WORKSHOP CALCULATION & SCIENCE

(NSQF)

2nd YEAR

(As per Revised Syllabus July 2022)

ELECTRONICS MECHANIC

Directorate General of Training

DIRECTORATE GENERAL OF TRAINING
MINISTRY OF SKILL DEVELOPMENT & ENTREPRENEURSHIP
GOVERNMENTOF INDIA

NATIONAL INSTRUCTIONAL MEDIA INSTITUTE, CHENNAI

Post Box No. 3142, CTI Campus, Guindy, Chennai - 600 032

Workshop Calculation & Science

Electronics Mechanic - 2nd Year NSQF

As per Revised Syllabus July 2022

Developed & Published by

National Instructional Media Institute
Post Box No.3142
Guindy, Chennai - 600032
INDIA
Email: chennai-nimi@nic.in
Website: www.nimi.gov.in

First Edition : November 2023 Copies: 1000

Rs.70/-

FOREWORD

The Government of India has set an ambitious target of imparting skills one out of every four Indians, to help them secure jobs as part of the National Skills Development Policy. Industrial Training Institutes (ITIs) play a vital role in this process especially in terms of providing skilled manpower. Keeping this in mind, and for providing the current industry relevant skill training to Trainees, ITI syllabus has been recently updated with the help of comprising various stakeholder's viz. Industries, Entrepreneurs, Academicians and representatives from ITIs.

The National Instructional Media Institute (NIMI), Chennai, has now come up with instructional material to suit the revised curriculum for **Workshop Calculation & Science - Electronics Mechanic 2nd Year** NSQF (Revised 2022) under CTS will help the trainees to get an international equivalency standard where their skill proficiency and competency will be duly recognized across the globe and this will also increase the scope of recognition of prior learning. NSQF trainees will also get the opportunities to promote life long learning and skill development. I have no doubt that with NSQF the trainers and trainees of ITIs, and all stakeholders will derive maximum benefits from these IMPs and that NIMI's effort will go a long way in improving the quality of Vocational training in the country.

The Director General of Training, Executive Director & Staff of NIMI and members of Media Development Committee deserve appreciation for their contribution in bringing out this publication.

Jai Hind

ATUL KUMAR TIWARI, *I.A.S.*
Secretary
Ministry of Skill Development & Entrepreneurship,
Government of India.

November 2023
New Delhi - 110 001

PREFACE

The National Instructional Media Institute(NIMI) was set up at Chennai, by the Directorate General of Training, Ministry of skill Development and Entrepreneurship, Government of India, with the technical assistance from the Govt of the Federal Republic of Germany with the prime objective of developing and disseminating instructional Material for various trades as per prescribed syllabus and Craftsman Training Programme(CTS) under NSQF levels.

The Instructional materials are developed and produced in the form of Instructional Media Packages (IMPs), consisting of Trade Theory, Trade Practical, Test and Assignment Book, Instructor Guide and Wall charts. The above material will enable to achieve overall improvement in the standard of training in ITIs.

A national multi-skill programme called SKILL INDIA, was launched by the Government of India, through a Gazette Notification from the Ministry of Finance (Dept of Economic Affairs), Govt of India, dated 27th December 2013, with a view to create opportunities, space and scope for the development of talents of Indian Youth, and to develop those sectors under Skill Development.

The emphasis is to skill the Youth in such a manner to enable them to get employment and also improve Entrepreneurship by providing training, support and guidance for all occupation that were of traditional types. The training programme would be in the lines of International level, so that youths of our Country can get employed within the Country or Overseas employment. The **National Skill Qualification Framework (NSQF)**, anchored at the National Skill Development Agency(NSDA), is a Nationally Integrated Education and competency-based framework, to organize all qualifications according to a series of **levels of Knowledge, Skill and Aptitude.** Under NSQF the learner can acquire the Certification for Competency needed at any level through formal, non-formal or informal learning.

The **Workshop Calculation & Science -** Electronics Mechanic 2nd Year NSQF (Revised 2022) under CTS is one of the book developed by the core group members as per the NSQF syllabus.

The **Workshop Calculation & Science -** Electronics Mechanic 2nd Year NSQF (Revised 2022) under CTS as per NSQF is the outcome of the collective efforts of experts from Field Institutes of DGT, Champion ITI's for each of the Sectors, and also Media Development Committee **(MDC)** members and Staff of **NIMI.** NIMI wishes that the above material will fulfill to satisfy the long needs of the trainees and instructors and shall help the trainees for their Employability in Vocational Training.

NIMI would like to take this opportunity to convey sincere thanks to all the Members and Media Development Committee (MDC) members.

Chennai - 600 032 **EXECUTIVE DIRECTOR**

ACKNOWLEDGEMENT

The National Instructional Media Institute (NIMI) sincerely acknowledge with thanks the co-operation and contribution of the following Media Developers to bring this IMP for **Workshop Calculation & Science - Electronics Mechanic 2nd Year** as per NSQF Revised 2022.

MEDIA DEVELOPMENT COMMITTEE MEMBERS

Shri. M. Sangara pandian	-	Training Officer (Retd.) CTI, Govt. of India, Guindy, Chennai - 32.
Shri. G. Sathiamoorthy	-	Jr.Training Officer - SG (Retd.) Govt I.T.I, Trichy, DET - Tamilnadu.

NIMI CO-ORDINATORS

Shri. Nirmalya Nath	-	Deputy General Manager, NIMI, Chennai - 32.
Shri. G. Michael Johny	-	Manager, NIMI, Chennai - 32.

NIMI records its appreciation of the **Data Entry, CAD, DTP Operators** for their excellent and devoted services in the process of development of this IMP.

NIMI also acknowledges with thanks, the efforts rendered by all other staff who have contributed for the development of this book.

INTRODUCTION

The material has been divided into independent learning units, each consisting of a summary of the topic and an assignment part. The summary explains in a clear and easily understandable fashion the essence of the mathematical and scientific principles. This must not be treated as a replacment for the instructor's explanatory information to be imparted to the trainees in the classroom, which certainly will be more elaborate. The book should enable the trainees in grasping the essentials from the elaboration made by the instructor and will help them to solve independently the assignments of the respective chapters. It will also help them to solve the various problems, they may come across on the shop floor while doing their practical exercises.

The assignments are presented through 'Graphics' to ensure communications amongst the trainees. It also assists the trainees to determine the right approach to solve the problems. The required relevent data to solve the problems are provided adjacent to the graphics either by means of symbols or by means of words. The description of the symbols indicated in the problems has its reference in the relevant summaries.

At the end of the exercise wherever necessary assignments, problems are included for further practice.

Time allotment - 2nd Year : 16 Hrs

Time allotment for each title of exercises has been given below. **Workshop Calculation & Science - Electronics Mechanic** 2nd Year NSQF Revised Syllabus 2022.

S.No	Title	Exercise No.	Time in Hrs
1	Algebra	2.1.01 & 2.1.02	8
2	Estimation and Costing	2.2.03 - 2.2.17	8
		Total	**16 Hrs**

LEARNING / ASSESSABLE OUTCOME

On completion of this book you shall be able to

- **Demonstrate basic mathematical concept and principles to perform practical operations.**
- **Understand and explain basic science in the field of study.**

CONTENTS

SYLLABUS

2nd Year

Workshop Calculation & Science - Electronics Mechanic
Revised syllabus July 2022 under CTS

S.no.	Syllabus	Time in Hrs
I	**Algebra** 1 Addition, Subtraction, Multiplication & Divisions 2 Algebra – Theory of indices, Algebraic formula, related problems	8
II	**Estimation and Costing** 1 Simple estimation of the requirement of material etc., as applicable to the trade 2 Problems on estimation and costing	8
	Total	16

Algebra - Addition, subtraction, multiplication & division

Introduction

Algebra is a form of mathematics in which letters may be used in place of unknown. In this mathematics numbers are also used in addition to the letters and the value of number depends upon its place. For example in $3x$ and x^3, the place of x is different. In $3x$ =3 is multiplied with x, whereas in x^3 - 3 is an Index of x.

Positive and negative numbers

Positive numbers have a + sign in front of them, and negative numbers have – sign in front of them. The same applies to letters also.

Example + x, – y.

+8 or simply 8 positive number.

– 8 negative number.

Addition and subtraction

Two positive numbers are added, by adding their absolute magnitude and prefix the plus sign.

To add two negative numbers, add their absolute magnitude and prefix the minus sign.

To add a positive and a negative number, obtain the difference of their absolute magnitudes and prefix the sign of the number having the greater magnitude.

+7 + 22 = +29
(–8) – 34 = – 42
(–27) + 19 = –8
44 + (–18) = +26
37 + (–52) = –15

Multiplication of positive and negative numbers

The product of two numbers having like signs is positive and the product of two numbers with unlike signs is negative. Note that, where both the numbers are negative, their product is positive.

Ex.
–20 x –3 = 60
5 x 8 = 40
4 x –13 = – 52
–5 x 12 = –60

Division

The number that is divided is the dividend, the number by which we are dividing is the divisor and the answer is the quotient. If the signs of the dividend and the divisor are the same then the quotient will have a + sign. If they are unlike then the quotient will have a negative sign.

$$\frac{+28}{+4} = +7$$

$$\frac{+56}{-4} = -14$$

$$\frac{-72}{+9} = -8$$

$$\frac{-96}{-6} = +16$$

When an expression contains addition, subtraction, multiplication and division, perform the multiplication and division operations first and then do the addition and subtraction.

Example

12 x 8 – 6 + 4 x 12 = 96 – 6 + 48 = 138

102 ÷ 6 – 6 x 2 + 3 = 17 – 12 + 3 = 8

Parentheses and grouping symbols

( ) Brackets

{ } Braces

7 + (6–2) = 7 + 4 = 11

6 x (8–5) = 6 x 3 = 18

Parentheses

These are symbols that indicate that certain addition and subtraction operations should precede multiplication and division. They indicate that the operations within them should be carried out completely before the remaining operations are performed. After completing the grouping, the symbols may be removed.

In an expression where grouping symbols immediately preceded or followed by a number but with the signs of operation omitted, it is understood, that multiplication should be performed.

Grouping symbols are used when subtraction and multiplication of negative number is done.

To remove grouping symbols which are preceded by negative signs, the signs of all terms inside the grouping symbols must be changed (from plus to minus and minus to plus).

Parentheses which are preceded by a plus sign may be removed without changing the signs of the terms within the parentheses.

When one set of grouping symbols is included within another set, remove the innermost set first.

When several terms connected by + or – signs contain a common quantity, this common quantity may be placed in front of a parentheses.

8 + 6(4–1) = 8 + 6 x 3 = 26

(6+2) (9–5) = 8 x 4 = 32

Plus 4 less negative 7 is written as 4 – (–7).

Plus 4 times negative 7 is written as 4(–7).

$4 – (–7) = 4 + 7 = 11$

$8 – (7–4) = 8 – 3 = 5$

$3 + (–8) = 3 – 8 = –5$

$7 + (4 – 19) = 7 + (–15) = 7 – 15 = – 8$

$3 \{40 + (7 + 5) (8–2)\}$

$= 3 \{40 + 12 \times 6\}$

$= 3 \times 112 = 336.$

$8x + 12$ - quantity 4 may be factored out giving the expression $8x + 12$ as $4 (2x + 3)$.

The innermost set in a grouping symbols of an expression is to be simplified first.

Algebraic symbols and simple equations

Algebraic symbol

An unknown numerical value of a quantity is represented by a letter which is the algebraic symbol.

Factor

A factor is any one of the numbers or letters or groups which when multiplied together give the expression. Factors of 12 are 4 and 3 or 6 and 2 or 12 and 1.

$8x + 12$ is the expression and this may be written as $4(2x + 3)$, 4 and $(2x + 3)$ are the factors.

Algebraic terms

If an expression contains two or more parts separated by either + or –, each part is known as the term.

$y – 5x$ is the expression. y and $– 5x$ are the terms.

The sign must precede the term.

Kinds of terms:

1 Like terms

a 13a, 15a, 19a, -12a, -18a

b $5xy$, $11xy$, $-xy$, $-14xy$

c $27m^2$, $25m^2$, $-3m^2$, $11m^2$

2 Unlike terms

a 3ac, - 4b, $8x$, 3yz

b $2xy$, y^2, a^2b, xz, 3bc

c $13m^2n$, $3mn^2$, $14lm^2$, $15a^2b$, 5lm

Examples :

1 Add 7a, - 2a, a, 3a

7a + (- 2a) + (a) + 3a

7a - 2a + a + 3a

= 11a - 2a

= 9a

2 Add $25xy$, + $2xy$, - $6xy$, - $3xy$

$25xy + 2xy + (- 6xy) + (- 3xy)$

$= 27xy - 9xy$

$= 18xy$

3 Add 9m, + 4m, - 2

9m + 4m + (- 2)

9m + 4m - 2

= 13m - 2

Coefficient

When an expression is formed into factors whose product is the expression, then each factor is the coefficient of the remaining factors.

$48x = 4 \times 12 \times x$

4 is the coefficient of $12x$. x is the coefficient of 48.

Equation

It is a statement of equality between numbers or numbers and algebraic symbols.

$12 = 6 \times 2$, $13 + 5 = 18$.

$2x + 9 = 5$, $y – 7 = 4y + 5$.

Simple equation

Equations involving algebraic symbols to the first power are simple equations.

$2x + 4 = 10$. $4x + 12 = 14$.

Addition

1 8a + 12b - a - 14b

= 8a - a + 12b - 14b

= 7a - 2b

2 14a + 3a + 25b + 2b + b

= 17a + 28b

3 (2a + 3b - c) + (4a - b - c) + (a - 8)

2a + 3b - c + 0

4a - b - c + 0

a + 0 + 0 - 8

7a + 2b - 2c - 8

4 Add : $(3x + 3z)$; $(5x - 4y)$; $(9y - 3z)$

$3x + 0 + 3z$

$5x - 4y + 0$

$0 + 9y - 3z$

$8x + 5y$

Subtraction

1 $38xy - 15xy = 23xy$

2 Subtract $3xy$ from $-4xy$

$-4xy$

$+3xy$

$-7xy$

3 Subtract $5x$ from $12x$

$= 12x - (5x)$

$= 12x - 5x$

$= 7x$

4 Subtract $18x$ from $7x$

$= 7x - (18x)$

$= 7x - 18x$

$= -11x$

5 Subtract $3x - 2y$ from $4y - 2x$

$= (4y - 2x) - (3x - 2y)$

$= 4y - 2x - 3x + 2y$

$= 6y - 5x$

Addition and subtraction

Quantities with algebraic symbols are added or subtracted by considering those terms involving same symbols and powers.

Example

1. $10x + 14 - 7y^2 - 11a + 2x - 4 - 3y^2 - 4a + 8$

   $= 10x + 2x - 7y^2 - 3y^2 - 11a - 4a + 14 - 4 + 8$

   $= 12x - 10y^2 - 15a + 18$

2. $2x = 10$, $2x + 6 = 10 + 6$

3. $y + 12 = 20$, $y + 12 - 8 = 20 - 8$

4. $x + 10 = 12$,

   $x + 10 - 10 = 12 - 10$

5. $3x = 6$, $2 \times 3x = 2 \times 6$, $6x = 12$

6. $5y = 20$, $\frac{5y}{5} = \frac{20}{5}$.

The same number may be added or subtracted to both members of an equation without changing its equality.

Each member of an equation may be multiplied or divided by the same number or symbol without changing its equality.

The equality of an equation is not altered when the numbers or symbols are added or subtracted from both sides. Multiplication and division by the same numbers or symbols on both sides also will not affect the equality.

Transposition of the terms of the equations

= equals to

\+ plus

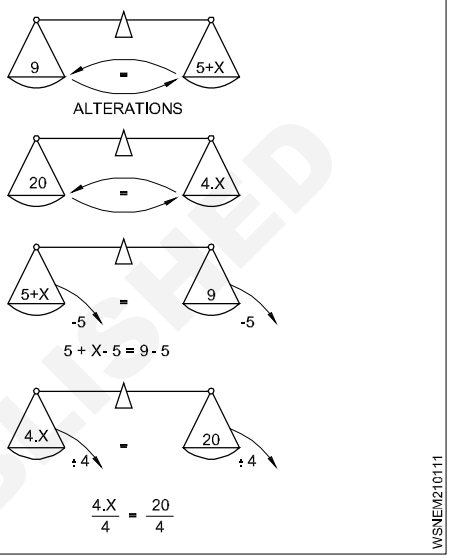
– minus

x multiply

÷ divided by

Concept of equality (Fig 1)

Fig 1



An equation can be compared to a pair of scales which always remain in equilibrium. The two sides of the equation can fully be transposed. $9 = 5 + x$ may also be written as $5 + x = 9$.

We must always perform the same operation on both sides of the equation to keep the equilibrium. Add or subtract the same amount from both sides. $5 + x = 9$ By adding 3 on both sides, the equation becomes $5 + x + 3 = 9 + 3$ or $x + 8 = 12$.

$5 + x = 9$ Subtract 5 from both sides then $5 + x - 5 = 9 - 5$.

$x = 4$.

5 is transposed from left side to the right side by changing its sign from + to –.

$\frac{x}{4} = 20$. Multiply both sides by 4. Then $\frac{x}{4} \times 4 = 20 \times 4$.

$x = 80$,

$5x = 25$.

Divide both sides by 5 then $\frac{5x}{5} = \frac{25}{5}$

$x = 5$.

When transposing numbers or letter symbols from one side to the other side multiplication becomes division and the division becomes multiplication.

The equality of an equation remains unchanged when both sides of the equation are treated in the same way. When transposing from one side to the other side,

a plus quantity becomes minus quantity.

a minus quantity becomes a plus quantity

a multiplication becomes a division

a division becomes a multiplication.

To solve simple equations isolate the unknown quantity which is to be found on the left side of the equation.

Example

- Solve for x if $4x = 3(35 - x)$

  $4x = 105 - 3x$ (brackets removed)

  $4x + 3x = 105$ (By transposing $-3x$ on the right side to the left side)

  $7x = 105$

  $x = 15$ (dividing both sides by 7)

Assignment

Add

1 14f - 2f + 5f - 7f + 9f

2 $3x$y + $5x$y - $2x$y + $8x$y - $4x$y

3 $17x$y - $4x$y + 13 - xy - 6

4 2a + a + 3a + 6a - 5b

5 8c + 5c + 3c + 2c

6 14d + 3d + 25e + 2e

7 5p + 3r - r - 2p

8 8t + 12u - t - 14u

9 x - z + y + z

10 15a + 13a - 37a

11 17a - 4b - 7a + 3b

12 9c - 15e + 4c + 3e

13 13f + 40g - 16f + 7f + 2g - 17g

14 $30x$ + 45y - $17x$ - 16y

15 8a + 3c - 6b - 5c + 4a + 8b

16 27i + 17k - 5l + 12i - 31k + 19l

17 230m + 472P - 320n - 75m + 180n - 141p

18 230m + 420s + 370y + 225m - 510y - 110s

19 45b + 25c + 18b + 40c

20 14d + 3d + 25e + 2e + e + d

21 15a - (4a + 3a - 5a)

22 $5x$ + 3y - ($2x$ - 5y)

23 (x + 2y + 3z) + ($4x$ - y + z)

24 ($2x$ + 5y) + ($4x$ - 8z) + (15z - 6y) + (z - $2x$)

25 (-$2x$ + 3y - 3z) + (-6y - $5x$ + z)

26 (a - 3b + 4c) + (-7c - a + 4b)

27 ($2x$ + 5y) + ($4x$ - 8z) + (15z - 2y)

Subtract

1 $38x$y - $25x$y

2 Subtract 2a - 3b - c from 3a - 2b + 4c

3 2a - 3(a - (a - b))

Add and Subtract

1 230a + 420b + 370c + 225a - 510c - 110b

2 15d - (4d + 3d - 5d)

3 $8x$ + 3z - 6y - 5z + $4x$ + 8y

Multiplication

1 5yz$x$ x (-5ab)

2 3ax -9b

3 2ab x -7pq

Division

1 $\frac{10a}{2a}$

2 -3ax ÷ -6x

3 15xy ÷ -5

4 $-\frac{8ac}{2bc}$

5 $\frac{-5m \times -6n - 7p}{-28\,mn}$

6 $\frac{5a + 20}{7a + 28}$

Algebra - Theory of indices, Algebraic formula, related problems

Calculations involving powers

Power : Concept

a.a.a... upto n times is = a^n

a is the base, n is the exponent.

When a number, say 2 is multiplied by itself 4 times, we write it as 2^4 (two to the power of 4) and it is equal to 2 x 2 x 2 x 2 = 16.

The exponent denotes how many times the base number is multiplied by itself.

Powers with a positive base have a positive result.

Powers with a negative base and with an exponent that is even will have a positive result.

The sign

$(+a)^n = a^n$

$(-a)^{2n} = a^{2n}$

$(2)^2 = 2 \times 2 = 4$ and

$(-2)^2 = -2 \times -2 = +4$ but

$(-2)^3 = -2 \times -2 \times -2 = -8$

Addition and subtraction of powers

Powers with the same base and exponents can be added or subtracted by addition or subtraction of the coefficients.

$x.a^n + y.a^n = a^n (x + y)$

$x.a^n - y.a^n = a^n (x - y)$

Ex .$4x^2 + x^2 - 3x^2 = x^2 (4 + 1 - 3) = 2x^2$.

Multiplication

Powers with the same bases are multiplied by involving the common base raised to the power of sum of the exponents.

$a^m \times a^n = a^{m+n}$.

$2^3 \times 2^2 = 2^{3+2} = 2^5$

(2 x 2 x 2) x (2 x 2) = 2 x 2 x 2 x 2 x 2 = 2^5

8 x 4 = 32.

Powers with the same exponent of different base numbers are multiplied by involving the product of the base numbers raised to the common exponent.

$a^n \times b^n = (a \times b)^n$

$2^2 \times 3^2 = (2 \times 3)^2$

2 x 2 x 3 x 3 = 6 x 6 = 36

Division

Powers with like bases are divided by involving the base raised to the difference between the exponents.

$$\frac{a^m}{a^n} = a^{m-n}$$

$$\frac{2^3}{2^2} = 2^{3-2} = 2^1 = 2$$

$$\frac{2 \times 2 \times 2}{2 \times 2} = \frac{8}{4} = 2$$

Powers with the same exponents are divided by involving the quotient of the bases by the common exponent.

$$\frac{a^n}{b^n} = \left(\frac{a}{b}\right)^n$$

$$\frac{2^2}{3^2} = \left(\frac{2}{3}\right)^2 = \frac{2 \times 2}{3 \times 3} = \frac{4}{9}$$

Only like powers can be added or subtracted.

Examples

(The exponent 1 is usually not written.)

$a^1 = a$

$2^1 = 2$

$2a^2 + 3a^2 = 5a^2$

(Any number raised to the power of 0 is 1.)

$a^0 = 1$

$2^0 = 1$

A number raised to a negative power corresponds to its reciprocal with the exponent's sign changed to +.

$$a^{-n} = \frac{1}{a^n}$$

$$2^{-2} = \frac{1}{2^2}$$

Powers are involved by multiplying the exponents.

$(a^n)^m = a^{nm}$

$(2^2)^3 = 2^{2.3} = 2^6$

Powers can be transposed without affecting the result.

$$\left(a^n\right)^m = \left(a^m\right)^n$$

$(2^2)^3 = (2^3)^2$

(2 x 2) x (2 x 2) x (2 x 2) = (2 x 2 x 2) (2 x 2 x 2)

4 x 4 x 4 = 64

8 x 8 = 64

A mixed number raised to a power is first converted into an improper fraction and then the result is evaluated.

$$\left(1\frac{3}{4}\right)^2 = \left(\frac{7}{4}\right)^2$$

$$= \frac{7}{4} \times \frac{7}{4} = \frac{49}{16}$$

Indices

- The indices are added in multiplication

  $a^m \times a^n = a^{m+n}$.

- The indices are subtracted in division

  $$\frac{a^m}{a^n} = a^{m-n}$$.

- In case of index of an index, both the indices are multiplied mutually

  $[a^m]^n = a^{m.n}$

- A fractional index shows root of a number

  $a^{1/m} = \sqrt[m]{a}$

- In case of an index having minus sign, the sign can be changed by taking the number from numerator to denominator or vice versa

  $$a^{-m} = \frac{1}{a^m}$$

  and $$\frac{1}{a^{-m}} = a^m$$

- If an index contains both the numerator and denominator then it means that the number has 'index' as well as 'root'.

  $$a^{m/n} = \sqrt[n]{a^m}$$

Basic problem

Addition

1 $5x^2y + 3xy^2 + 8x^2y + 7xy^2$

$= 5x^2y + 8x^2y + 3xy^2 + 7xy^2$

$= 13x^2y + 10xy^2$

2 Add $5a^3$, $+ 12b^3$, $- c^3$, $+ a^3$, $- 4b^3$, $+ 3$

$5a^3 + 12b^3 + (- c^3) + a^3 + (- 4b^3) + 3$

$= 6a^3 + 8b^3 - c^3 + 3$

Subtract

1 Subtract $2x^2 - 3y^2$ from $3x^2 + 2y^2$

$3x^2 + 2y^2$

$2x^2 - 3y^2$

$x^2 + 5y^2$

Multiplication

1 $- 4x^2 \times 8x^5 = - 4 \times 8x^{2+5}$

$= -32x^7$

2 $(3d^2 - 2d)\, 3d$

$= 9d^3 - 6d^2$

3 $(5x + 3y)(5x - 3y)$

$= (5x)^2 - (3y)^2$

$= 5x \times 5x - 3y \times 3y$

$= 25x^2 - 9y^2$

4 $5x^2y \times 8x^5y^3$

$= 40x^7y^4$

5 $(2a+b)(a+2b)$

$= 2a^2 + 4ab + ab + 2b^2$

$= 2a^2 + 2b^2 + 5ab$

6 $8a^3b^5c^{-5} \times 3a^2b^{-5}c^5$

$= 24a^5$

Division

1 $$\frac{12x^3y^2}{4x^2y} = 3xy$$

2 $$\frac{15y^{15}}{15y^5} = y^{10}$$

3 $9c^5d^3 \div c^2d^2$

$= 9c^3d$

4 $$\frac{3a^2 \times 4a \times 5a^3}{6a^4 \times 10a}$$

$$= \frac{60a^6}{60a^5} = a$$

5 $-25a^{15} \div -5a^{-8}$

$$= \frac{-25a^{15}}{-5a^{-8}}$$

$= 5a^{15}a^8 = 5a^{23}$

6 $4x^2y \div 2y$

$$= \frac{4x^2y}{2y} = 2x^2$$

7 $3x^2y^3 \div -6x^5y$

$$= \frac{3x^2y^3}{-6x^5y} = -\frac{y^2}{2x^3}$$

8 $3x^3y^2 \div xy$

$$= \frac{3x^3y^2}{xy} = 3x^2y$$

9 Divide $45a^2b^2c$ by $9a^2c$

$$= \frac{45a^2b^2c}{9a^2c}$$

$=5b^2$

Algebraic Formulae

1	$(a + b)^2$	=	$a^2 + b^2 + 2ab$
2	$(a - b)^2$	=	$a^2 + b^2 - 2ab$
3	$(a + b)^2$	=	$(a - b)^2 + 4ab$
4	$(a - b)^2$	=	$(a + b)^2-4ab$; $(a + b)^2-(a - b)^2=4ab$
5	$a^2 + b^2$	=	$(a + b)^2 - 2ab = (a - b)^2 + 2ab$
6	$a^2 - b^2$	=	$(a + b)(a - b)$
7	$a^3 + b^3$	=	$(a + b)(a^2 + b^2 - ab)$
8	$a^3 - b^3$	=	$(a - b)(a^2 + b^2 + ab)$
9	$(a + b)^3$	=	$a^3 + b^3 + 3ab(a + b)$
10	$(a - b)^3$	=	$a^3 - b^3 - 3ab(a - b)$
11	$(a + b + c)^2$	=	$a^2 + b^2 + c^2 + 2(ab + bc + ca)$
12	$a^4 - b^4$	=	$(a^2 + b^2)(a + b)(a - b)$

Examples

1 If $x + y = 9$ and $xy = 20$

Find i) $x^2 + y^2$ ii) $x - y$ iii) $x^2 - y^2$

iv) $x^3 + y^3$ v) $x^3 - y^3$ vi) x and y

i $(a + b)^2$ = $a^2 + b^2 + 2ab$

$(x + y)^2 = x^2 + y^2 + 2xy$

$(9)^2 = x^2 + y^2 + 2(20)$

$81 = x^2 + y^2 + 40$

$x^2 + y^2 = 81 - 40$

$x^2 + y^2 = 41$

ii $(a - b)^2$ = $(a + b)^2 - 4ab$

$(x - y)^2 = (x + y)^2 - 4xy$

$= (9)^2 - 4(20)$

$= 81 - 80$

$= 1$

$x - y = \sqrt{1} = 1$

iii $a^2 - b^2$ = $(a + b)(a - b)$

$x^2 - y^2 = (x + y)(x - y)$

$= 9 \times 1$

$x^2 - y^2 = 9$

iv $a^3 + b^3$ = $(a + b)(a^2 + b^2 - ab)$

$x^3 + y^3 = (x + y)(x^2 + y^2 - xy)$

$= 9(41 - 20)$

$= 9 \times 21$

$x^3 + y^3 = 189$

v $a^3 - b^3$ = $(a - b)(a^2 + b^2 + ab)$

$x^3 - y^3 = (x - y)(x^2 + y^2 + xy)$

$= 1(41 + 20)$

$= 1 \times 61$

$= 61$

$x^3 - y^3 = 61$

vi $x + y = 9$

$x - y = 1$

$2x = 10$

$$x = \frac{10}{2} = 5$$

If $x = 5$, $5 + y = 9$

$y = 9 - 5 = 4$

$x = 5$; $y = 4$

2 Solve $(x + 5)^2 - (x - 5)^2$

If $x + 5 = a$ and $x - 5 = b$

$a^2 - b^2 = (a + b)(a - b)$

$(x + 5)^2 - (x - 5)^2 = [(x + 5) + (x - 5)][(x + 5) - (x - 5)]$

$= (x + 5 + x - 5)(x + 5 - x + 5)$

$= (2x)(10)$

$= 20x$

3 If $(x - y) = 4$ and $xy = 12$, find the value of $(x^2 + y^2)$

$(x - y)^2 = x^2 + y^2 - 2xy$

$(4)^2 = x^2 + y^2 - 2 \times 12$

$16 = x^2 + y^2 - 24$

$x^2 + y^2 - 24 = 16$

$x^2 + y^2 = 16 + 24$

$x^2 + y^2 = 40$

4 If $x - y = 7$ and $xy = 60$ then find the value of $x^4 + y^4$

$(x - y)^2 = x^2 + y^2 - 2xy = 7^2$

$x^2 + y^2 - 2 \times 60 = 49$

$x^2 + y^2 = 169$

$(x^2 + y^2)^2 = (169)^2$ (take square on both side)

$x^4 + y^4 + 2x^2y^2 = (169)^2$

$x^4 + y^4 + 2(xy)^2 = 28561$

$x^4 + y^4 + 2(60)^2 = 28561$

$x^4 + y^4 + 2(3600) = 28561$

$x^4 + y^4 + 7200 = 28561$

$x^4 + y^4 = 28561 - 7200$

$x^4 + y^4 = 21361$

5 $x + y = \sqrt{5}$; $x - y = \sqrt{3}$ Find the value of $8xy(x^2 + y^2)$

$x + y = \sqrt{5}$; $x - y = \sqrt{3}$ (take square on both sides)

$(x + y)^2 = 5$; $(x - y)^2 = 3$

Solve the equations

$(x + y)^2 = x^2 + y^2 + 2xy = 5$

$(x - y)^2 = x^2 + y^2 - 2xy = 3$

$2(x^2 + y^2) = 8$

$(x^2 + y^2) = \frac{8}{2} = 4$

$= x^2 + y^2 + 2xy = 5$

$= x^2 + y^2 - 2xy = 3$

(-) (-) (+) (-)

$4xy = 2$

$xy = \frac{2}{4} = \frac{1}{2}$

$8xy(x^2 + y^2) = 8 \times \frac{1}{2} \times 4$

$= 4 \times 4 = 16$

6 If $(a - \frac{1}{a}) = 6$. Find the value of $a^2 + \frac{1}{a^2}$

$\left(a - \frac{1}{a}\right) = 6$

$\left(a - \frac{1}{a}\right)^2 = 6^2$ (take square on both sides)

$a^2 + \left(\frac{1}{a}\right)^2 - 2(a)\left(\frac{1}{a}\right) = 36$

$a^2 + \frac{1}{a^2} - 2 = 36$

$a^2 + \frac{1}{a^2} = 36 + 2$

$a^2 + \frac{1}{a^2} = 38$

7 If $x - \frac{1}{x} = 2$, Find the value of $x^3 - \frac{1}{x^3}$

$(a - b)^3 = a^3 - b^3 - 3ab(a - b)$

$\left(x - \frac{1}{x}\right)^3 = x^3 - \frac{1}{x^3} - 3(x)\left(\frac{1}{x}\right).\left(x - \frac{1}{x}\right)$

$= x^3 - \frac{1}{x^3} - 3\left(x - \frac{1}{x}\right)$

$2^3 = x^3 - \frac{1}{x^3} - 3\left(x - \frac{1}{x}\right)$

$8 = x^3 - \frac{1}{x^3} - 3(2)$

$8 = x^3 - \frac{1}{x^3} - 6$

$8 + 6 = x^3 - \frac{1}{x^3}$

$14 = x^3 - \frac{1}{x^3}$

$x^3 - \frac{1}{x^3} = 14$

8 If $x - \frac{1}{x} = 4$, Find the value of $x^4 + \frac{1}{x^4}$

$x - \frac{1}{x} = 4$ (take square on both sides)

$\left(x - \frac{1}{x}\right)^2 = 4^2$ $[(a - b)^2 = a^2 + b^2 - 2ab]$

$x^2 + \frac{1}{x^2} - 2 \times x \times \frac{1}{x} = 4^2$

$x^2 + \frac{1}{x^2} - 2 = 16$

$x^2 + \frac{1}{x^2} = 16 + 2$

$x^2 + \frac{1}{x^2} = 18$

$\left(x^2 - \frac{1}{x^2}\right)^2 = (18)^2$ (take square on both sides)

$(x^2)^2 + \left(\frac{1}{x^2}\right)^2 + 2 \times x^2 \times \frac{1}{x^2} = 324$

$x^4 + \frac{1}{x^4} + 2 = 324$

$x^4 + \frac{1}{x^4} = 324 - 2$

$x^4 + \frac{1}{x^4} = 322$

Assignment

Add

1 $(5x^2 - 3y^2 + z) + (-x^2 + 2y^2 - 4z)$

2 $7a^2 - 5a^2 + a^2 + 3a^2$

3 $3m^2n - 2m^2n + 4m^2n - m^2n + 7m^2n$

4 $18 + 13x^2 - 13 + 2x^2 - 15x^2$

5 $6l^2m + 3lm^2 - 2l^2m - 17lm^2 + 1$

6 $3a^2b - 2ab - 2a^2b - 3ab - 2a^2b + ab$

Subtract

1 Subtract $2a^2 - 3b^2$ from $3a^2 + 2b^2$

2 Subtract $-2y^2 + 3xy - 5$ from $3x^2 - 4xy + 7y^2 - 5$

3 Subtract $3x - 4x^2 + 2y^2$ from $4y^2 - 2x + 8x^2$

Add and Subtract

1 $48m^2 + 24m^2n + 12m^2 - 6m^2 - 12m^2n$

2 $3x^2y - 2xy - 2x^2y - 3xy - 2x^2y + xy$

3 $10x + 14 - 7y^2 - 11a + 2x - 4 - 3y^2 - 4a + 8$

Multiplication

1 $7pq^2 \times 5r$

2 $(4x^2 + 3y^2) \times (-2z)$

3 $-7p \times 4q^2$

4 $p^2q^3 \times 3p^3q^2$

5 $(3b^2 - 2b)3b^2$

6 $5y \times 2y^3y^2$

7 $ab^{-1} \times ba^{-1}$

Division

1 $4a^8 \div 2a^3$

2 $-15a^8 \div 3a^5$

3 $\frac{8a^4}{12a^{-7}}$

4 $\frac{3p^2 \times 4p \times 5p^3 \times p}{6p^4 \times 10p}$

5 $\frac{25m^2n}{5m^3n^2}$

Estimation and Costing - Simple estimation of the requirement of material etc., as applicable to the trade - Construct LED light bulb with driver circuit

Introduction

Estimation is the method of calculating the various quantities and the expenditure to be incurred on a particular job or process.

Estimate is the method used to measure or quantify the different quantities and the expected expenditure to be incurred on a particular work or project.

We know that the estimation is a long procedure, and it is totally depends upon the projects,

In case the funds available are less than the estimated cost the work is done in part or by reducing it or specifications are altered,

The following essential details are required for preparing an estimate.

Drawings like plan, elevation and sections of important parts.

Detailed specifications about workmanship & properties of materials, etc.

Standard schedule of rates of the current year.

Estimating is the process of preparing an approximation of quantities which is a value used as input data and it is derived from the best information available.

An estimate that turns out to be incorrect will be an overestimate if the estimate exceeded the actual result, and an underestimate if the estimate fell short of the actual result.

A cost estimate contains approximate cost of a product process or operation. The cost estimate has a single total value and it is inclusive of identifiable component values.

Purpose of Estimating and Costing

1 Estimates provide a rough idea of the cost of the job and therefore its feasibility can be calculated, i.e. whether or not the project would be included in the funds available.

2 Estimate gives an idea of the time needed to complete the work.

3 Estimates are required to invite tenders and quotations and to arrange the contracts.

4 Estimates are also required to control expenditure during the execution of the work.

5 Estimates decide whether or not proposed plan matches the funds available.

Estimation Methods

Estimate involves the following operations

- Preparing detailed Estimate.
- Calculating the rate of each unit of work.
- Preparing abstract of estimate.

Estimation is the process of calculating or evaluating a quantity by estimation, that is, without reference to specific measurements. Estimating is a fundamental process in all engineering.

This is usually done before purchase or construction begins or during preliminary planning stages. Estimating is usually more accurate, but there are a few limitations - namely that if your estimate relies on labour costs, you'll need to know how many man-hours will take to complete the project.

Estimates are developed from observations and knowledge of past experience. The accuracy of an estimate often depends on the level of detail available and the amount of time for which data are available for analysis.

Costing is the process of estimating the cost of a project before it's completed. It can be done with an itemized list, or through estimation using a construction cost calculator.

Costing includes three steps: estimating, bidding, and finalizing. It helps predict how much money will be required to construct the project.

A "costing" typically refers to how much it will cost someone to produce a single unit.

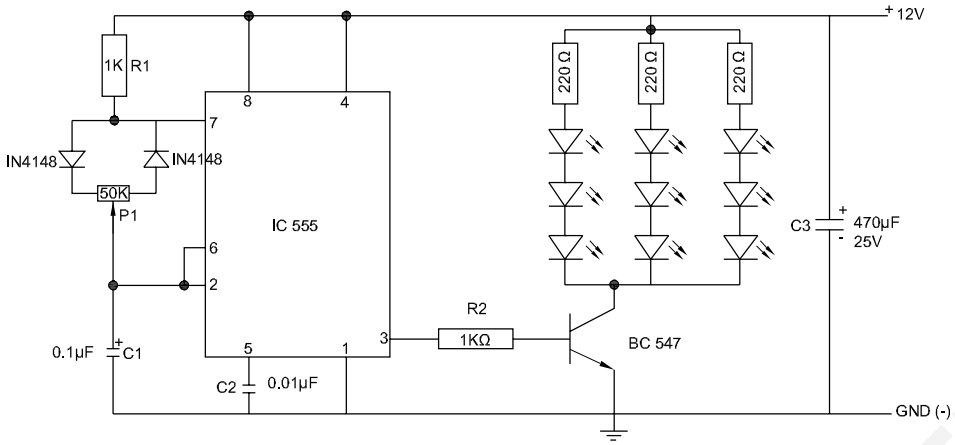
There are two types of costings

Independent costing - this is the cost of direct material and labour costs. This type of costing only takes into account the cost of a single-phase, so it's not representative of the overall project cost.

Cumulative Costing - this type of costing looks at the total cost for all phases of work, but it can be difficult to ensure that estimates are accurate.

Construct LED light bulb with driver circuit (Fig 1)

Fig 1



Material / Components

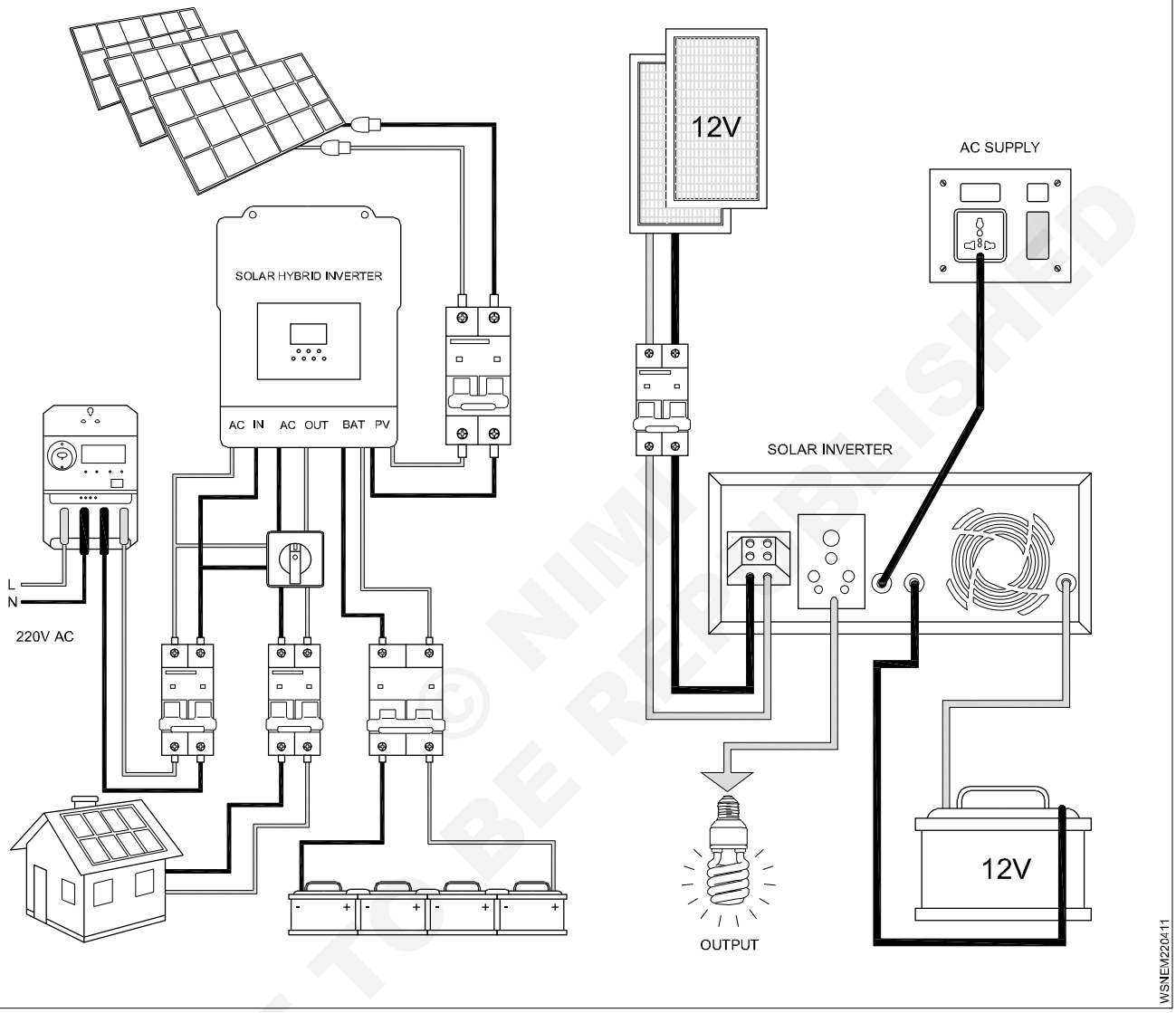
1	IC 555	- 1 No.
2	Bread board / PCB	- 1 No.
3	Transistor BC 547	- 1 No.
4	Resistor 1 kΩ / ½ W	- 2 Nos.
5	Capacitor 0.1 mF	- 1 No.
6	Capacitor 0.01 mF	- 1 No.
7	Diode IN4148	- 2 Nos.
8	Linear potentiometer	- 50 kΩ
9	Thermistor (around 100Ω)	- 1 No.
10	LED white / 5 mm - 1watt rated	- 26 Nos.
11	LED strip / LED flexible strip	
12	Shrink sleeves	- as required
13	Assorted spare SMD LEDs	- as required
14	Flux / solder wire	- as required

Cost of Material / Components **= Rs. 2,000**

Estimation and Costing - Simple estimation of the requirement of material etc., as applicable to the trade - Install the solar inverter 1kW

Install the solar inverter 1kW

Fig 1



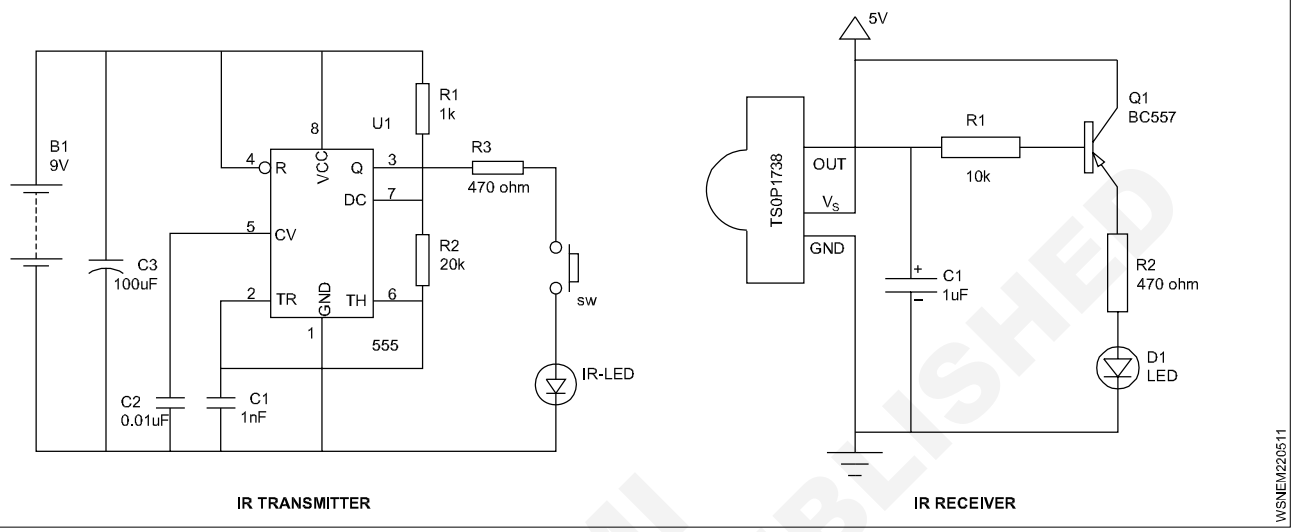
Material / Components

1	Solar panel	=	Rs. 65,000
2	Steel fabrication material	=	Rs. 5,000
3	Wires conduit pipes and connecting components	=	Rs. 10,000
4	Inverter	=	Rs. 8,000
5	Battery	=	Rs. 15,000
	Total	=	**Rs.1,03,000**

Estimation and Costing - Simple estimation of the requirement of material etc., as applicable to the trade - Construct and test IR transmitter and receiver

Construct and test IR transmitter and receiver

Fig 1



Material / Components

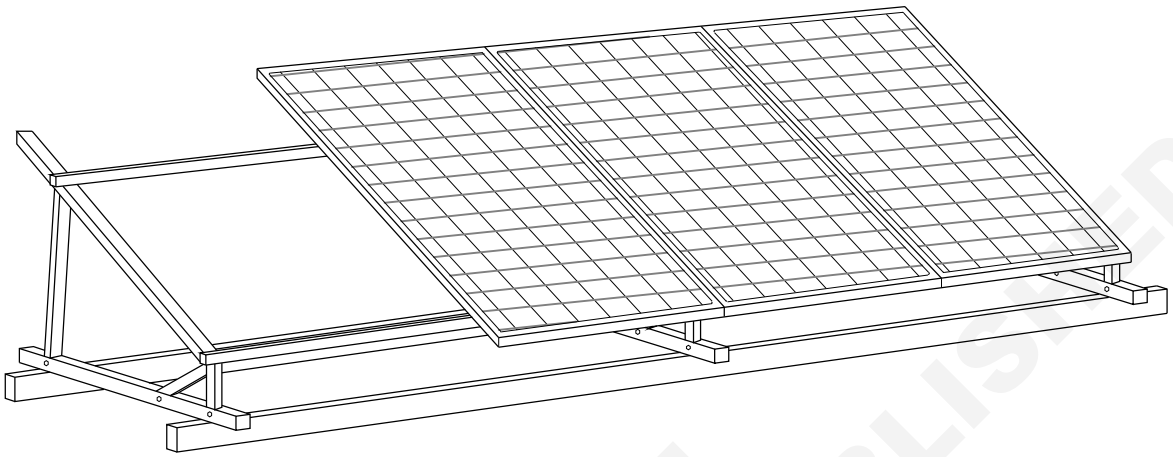
1	Bread board / PCB - GP	- 1 No.
2	IC 555 Timer IC	- 1 No.
3	BC 557 transistor	- 1 No.
4	TSOP 1738	- 1 No.
5	IR LED	- 1 No.
6	LED RED 5mm	- 1 No.
7	Push - to - ON switch	- 1 No.
8	Resistor 1/4 watt (1k, 20k, 10k)	- 1 No each.
9	Resistor (470 ohms)	- 2 Nos.
10	Capacitor (100 µF, 25V DC, 0.01 µF, 1 µF, 1 nF)	- 1 No.
11	9V battery	- 1 No.
12	Hook up wire	- as required
13	Solder and flux	- as required

Cost of Material / Components = **Rs.1,500/-**

Estimation and Costing - Simple estimation of the requirement of material etc., as applicable to the trade - Installation of solar panel on a roof 2kW

Installation of solar panel on a roof 2kW

Fig 1



List of Material / Components

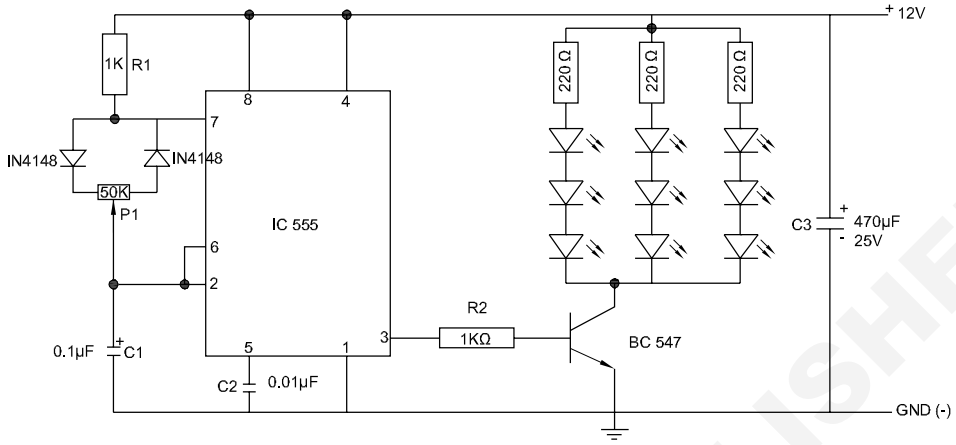
1	Base pipe	-	10 metres
2	Contact pipe	-	5 metres
3	supporting pipe	-	5 metres
4	Rail splice	-	2 metres
5	Rail	-	4 Nos.
6	Rail contact AC	-	12 Nos.
7	End clamp	-	20 Nos.
8	Mid clamp	-	20 Nos.
9	M8 x 25mm screws	-	50 Nos.
10	Bolts & nuts	-	20 Nos.

Material / Components	=	Rs.5,000
Cost of 2kW solar panel	=	Rs.40,000
Cost of steel pipe, material / components	=	Rs. 5,000
Total cost of Material / Components	**=**	**Rs. 45,000**

Estimation and Costing - Problems on estimation and costing - Construct LED light bulb with driver circuit

Construct LED light bulb with driver circuit

Fig 1



1 Take all the components as per the circuit diagram as shown in Fig

2 Test the components by multimeter and for any physical damages

3 Check all the LEDs individually by the DMM

4 Construct the above circuit using IC555 for any in the bread board

5 Plan your layout and connect the necessary wiring and supply connections

6 Check and confirm the connections as per the circuit diagram

7 Switch ON the supply, observe the illuminations of all LED's

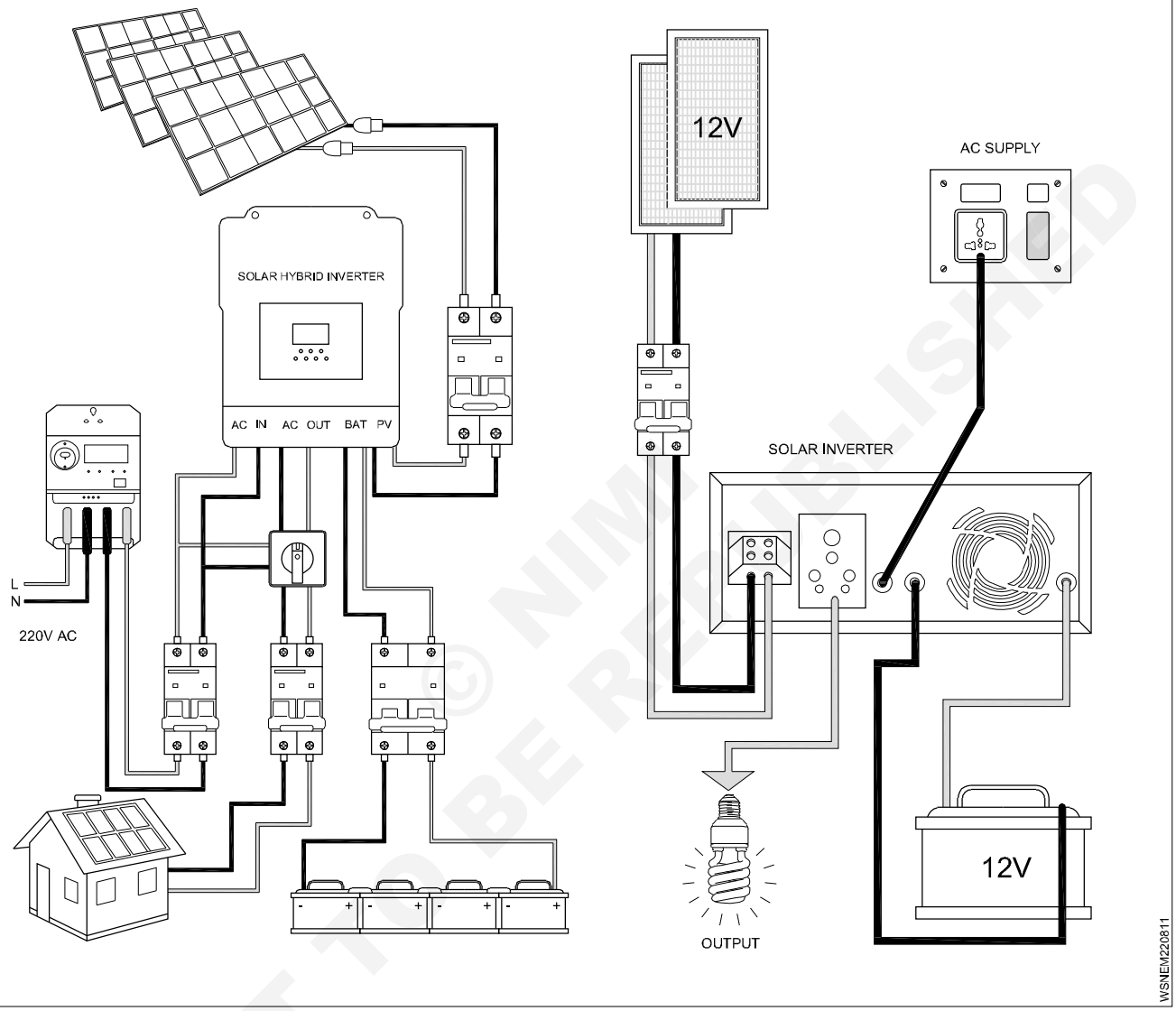
8 Check the voltage at the output of the driver

Construct LED light bulb with driver circuit charge	= Rs.1000
Cost of Material / Components	= Rs.2000
Total cost	**= Rs.3000**

Estimation and Costing - Problems on estimation and costing - Install the solar inverter 1kW

Install the solar inverter 1kW

Fig 1



1 Check that the wall is capable of bearing the heavy load of the device and vibration free to avoid disruptive vibration

2 Measure the dimesions of the solar inverter and mark the hole in wall

3 Drill 4 holes in the marked location with 4 screws

4 Place the unit on the surface and align the mounting holes with 4 screws and mount the solar inverter

5 Check that the solar inverter is firmly secured

Connecting the solar inverter to the grid (AC)

1 Read label and note down rated voltage and current of the given solar inverter

2 Check the grid voltage and frequency with DMM, it should be the same to “VAC” value on the product label

3 Turn off the circuit breaker

4 Remove the installation sleeve 8mm for 3 conductors and shorten the phase L and neutral conductor N3mm

5 Connect wires according to polarities indicated on terminal block, be sure to connect PE protective earth conductor ⏚ first.

6 L - line (brown or black) next ⏚ ground (yellow - green) and N - Neutral (blue)

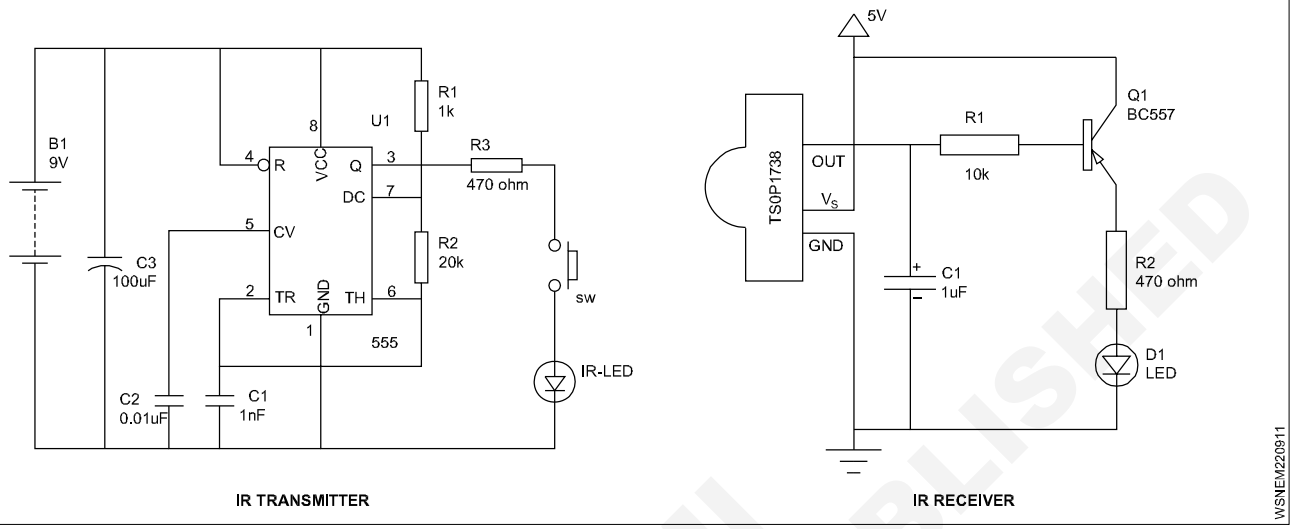
7 Make sure the wires are securely connected. The reference tightening torque is 0.82 N.M

Installation charge	= Rs. 20,000
Cost of Material / Components	= Rs. 1,03,000
Total cost	**= Rs. 1,23,000**

Estimation and Costing - Problems on estimation and costing - Construct and test IR transmitter and receiver

Construct and test IR transmitter and receiver

Fig 1



1 Refer the circuit diagram as shown in Fig 1&2. List the components and quantity required

2 Test and confirm the good condition of given components

3 Plan the layout and assemble the components on the bread board

4 Give the circuit connection as shown in Fig 1&2 with the help of hook up wires

5 Get the assembled circuit

6 Connect the 5V unregulated power supply to the receiver circuit

7 Connect the 9V battery to the transmitter

8 Switch ON the power supply for the receiver circuit

9 Press the push ON switch on the transmitter circuit

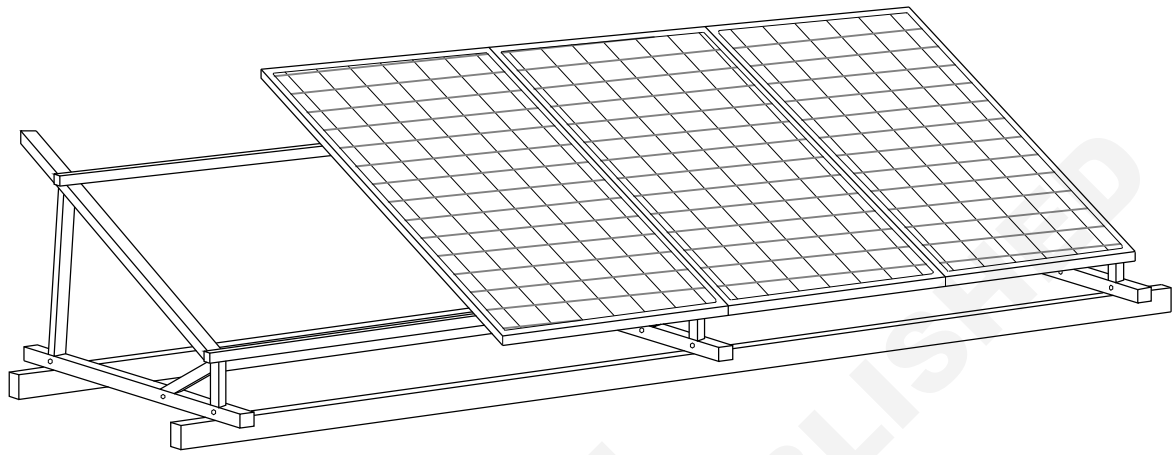
10 If the LED in the receiver circuit is glowing means that the transmitter and receiver circuit is in working condition

Construction and test charge for IR transmitter	=	Rs.1000
Cost of Material/ Components	=	Rs.1500
Total cost	**=**	**Rs.2500**

Estimation and Costing - Problems on estimation and costing - Installation of solar panel on a roof 2kW

Installation of solar panel on a roof 2kW

Fig 1



Select the roof

1 Select the roof without shading for the solar panel installation

2 Leave a safe working area between the edge of the roof and the external edge of the solar array for installation

3 Make sure the direction of installation of the solar panels takes sun into consideration

4 Pick an area of your roof to install the solar panels that gets the sun light rays as long as possible each day

5 The solar panels can either be mounted flush on the roof or stand or mounted at an angle to maximise, the position of accessibility to the sun's direct rays

Prepare frame set up

1 Contact pipe with M8 x 25 contact base pipe

2 Use M8 x 25 contact support pipe

3 Rail AC with M8 x 25 fixed on contact pipe

4 Take 2 fixed file rack and position them with rail

5 Slide the splice on the rear side of the pre-assembled rails. Fasten the first bolt, then slide the next rail into the splice

6 Put one panel on the rack, use 2 end clamps to hold and fix by following the picture (Attention end of Rail distance must <2.5mm to 30mm)

7 Install the method for mid clamp and end clamp

8 Follow and use mid clamp fixed between panels

Select the correct position of solar panel end installation

1 Select the best / perfect angle for solar panels with the help of manual to produce the maximum power

2 Refer to the perfect angle for standard roof pitch angle

3 Mark the holes after selecting the place and angle of inclination

4 Drill the hole on the roof with the help of drlling machine

5 Fix the frame with the help of screw

6 Place the panel on frame

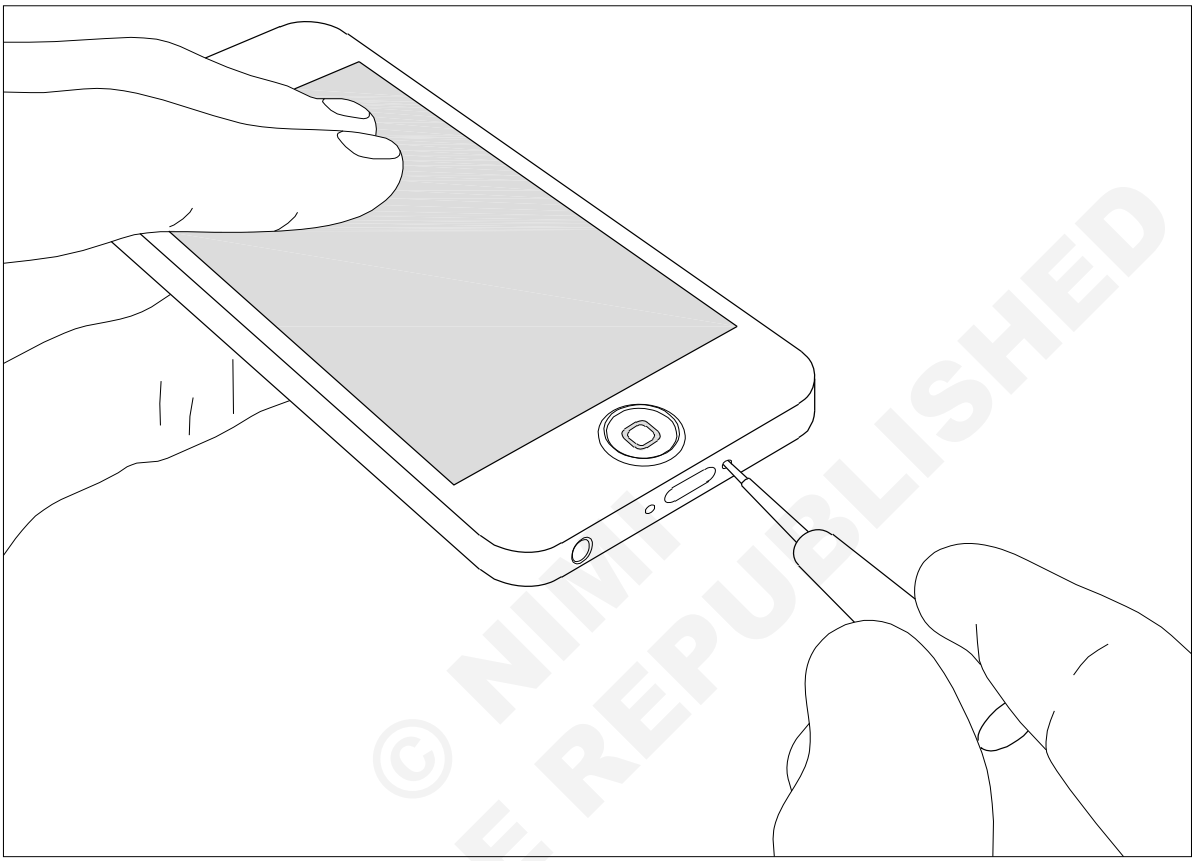
Cost of installation

Total cost of material / components	=	Rs.45,000
2kW Solar Panel Installation charge	=	Rs. 2,000
Total cost	**=**	**Rs.47,000**

Estimation and Costing - Problems on estimation and costing - Replace faulty part of mic

Replace faulty part of mic

Fig 1



WSNEM221111

Testing and replacing of Mic

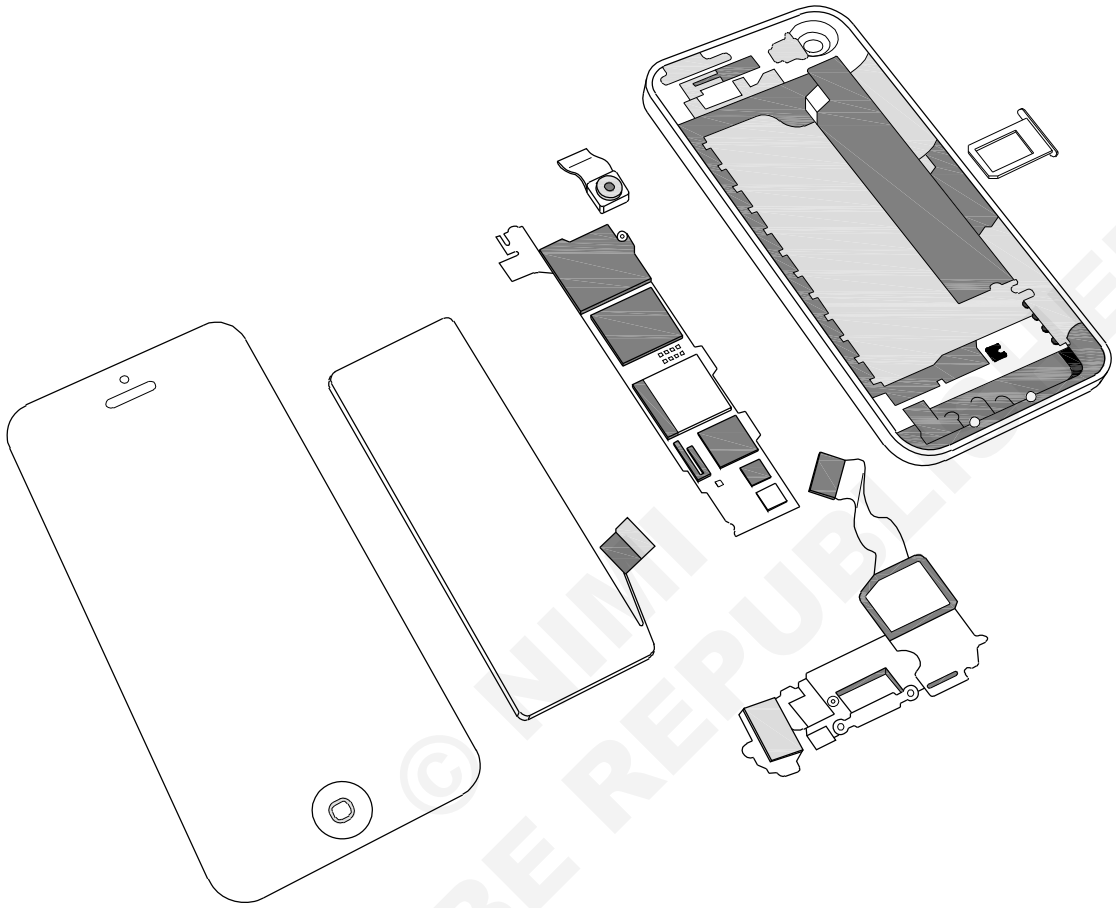
1 Check the mic healthness by recording voice (or) by making a call
2 Switch OFF the phone and dismantle the phone by referring exercise.
3 Remove the mic connection and clean the dust using pump blower
4 Check the continuity of Mic and check tracks of Mic upto the audio IC
5 Clean the track using CTC (or) IPA solution
6 Check the continuity of track using multimeter
7 Join the defective tracks
8 Warm the audio IC by using test lamp (or) by soldering station temperature at 250°C.
9 Now assemble the phone and switch ON
10 Check the phone sound
11 Replace the Mic with similar one if found defective

Depending on the model of the phone repair and service charge range = **Rs.1000 to Rs.5000**

Estimation and Costing - Problems on estimation and costing - Replace faulty part of speaker

Replace faulty part of speaker

Fig 1



WSNEM221211

1 Switch ON the cell phone and operate volume keys, check speaker sound by play any sound file like music

2 Switch 'OFF' the phone and dismantle

3 Remove the speaker connection and check the continuity

4 Check the tracks of speaker upto the audio IC

5 Clean the track using CTC solution

6 Check the continuity of track using multimeter

7 Join the defective tracks

8 Warm the audio IC by using test lamp (or) by soldering station temperature at 250°C

9 Now assemble the phone and switch ON

10 Check phone sound

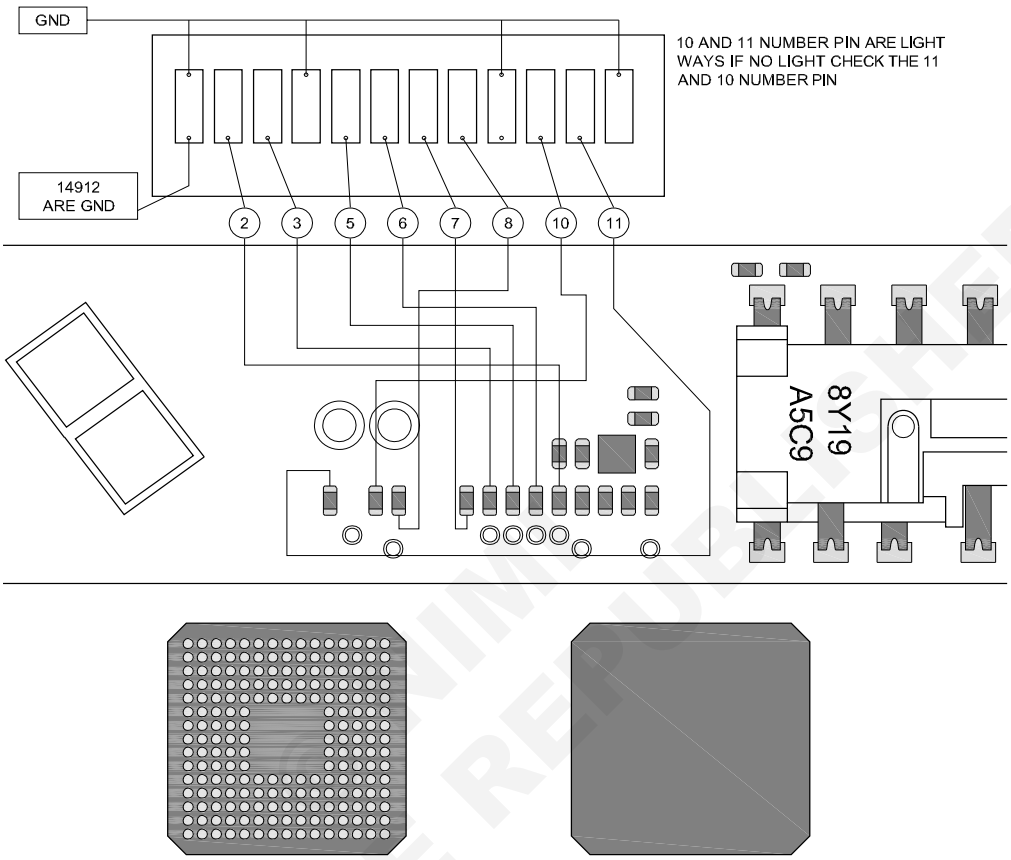
11 Replace the speaker with similar one if found unserviceable defective

Depending on the model of the phone repair and service charge range = **Rs.1000 to Rs.2000**

Estimation and Costing - Problems on estimation and costing - Faults in blank display and blue display in cell phone / smart phone

Faults in blank display and blue display in cell phone / smart phone

Fig 1



1 Clean the display connector in case if found any dry-solder, solder again.

2 In sliding or folding handset. Change the strip.

3 Check & change display.

4 Clean the display connector in case, if found any dry-solder, solder again.

5 Heat the display IC.

6 If not ok then change the display IC.

7 Check the display related tracks.

8 If tracks are open then join the track.

9 If all tracks are ok but problem is same then heat the CPU IC (20 Sec to 30 Sec) Set the soldering station temp at 250ºC.

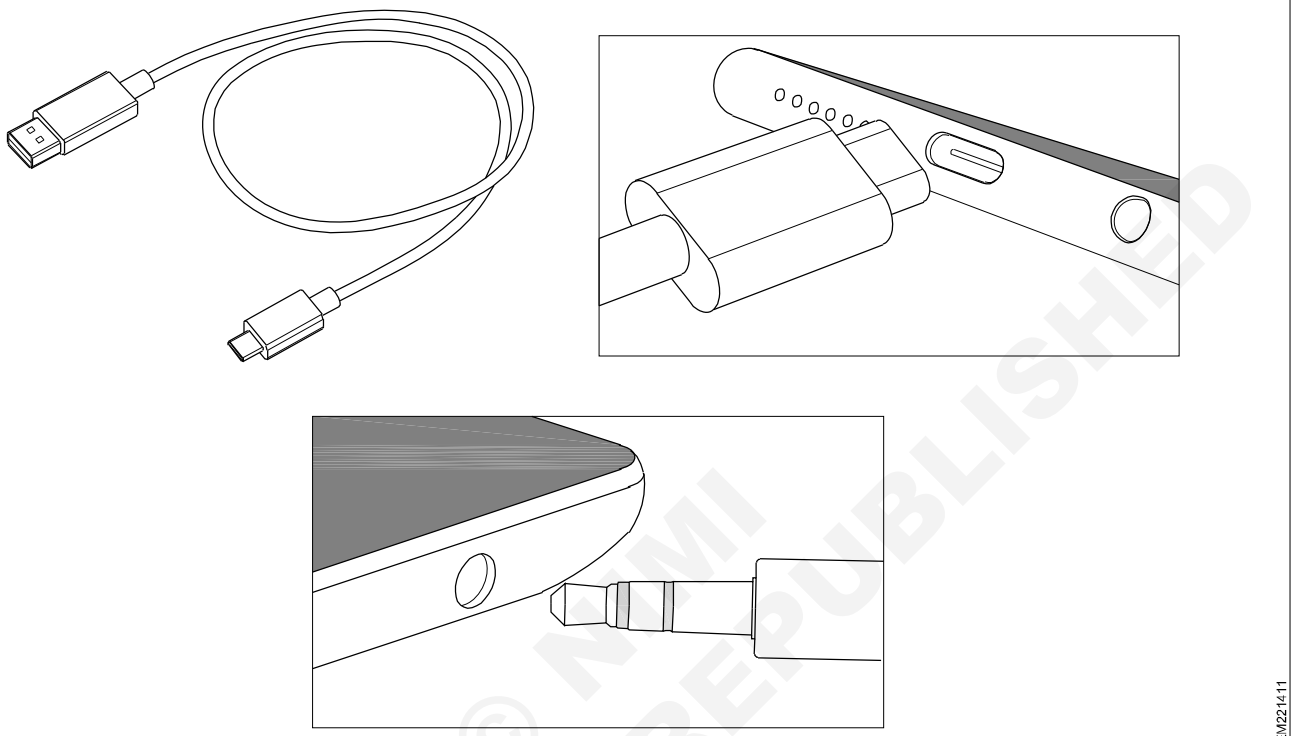
Material / Components

1	Change the strip	= Rs. 100
2	Change the display IC	= Rs. 500
3	Service charge	= Rs. 500
	Total cost	**= Rs. 1,100**

Estimation and Costing - Problems on estimation and costing - Replace parts like data / charging / audio jack etc

Replace parts like data / charging / audio jack etc

Fig 1



WSNEM221411

1 Connect the charger to phone and check the signal of charging indication on the screen

2 Transfer the data from phone to PC using data cable

3 Switch OFF the phone if the jack is found to be defective and dismantle

4 Desolder the audio jack and replace it with similar one

5 Switch ON the phone and check the healthyness of phone

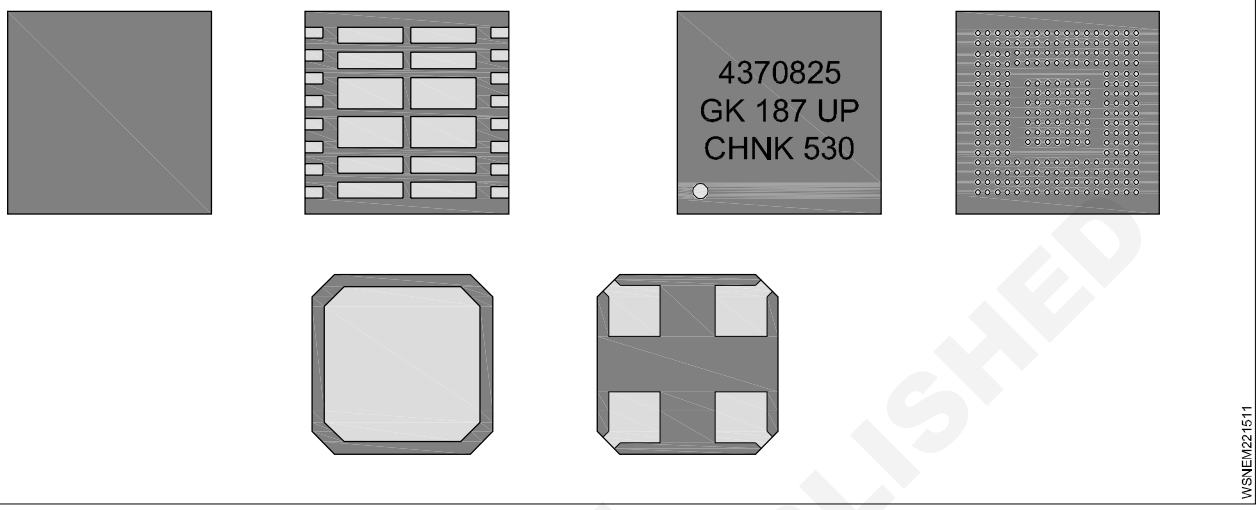
Service replaced the faulty part data / charging / audio jack. = **Rs.800**

Approximate cost of replace charging / audio depending on the model = **Rs.1000 to Rs.3000**

Estimation and Costing - Problems on estimation and costing - Auto dead

Auto Dead

Fig 1



1 Check & change battery

2 PCB cleaning & heating

3 Check Battery connector or clean the battery connector.

4 Check the Battery connector voltage =1.5V to 3.6V

1.5V to 3.6V (correct voltage)	Less then 1.5V (low voltage)	More than 3.6 (high voltage)

Correct Voltage (1.5V to 3.6 V) = software complaint

5 Flash the Handset through the software. Low Voltage (Less than 1.5 V) = Hardware complaint

6 Check the voltage tracks

7 If tracks are open then to join the tracks.

8 If all track are ok. But problem is same then change the Crystal IC.

9 If not ok then change power amplifier IC.

10 If not ok it means problem in Power IC (UEM IC).

11 Then Heat the UEM IC (20 Sec to 30 Sec). Set the soldering station temp at 250ºC

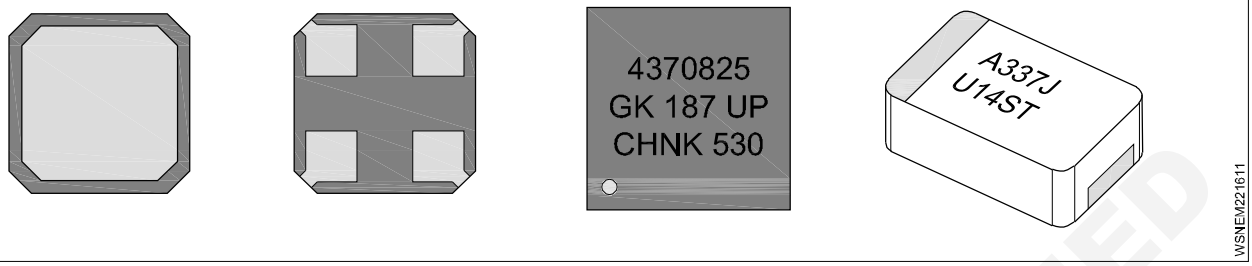
Material / Components

1	Crystal IC	- Rs.100
2	Amplifier	- Rs.150
3	Service charge	- Rs.500
	Total cost	**= Rs.750**

Estimation and Costing - Problems on estimation and costing - Water Damaged Dead (PCB Short)

Water Damaged Dead (PCB Short)

Fig 1



1 Check battery connection short

2 PCB cleaning & heating by using Elma & IPA solution

1st time = Elma

2nd time = IPA solution

3 Change the Battery connector

4 Change crystal IC.

5 If Not ok then change the power capacitor.

6 If not ok then remove the Power Amplifier IC.

7 If not ok then heat the power IC.(20sec to 30sec). Set the soldering station temp at 250ºC

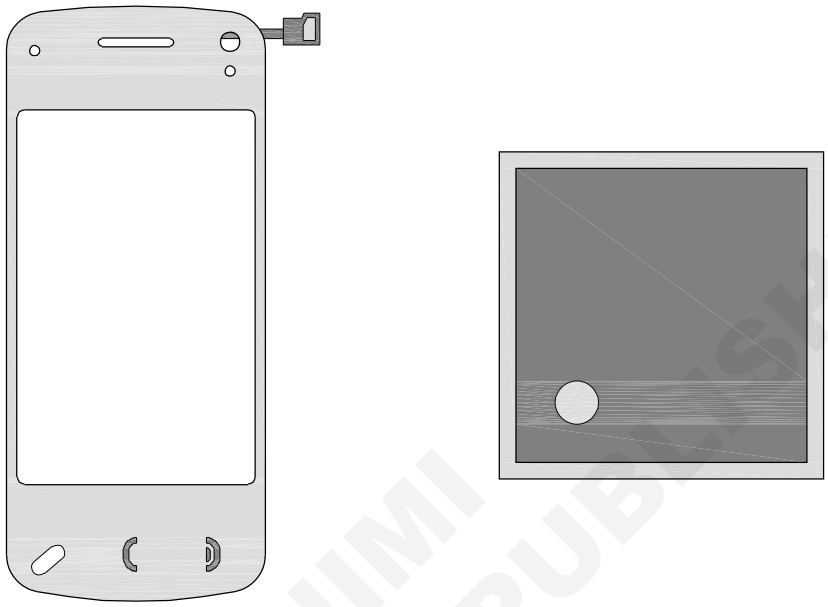
Material / Components

1	Battery connector	= Rs. 80
2	Crystal IC	= Rs.140
3	Power capacitor	= Rs.100
4	Service charge	= Rs.500
	Total cost	**= Rs.820**

Estimation and Costing - Problems on estimation and costing - Touch Screen Complaint and Touch pad not working

Touch Screen Complaint and Touch pad not working.

Fig 1



WSNEM221711

1 Check and change Touch pad.

2 Clean touch pad connector for dry soldering.

3 Flash the handset through the Software.

4 If not ok then Change the touch pad IC.

Material / Components

1	Touch pad	= Rs. 600
2	Touch pad IC	= Rs. 200
3	Service charge	= Rs. 500
	Total cost	**= Rs. 1300**