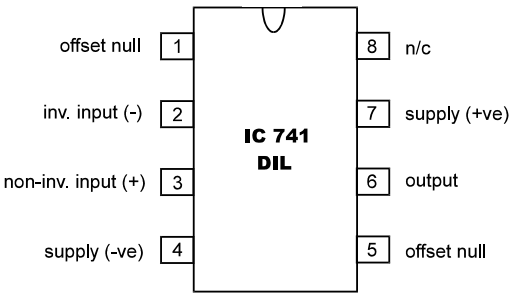
Circuit diagram –

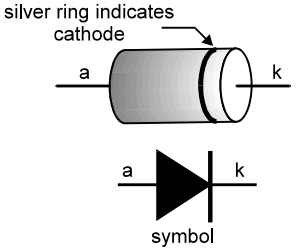


Specifications of components –

Type of the component	Specifications
Diodes	1N4001, silicon rectifier diode
IC 741	Operational amplifier, Supply voltage = ±18Vmax, Input offset voltage = 2mV, CMRR = 90dB, Ri = 2MΩ, Ro = 75Ω, slew rate = 0.5V/μsec.
Capacitor	1000μF/25V electrolytic capacitor
Resistors	10kΩ, 5kΩ, 3.3kΩ, carbon type ±5% tolerance
Potentiometer	10kΩ, carbon composition type
Transformer	230V/6–0–6V, 500mA step down, center tapped

Pin configuration –



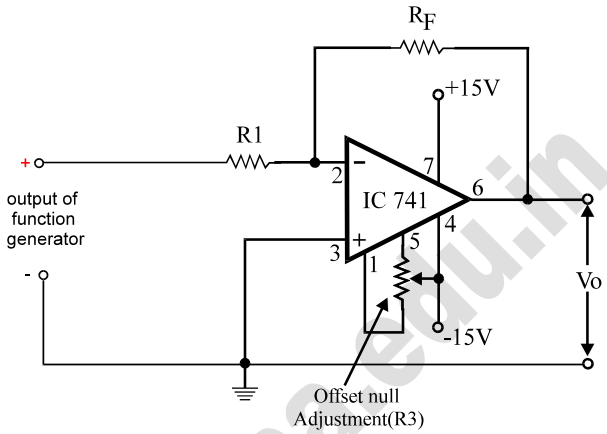


Inverting Amplifier
Frequency Response (Slip-15)

HSC Board Questions Slip (Inverting Opamp)

a) Draw the circuit diagram of inverting configuration of opamp. Write typical specifications. **(7)**
b) Do offset nulling. **(3)**
c) Determine Rf and Ri for the gain _____ **(5)**
d) Apply various frequencies to its input and find gain (e.g. 10Hz, 100Hz, 1kHz, 5kHz, 10kHz). **(5)**
e) Plot a graph of gain versus frequency (on semi–log graph paper) and find the maximum frequency up to which gain remains constant. **(5)**
f) Orals **(5)**

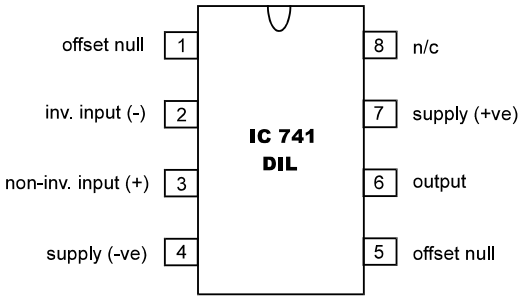
Circuit diagram –

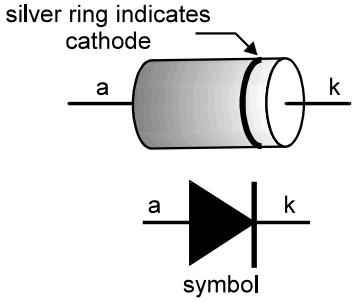


Specifications of components –

Type of the component	Specifications
Diodes	1N4001, silicon rectifier diode
IC 741	Operational amplifier, Supply voltage = ±18Vmax, Input offset voltage = 2mV, input bias current = 80nA, CMRR = 90dB, input impedance = 2MΩ Output impedance = 75Ω, slew rate = 0.5V/μsec.
Capacitor	1000μF/25V electrolytic capacitor
Resistors	10kΩ, 5kΩ, 3.3kΩ, carbon type ±5% tolerance
Potentiometer	10kΩ, carbon composition type
Transformer	230V/6–0–6V, 500mA step down, center tapped

Pin configuration –



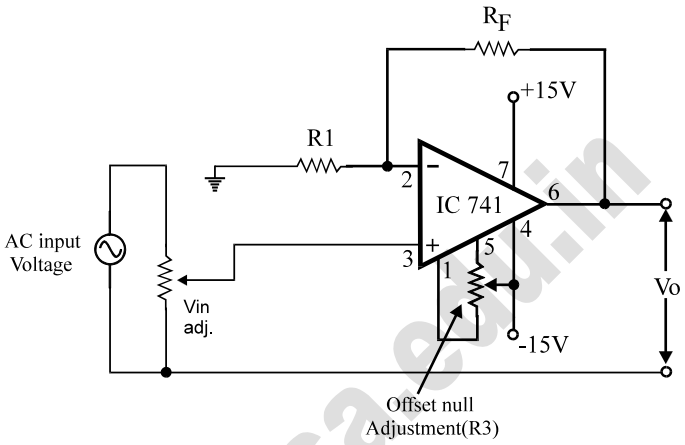


Non-inverting Amplifier
AC voltages (Slip-16)

HSC Board Questions Slip (Non–inverting Opamp)

a) Draw circuit diagram of non–inverting configuration of opamp. Write typical specifications. **(7)**
b) Do offset nulling. **(3)**
c) Determine Rf and Ri for three different values of gain _____, _____, _____ **(5)**
d) Adjust ac input voltage and measure output voltages and determine the gain. **(5)**
e) Compare the calculated and observed gain in tabular form. **(5)**
f) Orals **(5)**

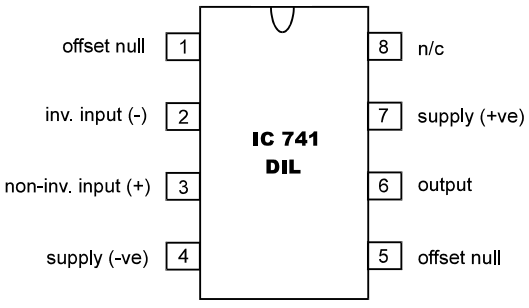
Circuit diagram –

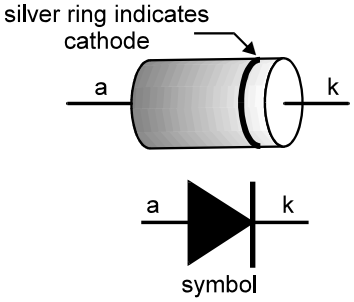


Specifications of components –

Type of the component	Specifications
Diodes	1N4001, silicon rectifier diode
IC 741	Operational amplifier, Supply voltage = ±18Vmax, Input offset voltage = 2mV, input bias current = 80nA, CMRR = 90dB, input impedance = 2MΩ Output impedance = 75Ω, slew rate = 0.5V/μsec.
Capacitor	1000μF/25V electrolytic capacitor
Resistors	10kΩ, 5kΩ, 3.3kΩ, carbon type ±5% tolerance
Potentiometer	10kΩ, carbon composition type
Transformer	230V/6–0–6V, 500mA step down, center tapped

Pin configuration –



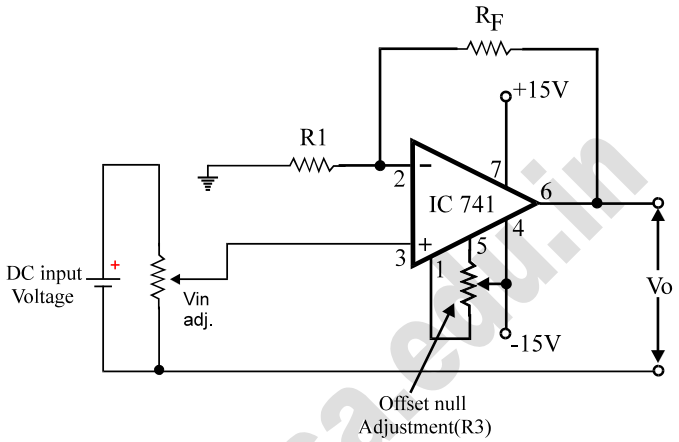


Non-inverting Amplifier
DC voltages (Slip-17)

HSC Board Questions Slip (Non–inverting Opamp)

a) Draw circuit diagram of non-inverting configuration of opamp. Write typical specifications. **(7)**
b) Do offset nulling. **(3)**
c) Determine Rf and Ri for three different values of gain _____, _____, _____ **(5)**
d) Determine output voltage for at least 3 dc input voltages for each of gain and compare calculated and observed gains. **(5)**
e) Determine maximum input voltage that can be applied without output getting saturated. **(5)**
f) Orals **(5)**

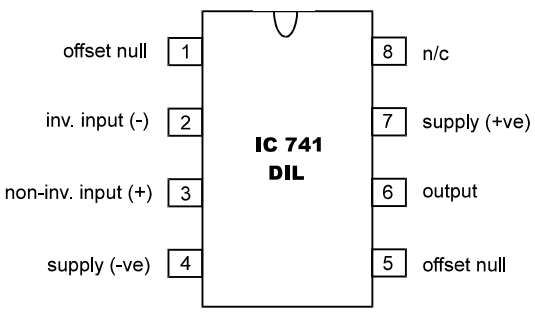
Circuit diagram –

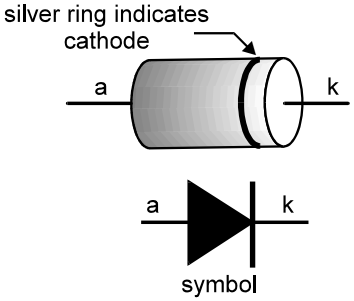


Specifications of components –

Type of the component	Specifications
Diodes	1N4001, silicon rectifier diode
IC 741	Operational amplifier, Supply voltage = ±18Vmax, Input offset voltage = 2mV, input bias current = 80nA, CMRR = 90dB, input impedance = 2MΩ Output impedance = 75Ω, slew rate = 0.5V/μsec.
Capacitor	1000μF/25V electrolytic capacitor
Resistors	10kΩ, 5kΩ, 3.3kΩ, carbon type ±5% tolerance
Potentiometer	10kΩ, carbon composition type
Transformer	230V/6–0–6V, 500mA step down, center tapped

Pin configuration –



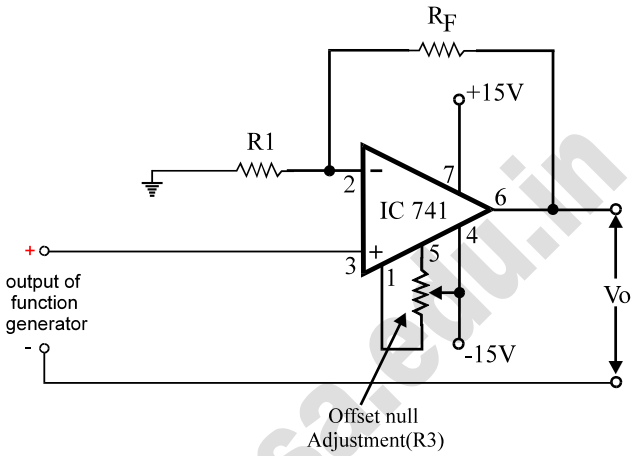


Non-inverting Amplifier
Frequency Response (Slip-18)

HSC Board Questions Slip (Non–inverting Opamp)

g) Draw circuit diagram of non–inverting configuration of opamp. Write typical specifications. **(7)**
h) Do offset nulling. **(3)**
i) Determine Rf and Ri for the gain _____ **(5)**
j) Apply various frequencies to its input and find gain (e.g. 10Hz, 100Hz, 1kHz, 5kHz, 10kHz). **(5)**
k) Plot a graph of gain versus frequency (on semi–log graph paper) and find the maximum frequency up to which gain remains constant. **(5)**
l) Orals **(5)**

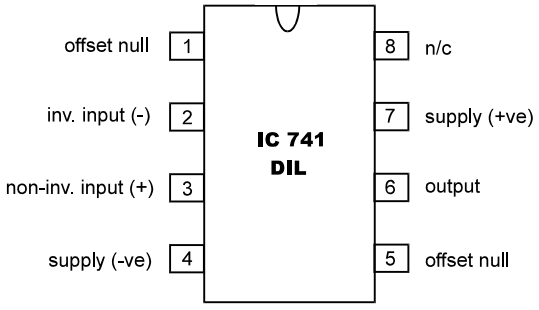
Circuit diagram –

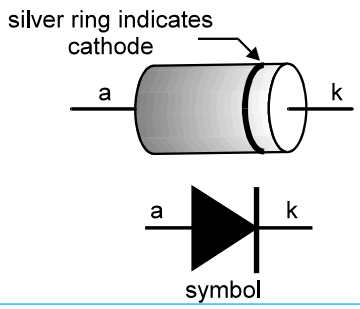


Specifications of components –

Type of the component	Specifications
Diodes	1N4001, silicon rectifier diode
IC 741	Operational amplifier, Supply voltage = ±18Vmax, Input offset voltage = 2mV, input bias current = 80nA, CMRR = 90dB, input impedance = 2MΩ Output impedance = 75Ω, slew rate = 0.5V/μsec.
Capacitor	1000μF/25V electrolytic capacitor
Resistors	10kΩ, 5kΩ, 3.3kΩ, carbon type ±5% tolerance
Potentiometer	10kΩ, carbon composition type
Transformer	230V/6–0–6V, 500mA step down, center tapped

Pin configuration –



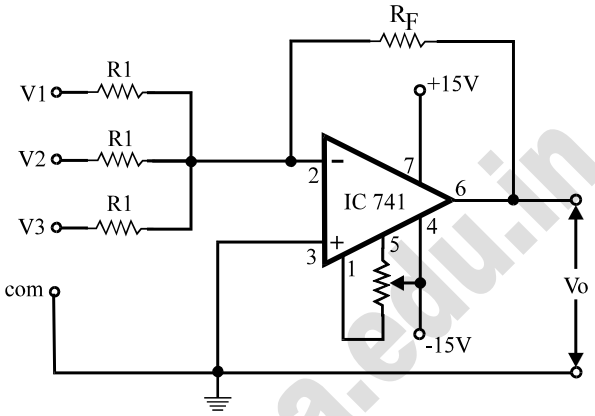


Inverting Adder (Slip-19)

HSC Board Questions Slip (Inverting Adder)

a) Draw circuit diagram of inverting adder (gain=1) with 3 inputs. Write typical specifications. **(7)**
b) Do offset nulling adjustment. **(3)**
c) For different values of input voltages, find the output voltage, (at least 5 combinations of V1, V2 and V3 including negative voltages). **(5)**
d) Compare the observed output voltages with calculated voltages. **(5)**
e) Adjust V1, V2 and V3 such that output is zero for all non–zero input voltages. **(5)**
f) Orals **(5)**

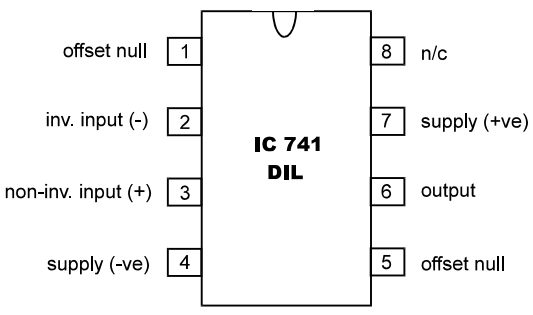
Circuit diagram –

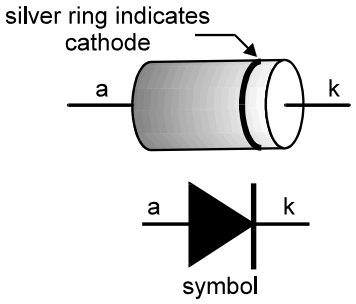


Specifications of components –

Type of the component	Specifications
Diodes	1N4001, silicon rectifier diode
IC 741	Operational amplifier, Supply voltage = ±18Vmax, Input offset voltage = 2mV, input bias current = 80nA, CMRR = 90dB, input impedance = 2MΩ Output impedance = 75Ω, slew rate = 0.5V/μsec.
Capacitor	1000μF/25V electrolytic capacitor
Resistors	10kΩ, 5kΩ, 3.3kΩ, carbon type ±5% tolerance
Potentiometer	10kΩ, carbon composition type
Transformer	230V/6–0–6V, 500mA step down, center tapped

Pin configuration –



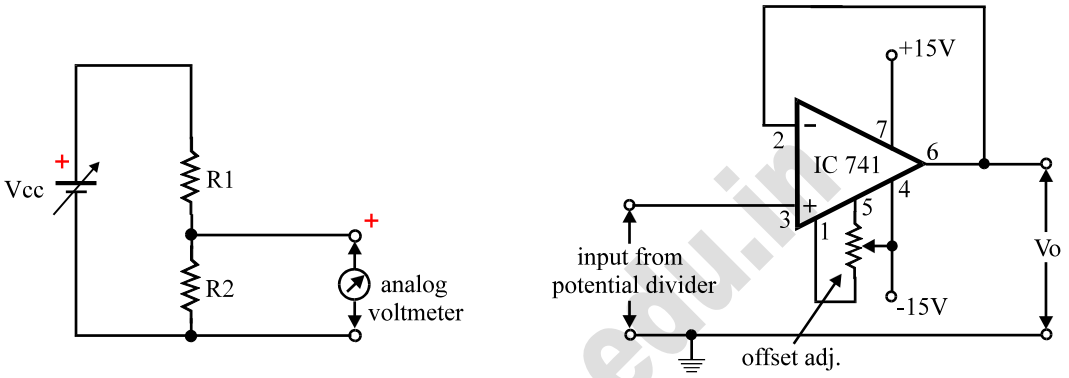


Buffer (Slip-21)

HSC Board Questions Slip (Buffer)

a) Draw circuit diagram of opamp as buffer. Write typical specifications. **(7)**
b) Do offset nulling adjustment. **(3)**
c) Connect potential divider across PS with high resistance value (R1=R2=100k). Calculate and measure using AMM, the voltage across one of the resistors (R2). **(5)**
d) Build the circuit of buffer. Apply various inputs and measure the output using DMM. **(5)**
e) Measure voltage across R2 through the buffer and compare the voltages. **(5)**
f) Orals **(5)**

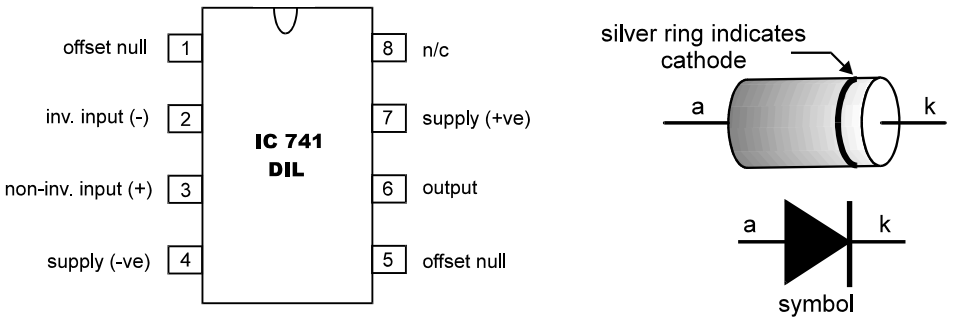
Circuit diagram –



Specifications of components –

Type of the component	Specifications
Diodes	1N4001, silicon rectifier diode
IC 741	Operational amplifier, Supply voltage = ±18Vmax, Input offset voltage = 2mV, input bias current = 80nA, CMRR = 90dB, input impedance = 2MΩ Output impedance = 75Ω, slew rate = 0.5V/μsec.
Capacitor	1000μF/25V electrolytic capacitor
Resistors	10kΩ, 5kΩ, 3.3kΩ, carbon type ±5% tolerance
Potentiometer	10kΩ, carbon composition type
Transformer	230V/6–0–6V, 500mA step down, center tapped

Pin configuration –

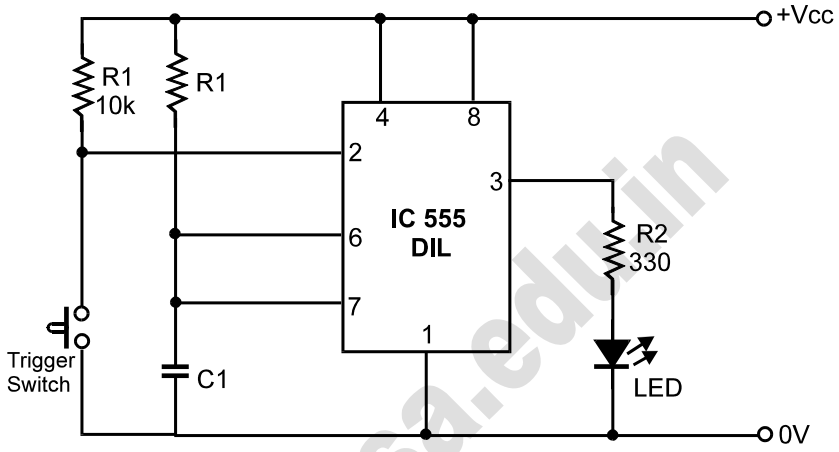


Monostable Multivibrator (Slip-26)

HSC Board Questions Slip (Monostable Multivibrator)

a) Draw the circuit diagram of MMV using IC 555. **(5)**
b) Design the value of R & C for period of T = _____ sec. **(5)**
c) Construct the circuit. **(5)**
d) Measure the period T for which output remains high (take at least 3–4 readings and find their average. **(5)**
e) Compare the calculated and observed time. **(5)**
f) Orals **(5)**

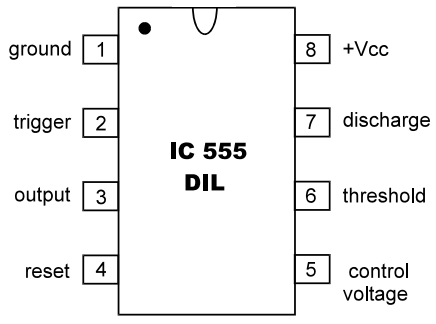
Circuit diagram –

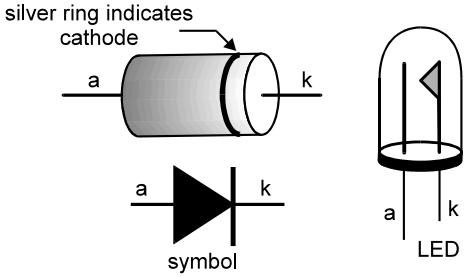


Specifications of components –

Type of the component	Specifications
Diodes	1N4001, silicon rectifier diode
IC 555	Timer IC, Supply voltage = ±18Vmax
LED	Color _____, VF _____
Capacitors	1000μF/25V, 10μF/63V, electrolytic capacitor
Resistors	100kΩ, 220kΩ, 330kΩ, 470kΩ 1MΩ, all carbon type ±5% tolerance
Transformer	230V/6–0–6V, 500mA step down, center tapped

Pin configuration –



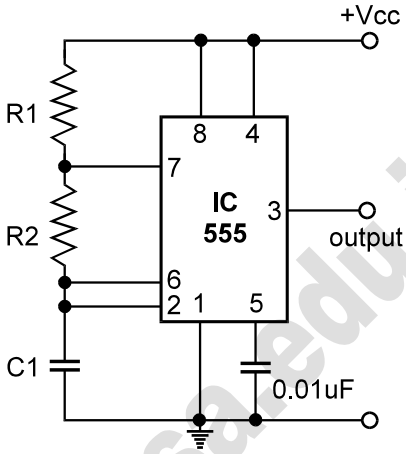


Astable Multivibrator (Slip-27)

HSC Board Questions Slip (Astable Multivibrator)

a) Draw the circuit diagram of AMV using IC 555. (5)
b) Design Ra and Rb and C for the frequency F = _____ and Duty cycle D = _____. (5)
c) Construct the circuit. (5)
d) Measure the frequency and duty cycle on CRO. Trace the waveform. (5)
e) Compare the calculated frequency with observed frequency. (5)
f) Orals (5)

Circuit diagram –



Specifications of components –

Type of the component	Specifications
Diodes	1N4001, silicon rectifier diode
IC 555	Timer IC, Supply voltage = ±18Vmax
LED	Color _____, VF _____
Capacitors	1000μF/25V, 10μF/63V, electrolytic capacitor
Resistors	100kΩ, 220kΩ, 330kΩ, 470kΩ 1MΩ, all carbon type ±5% tolerance
Transformer	230V/6–0–6V, 500mA step down, center tapped

Pin configuration –