III BSC SEMESTER-VI

RENEWABLE ENERGY

PHYSICS PRACTICAL MANUAL

(PAPER VII)

2022-2023

(Old Syllabus)

Department of Physics

Sri Y.N.College (A)

Narsapur

III BSc (VI Sem) Practical Time Table

2021 - 22

1. Measurement of V-I characteristics of Solar cell.
2. Study of the effect of input Light intensity on the performance of Solar cell.
3. Constant of Ballistic Galvonameter by standard Condensen method.
4. Resonant frequency of phase shift Oscillator.
5. Study of characteristics of wind
6. Performance testing of Solar Cooker.

V-I characteristic of solar cell

Date 18-05-22

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Expt. No. 5

Aim:-

To study the V-I characteristics of solar cell

Apparatus:- 1, Solar panel trainer
2, Solar panel setup
3, patch chords

Theory and description:-

one solar cell is mounted on the box and connection brought out on mainals two meters are mounted on the font panes into measure the solar cell voltage and current different types of Load resistances selected using hand switch are also provided on the front panel.

The solar cell is a semi-conductor devices with requests. the solar energy into electrical energy. It is also calved a photo voltaic cell. A solar panel consists of no. of solar cell connected voltaic cell. A/solar voltage and current different types of load resistances selected using load switch in a series of panel quarcity the designed output current the connision of sun light into electrical energy take place body only when the light is following on the cells of the solar power batteries. In the sun light, the solar panel charges the battery and also supplies the power in the load directly when there is an sunlight, the charged battery supplies the required power to the load.

A solar cell operaties in same what the some manner are

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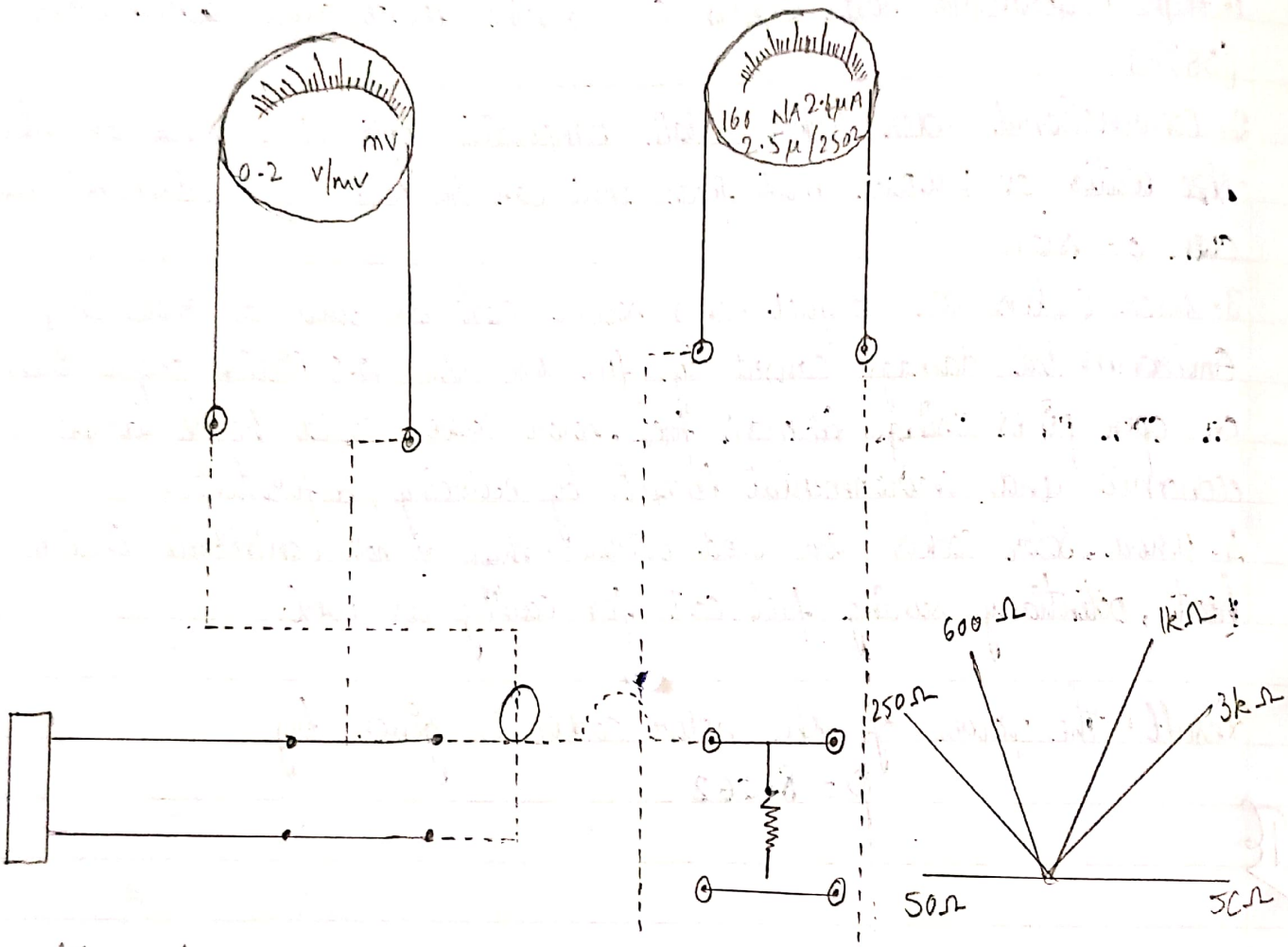
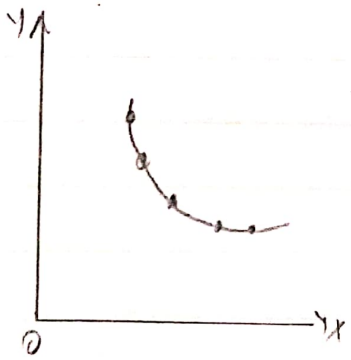


model graph:



junction photo detectors. A buities regin is aperated in that evithout an applied cause bais and photos is adequate energy creates hole electrons pairs in the solar cell. the pair must difference a consider-able distance in much the narrow depletion hence. there is higher probability of recomination the current generated by the separated pairs intrise the depletion region voltage where a load is connected photo current to flow through the load

procedure:-

1, place the solar cell a Light source (100 watt lamp) opposite to each other a wooker plank connect the circuit as shown by dotted uses through patch chords

2, Selett voltmeter range in 5v current meter range into 350 μA. Load resistance to 300Ω

3, Switch on the lamp to expose the light on solar cell

4, Set the distance b/w. solar cell a lamp in such away that current meter shows 250 μA. Deflection note down that other observations of voltage and current in table.

5, why. the load resistance through hand width and the current and voltage loadings way.

6, plot a graph b/w output voltage vs output current by deducing voltage along a anis and current along y-axis

when experiment is performed in sun light:-

1, Connect the circuit as shown my dotted lines throught patch chords.

Signature :

Voltmeter reading in volts	Ammeter reading in mA
0.5	5
1	4.9
1.5	4.8
2	4.7
2.5	4.5
3	4.3
3.5	4.1
4	3.7
4.5	3.5
5	3.0

Date

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2, the voltmeter range. the well current meter range 10mA it Load resistance to 300Ω

3, expose the sunlight on solar cell.

4, note down the observation of voltages and current

Input Light intensity

Date 18-05-22

Expt. No. 6

Page No. 15

Aim:- To study the effect of input light intensity on the performance of solar cell

Apparatus:-
1, Solar panal trailer
2, solar panal setup
3, patch chords
4, meelticolar

procedure:-
1. Connect the solar panal to the solar panal trainer using pin table
2. Switch on the Light
3. Connect the panel input P_1/P_2 to the voltmeter as given in the interfacing diagram
4. very the source input voltage with the help of intensity control unit
5, Measure the voltage in digital voltmeter and measure the intensity voltage

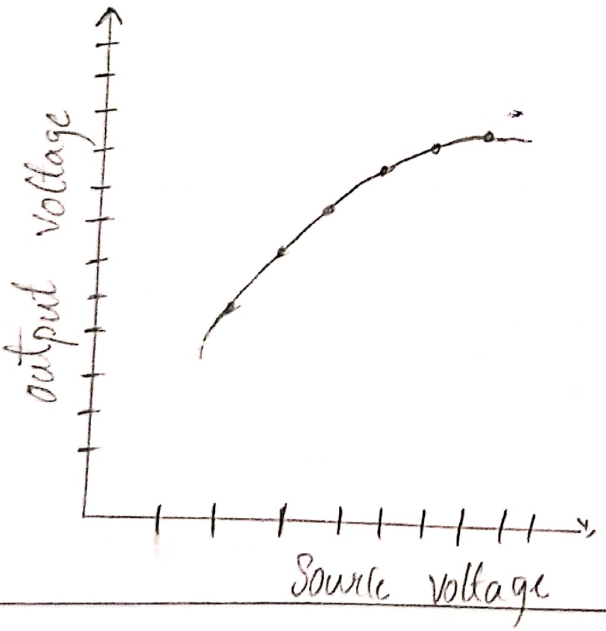
Current taking along x-axis is current along x-axis

Result:-
The v-I characteristics of solar cell is verified

Signature :

Source voltage / Intensity ($T_{25} - T_{20}$)	out put voltage (C·pv panel)
1.5	4.36
2	5.35
2.5	5.52
3	5.66
3.5	5.7
4	5.76
4.5	5.75
5	5.78
5.5	5.82
6	5.91
6.5	5.93
7	5.94
7.5	5.97
8	5.97
8.5	5.99

graph:-



Ballastic galvanometer

Date 13-4-22

Expt. No. 1

Page No. 1

Aim:-

To determine the constant of ballistic galvanometer by standard condenser method.

Apparatus:-

A battery, a stand condenser, ballistic galvanometer, two resistance boxes (1 to 500 ohm), commutator charge and discharge key (C.C.D.R), plug key and connecting wires

Formula:- $K = \frac{CE}{(P+Q)\theta} \times 10^6$ Micro coulomb/m.m

where K = constant of the B.G

E = E.M.F of the battery (1.5 volt)

P, Q = resistanes

C = capacitance of the condensor

θ = corrected throw for damping

Some important Instruments used In this experiment:-

b, ch

1, charge and discharge key (C.D.K):- when ever a condenser is used in a galvanometer circuit, then the charge and discharge key is used. It consists of three terminals, namely (1) common 2, charging terminal and 3, discharging terminal ~~and~~ the common C.D.K is connecting in the circuit as shown in the figure

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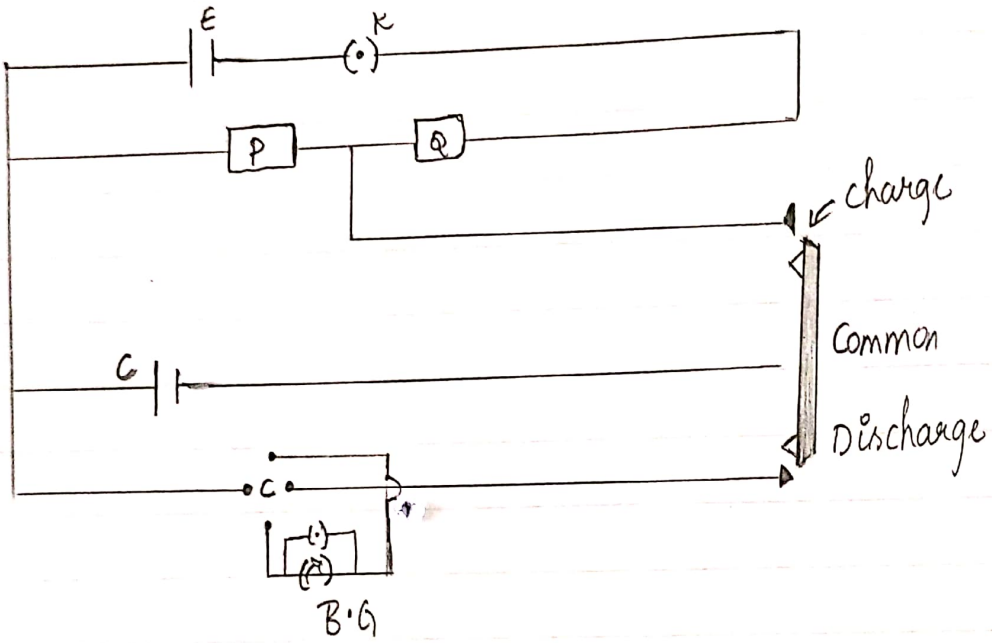
E
K
P
Q
charge
Common
C
Discharge
C
B·G

i. Charging:-

During charging the changing terminal and the common terminal are connected charge and thus the condenser is tapped to the potential divider and the p.d is applies across it. the charge on the condenser flows through the galvanometer

ii. discharging:-

During discharge, the charging terminal is disconnected and the common terminal and dischdege terminal are connected.

2, Ballistic Galvanometer (B.G):-

The Ballistic galvanometer is an instrument used to meas-ure the total quantity of electrical moment of incitia of the moving system is very large and hence it is show to being its motion under the impulse of the charge. so that the whole of the impluse of the charge so that moving system has moved appreciately from its position of rest. The ballistic galvanometer is shown in fig. the damping in a B.G cannot be removed absolutely. so, correction must be applied to the damping arised in the ballistic galvanometer.

3, Lamp and scale arrangement:-

The deflection of the moving coil galvanometer can be measured by means of a lamp and scale arrangement.

It consists of a tranluent ground glass or plastic scales. the scale is graduated into c.m in such away that the centre of the scale having zero graduation and 25cm on either side

Signature :

P	Q	first throw			Second throw			$\theta = \frac{\theta' + \theta''}{2}$	P/θ
		Left θ_1	Right θ_3	Mean θ'	Left θ_1	Right θ_3	Mean θ''		
5000	5000	11	3	13.0	11	4.5	12.625	12.8125	390.24
6000	4000	15	4	17.75	14.5	5.5	16.75	17.25	347.82
7000	3000	16	5	19	15.5	6	17.875	18.4375	379.66
8000	2000	18.5	5.5	21.75	18	7	20.75	21.25	376.47
9000	1000	23	6.5	27.125	21	7.5	24.375	25.75	349.51

Calculation:-

mean

① $\theta' = \theta_1 + \frac{\theta_1 - \theta_3}{4}$

$= 11 + \frac{11-3}{4}$

$= 11 + 2.0$

$= 13.0$

② $= 15 + \frac{15-4}{4}$

$= 17.75$

=) $\frac{CE}{(P+Q)} \times \frac{10^6}{\theta}$

=) $\frac{CE}{P+Q} \times 10^6 \frac{P}{\theta}$

of the Center. It is mounted horizontally on a stand as shown in the. A lamp fixed to one end and a convex lens with crossed lines masked on it at the other end of a mental tube is pinion arrangement, B. the height of the lamp the position of the scale are to be adjusted in such away that, the light from the lamp falls on mirror M for the galvanometer and the reflected light from the mirror falls at the centre of the scale.

Description :-

A battery of E.M.F, E volt and a plug key K are connected in series with two resistance boxes p and q as shown in the one end of p is condenser C. the other end of p is connected to the charge terminal of the C.D.K. the ballistic galvanometer (B.G) is connected to the charge terminal of C.D.K common terminal and the discharge terminal of the C.D.K as shown in the fig.

procedure :-

Make the connections as shown in place the lamp and scale arrangement at a distance of 1 meter from the mirror of the balistic galvanometer. switch on the lamp. then the spot of light moves on the scale. Adjust the lamp and comes to rest at the zero division mark.

Note :- If the throw produced two small then increase the resistance in p until a sufficien large throw is obtains keeping p+q = 10,000 ohm.

Now keeping p=q=5000 ohm press the charges button

Signature : _____

$$= \frac{0.3 \times 10^{-6} \times 1.5}{5000 + 5000} \times 10^{6} \times 390.24$$

$$= \frac{0.45}{10,000.0} \times 390.24$$

$$= 4.5 \times 10^{-05} \times 390.24$$

$$= 0.01756$$

② $\Rightarrow$ $\frac{0.3 \times 10^{-6} \times 1.5}{6000 + 4000} \times 10^{6} \times 347.82$

$$= \frac{0.45}{10,000.0} \times 347.82$$

$$= 0.01566519$$

③ $\frac{0.3 \times 10^{-6} \times 1.5}{7000 + 3000} \times 10^{6} \times 379.66$

$$= \frac{0.45}{10,000.0} \times 379.66$$

$$= 0.017084 7$$

④ $\Rightarrow$ $\frac{0.3 \times 10^{-6} \times 1.5}{8000 + 8000} \times 10^{6} \times 376.47$

$$= \frac{0.45}{10,000.0} \times 376.47$$

$$= 0.01694$$

(5) → $\frac{0.3 \times 10^{6} \times 1.5}{9000 + 1000} \times 10^{6} \times 349.51$

$\Rightarrow \frac{0.45}{10,000.0} \times 349.51$

$\Rightarrow 0.015722795$

and then discharge button. then note first throw θ_1 and second throw θ_2 and the same side of the scale.
The correction throw for damping is

$$\theta' = \theta_1 + \frac{\theta_1 - \theta_2}{4}$$

Reverse the direction of the current by means of the commuta -tor and again note the first and second throws θ_1 and θ_3 keeping $P+Q = 10,000$ ohm. the corrected throw is given by

$$\theta'' = \theta_1 + \frac{\theta_1 - \theta_3}{4}$$

Find the mean value θ of the corrected throws θ_1 and θ_3 values of P. keeping $P+Q$ = constant. Note the observations in the table. The Constant K of B.G can be calculated by substituting values of ϵ, P, Q, C and θ in the formula.

precautions:-
* The condenser should be kept dry
* The galvanometer should be levelled so that the movement of the spot of light is free
* Throws on both sides of the centre of the scale should be the same
* The galvanometer should be levelled horizontally by means of the leveling screws

Result:-
Constant of Ballistic galvanometer
$= 0.01659 \times 10^{-6}$ Coulombs/mm

Phase shift oscillator

Expt. No. 2 Date 13-4-22

Page No. 5

Aim:-

To determine the frequency of oscillation of phase shift RC oscillator

Apparatus:-

CRO, DC-power supply, digital multimeter, transistor bread system, capacitance resistance box connected wires.

Formula:-

$$F = \frac{1}{2\pi RC\sqrt{10}} \text{ Hz}$$

where F = frequency of oscillator of the phase sift oscillator
R = resistance of the resistor
C = capacitence of the capacitor.

Description:-

Re phase shift oscillator are optimised for generated sfew frequency some sector wires from they are used as signal sources in the radio frequency range.

The circuit diagram Rc-phase shift oscillator using voltage feed back net work as flower in figure. It consists of a circuit the sector which us the Rc-phase shift network provides a phase shift angle of 60° for the oscillatery frequency (f) Rc is the resistance in the connected circuit which edlectors voltage of RF and CF combinations provides temprarics stability and previous signal operation. the oscillator o/p voltage is capacity controled to the load

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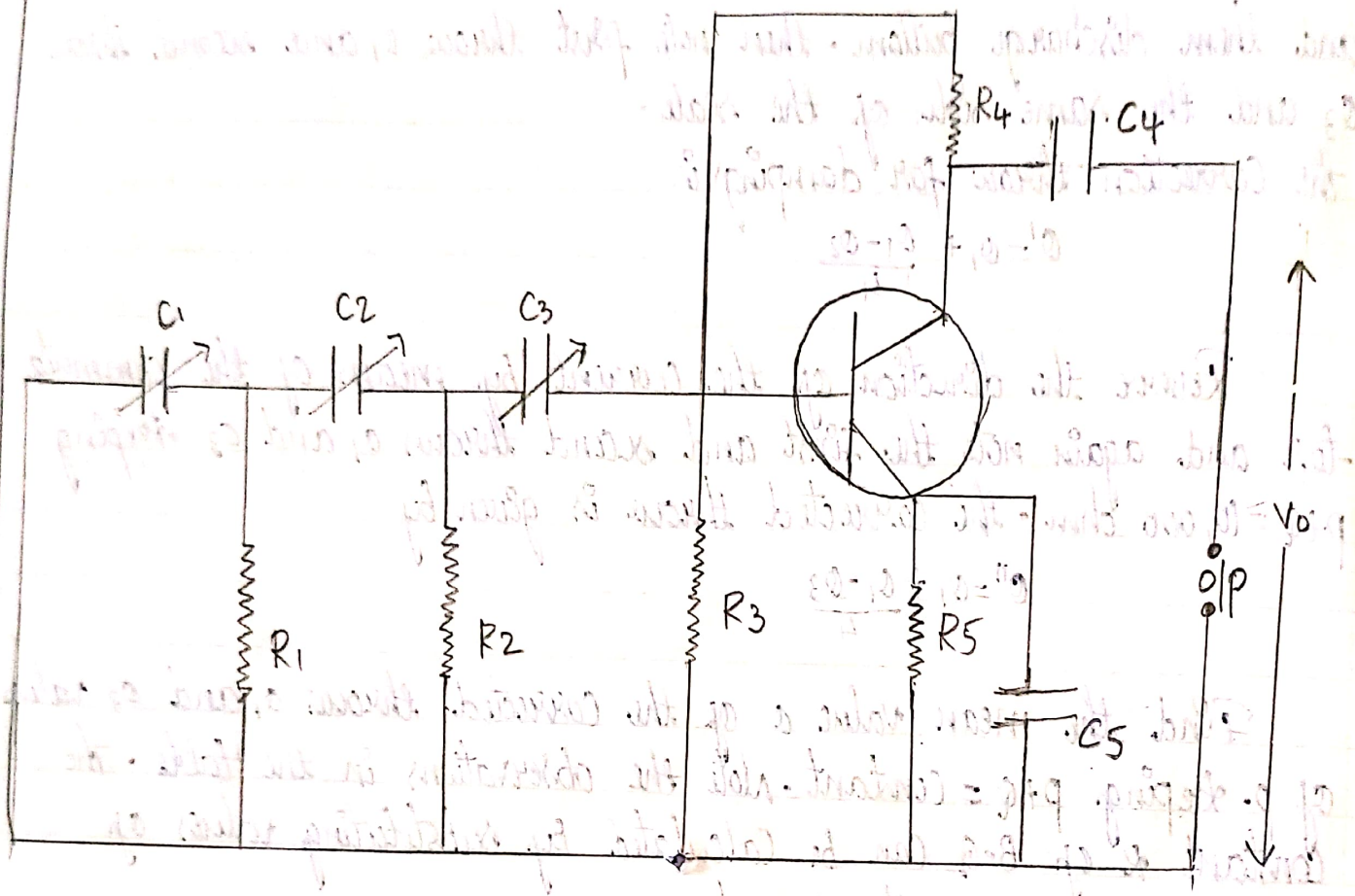
R4
C4
C1
C2
C3
Vo
R1
R2
R3
R5
C5
O/P

S.No	R	C	Time period T	Frequency Experimental	Frequency theoritical
1.	$10^4\Omega$	$4.7\times10^{-4}F$	$2.8\times0.2\times10^{-3}$	1.7587×10^{-5}	1.07×10^{-5}
2.	$10^4\Omega$	$1\times10^{-4}F$	$1.8\times0.2\times10^{-3}$	1.59×10^{-6}	5.040×10^{-6}

Calculation:

$T = 2.8\times0.2\times10^{-3}$

$F = \frac{1}{T}$

1.7857×10^{-5}

$F = \frac{1}{2\pi RC\sqrt{10}}$

$= \frac{1}{2(3.14)10^4\times4.7\times10^{-9}\times\sqrt{10}}$

$= \frac{1}{6.28\times10^{-5}\times1.486}$

$= \frac{1}{9.33\times10^{-5}}$

$= 1.07\times10^{-5}$

$T = 1.8\times0.2\times10^{-3}$

$= \frac{1}{3.6\times10^{4}}$

$= 1.59\times10^{-6}$

$F = \frac{1}{2\pi RC\sqrt{10}}$

$= \frac{1}{2\times3.14\times10^4\times1\times10^{-9}\times\sqrt{10}}$

$= \frac{1}{6.28\times3.16\times10^{-5}}$

$= \frac{1}{19.84\times10^{-5}}$

$= 5.040\times10^{-6}$ Hz

frequency of ① experimental $= 1.7587\times10^{-5}$ Hz

theoretical $= 1.07\times10^{-5}$ Hz

frequency of ② experiment $= 1.59\times10^{-6}$ Hz

theoritical $= 5.04\times10^{-6}$ Hz

by the circuit is the oscillator by any random vacialion closed in the base circuit that was either due to the horizontal noises signal in transmited by mirror variation in the voltage frequency for angle in the given frequency.

If the condition (pB) = 1 satisfied then oscillation will be main if R, is taken equal to the frequency of oscillator of RC = phase shift oscillator is given by

$$F = \frac{1}{2\pi RC\sqrt{10}} \text{ Hz}$$

procedure:-

Identesfy the emitter base and collector tramisrass and more down the connected the given n-p-n transistor make the circuit connections as shaven in figure select the suitable resistor circuit capacitor and inductance in the circuit the CRO across capacitors

Result:-

The theriticals and experimentally value of the frequencies of oscillator compared these are fand to be Equal

Signature :

Wind Energy

Date 4-5-22

Expt. No. 3

Page No. 7

Aim:-

To determine the wind speed with respect the horizontal mast by using anemometer

Apparatus:-

Anemometer, Beallifort, wind scale, scale 0-12 based on visu-al uses

Description:-

1. this Anemometer has few cups which catch the cause the anemometer to spin. the inword curus of cups must of force the wind. that's what makes the cups now spins per minute, grauter wind velocity.
2. Arrange four plastic drinking straws across and tape togeth-er at the centre.
3. staple the top of one drinking cup. such as small paper cups bathroom open ends of cups all face same direction
4. push a straight pin through centre of straws into end of pencil. this provides the axle
5. make one of cups, this be the one they use for concesti-ng when anemometer spins.
6. Blow anemometer as ektric pan on Low make sure spins Eaisly many times anemometer spin in one minute say make a statement. Spins of your anemometer and speed of the wind.

Signature :

Table :-

Wind Speed (Kmph)	Term	Description
0-5	Calm	Smoke goes straight
6-20	Light	up wind is pelt on face = weather values
21-39	moste rate	Twins Leaves mushale Raiser dust : Flags flop
40-61	Strong	Large branches move, umbralleces turns on side out
62 (or) more	Gale whole gale	

S.No	Load resistor	current (amp)	voltage (in volts)
1,	1	5	3.5
		4	3
		3	2.25
		2	1.75
		1	1.25
(2)	2	3	5.25
		2	3.5
		2	3.25
		1	2.75
		1	2.5
(3)	3	2	6.25
		2	5.75
		1	3.75
		1	3.25
		2	5.25
(4)	4	2	5.75
		2	6.0
		1	4.25
		1	4.75
		1	4.5

Date

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procedure:

1. place the anemometer outside sea if the wind will spins
2. using the watch, count number of times marked cup spins around is one minute
3. Repeat this Energy 2 mins
4. Record the data on note pad
5. choose reading of gap of 10 mins to show difference
6. After reading draw a graph to represents the data
7. plot time along the horizontal axes wind speeds c turns per minute along vertical axis
8. Join the dots

Result:-

The values of wind speed then tabulated along the time interval and graph is ploted

Signature :

Solar Cooker

Date 4-5-2022

Expt. No. 4

Page No. 9

Aim:-

To test the performance of solar cooker

Formula:-

$$P = \frac{(T_2 - T_1)}{600} \times m.s$$

where P = power

m = mass of water

S = Specific heat of water $h = 186 J/cal^{\circ}C$

And $T_2 - T_1$ = difference in temperature

principle:- The principle involved in the working of solar cooker can be Explained see following 3 points

1, Concentrating sun Light:- A mirrored surface with hight specular reflectivity is used to concentrate Light from the sun on to a small cooking area

2, converting Light Energy heat Energy:- Solar cookers concentrate sun Light into a reciver such as a cooking pass. the interactions between the Light energy and the reciver natural converts Light to heat

3, Trapping heat Energy:- It is important to reduces Concention by iso-lating air inside the cooker from the air outside the cooker

Description:- The reflections of the solar cooker generate high temper-ature and cook quickly. but require frequent adjustment and

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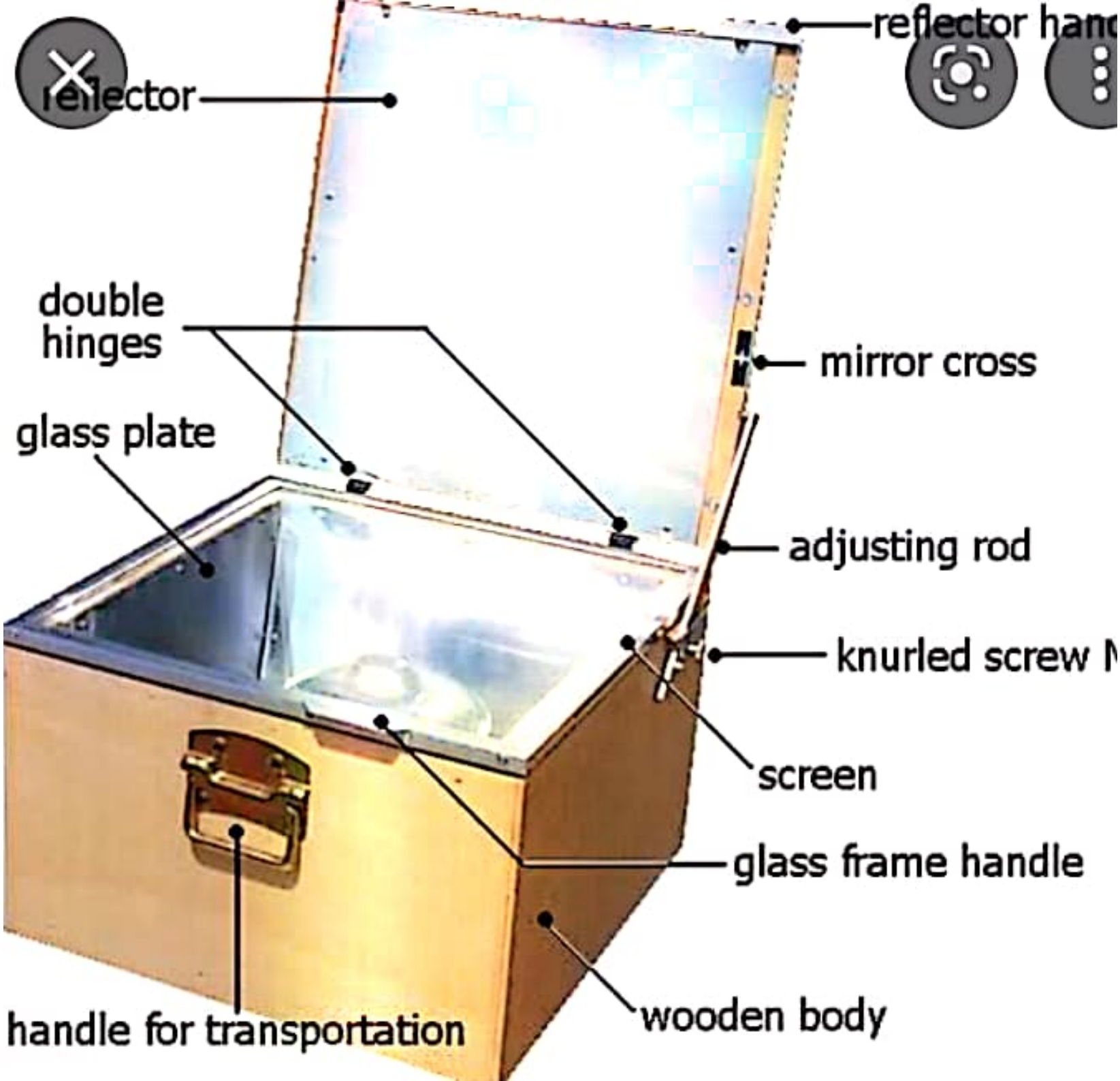
reflector
reflector hand
double hinges
mirror cross
glass plate
adjusting rod
knurled screw
screen
glass frame handle
handle for transportation
wooden body

S.No	Mass (gm)	T_1 (°C)	T_2 (°C)	$T_2 - T_1$	$P = \frac{T_2 - T_1}{600} \times m \times s$
1.	525-160	33	40	7	17.82
2.	365	40	44	4	10.185
3.	365	44	45	1	2.546
4.	365	45	48	3	7.639
5.	365	48	50	2	5.092
6.	365	50	52	2	5.092

Date

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Supervision for safe operation

The cooking vessels is located at the focus which concentrates sun light onto it all the day. the mirror has to be all wionally tilted about is perpendicular on is to compensate for the seasonal variation in the declination this perpendicular do axis does not pass through the cooking vessel. to keep the focus stationary the reflecti-ons shape has to vary.

Some time the rotating reflector is located out doors and the reflected sun light passes throught are opening in a wall into a indoor kitchen of term a learge communal are where the cooking is done.

working:- The container of food is placed inside the solar cooker. which may be elevated on a brick, rock, metal tunit & other heat sink and the solar cooker is placed in direct sun light

Deperding on the size of the solar and the member and quality of cooked foods

A solar oven is turned towards the sun and left until the food is cooked. unlike cooking on a stove or oven a time which may requires more than an hour of constant super vision food in a solar oven is generally not stirred or turned oven, both because it is and because opening the solar oven allows the trapped heat to escape

The cooking time depends prianely on the equipment being using, the amount of sun light at the times and the equality of food that latitudes also affect performance food cooker faster in the two hours be four and after the local solar than it does in either the early morking or the late after noon.

Signature :

Calculation:- $W = W_1 - W_2$

$= 525 - 160 = 365$ gms

$$P = \frac{T_2 - T_1}{600} \times ms$$

$$P = \frac{7}{600} \times 365 \times 4.186$$

$= 10.185$

$$P = \frac{1}{600} \times 365 \times 4.186$$

$= 2.546$

$$P = \frac{3}{600} \times 365 \times 4.186$$

$= 7.639$

$$P = \frac{2}{600} \times 365 \times 4.186$$

$= 5.092$

$$P = \frac{2}{600} \times 365 \times 4.186$$

$= 5.092$

Date

Expt. No. Page No. 11

Advantages of solar cooker:-

1. High performance solar cookers can attains temperatures above 290°c (550°c)
2. Conventional solar cooker attain temperatus upto 165°c they can steri-ize water or prepare most foods that can be nook in a communctional oven or store
3. Solar cookers are no fuel. this source cost as well as reducing Environmental damage caused by ful use since 2.5 billion people them on open pines using biomass fuels, solar cooker could house large economic and environmental benefits by reducing, diforestation.
4. Where solar cookers are used outside. they do not contribute inside heat, potentially suning fuel costs for cooling as well.

Result: The power of the solar cooker is given by

$$P = 8.062$$

Signature :