

**ELECTRONICS AND INSTRUMENTATION ENGINEERS ASSOCIATION**

**MUTHAYAMMAL ENGINEERING COLLEGE  
RASIPURAM- 637 408, NAMAKKAL(DT).**

# **INST'RONICS**

**The best INSTRUMENTATION magazine, JAN, 2013 vol. 17**



**INTEL CORE i7**



**EEG HEADPIECE**



**Convenor**

Prof.M.Muruganandam,  
HOD/EIE.

**Chief Editor**

Prof.C.Venkatesh,  
Asst.Prof./EIE.

**Student Editors**

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**Graphics  
&  
Designing**

Mr.A.Gokul Kumar,  
Mr.S.Mohammed Javeeth,  
Mr.P.S.Govindaraj,  
Mr.D.Naveen Bharathi.

**EDITORS:**

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**“Our life is what our thought makes of it  
Great thought comes from the heart”**

*We thank Our Beloved Principal **Dr.M.Madheswaran** for his  
valuable guidance and encouragement in bringing up this  
magazine “**INSTRONICS**” successfully.*

**- EIE ASSOCIATION**

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## **TERMS & DEFINITIONS:**

### **Salt Bridge:**

The salt bridge of a reference electrode is that part of the electrode which contains the filling solution to establish the electrolytic connection between reference internal cell and the test solution.

### **Salt Effect (fx):**

The effect on the activity coefficient due to salts in the solution.

### **Scientific Apparatus Makers Association:**

Scientific Apparatus Makers Association (SAMA) is an association that has issued standards covering platinum, nickel, and copper resistance elements like RTDs.

### **Scroll:**

To move all or part of the screen material up to down, left or right, to allow new information to appear.

### **Secondary Device:**

A part of the flow meter which receives a signal proportional to the flow rate, from the primary devices, displays, records and/or transmits the signal.

### **Secondary Standard:**

pH buffer solutions which do not meet the requirements of primary standard solutions but provide coverage of the pH range not covered by primary standards. The pH value of the primary standard is not close to the sample pH value.

### **Seebeck Coefficient:**

The derivative (rate of change) of thermal EMF with respect to temperature normally expressed as mill volts per degree.

### **Seebeck Effect:**

The circuit is formed by a junction of two dissimilar metals and the junctions are held at different temperatures, a current will flow in the circuit caused by the difference in temperature between the two junctions.

### **Seebeck EMF:**

The open circuit voltage caused by the difference in temperature between the hot and cold junctions of a circuit made from two dissimilar metals.

### **Sensing Element:**

The part of the transducer which reacts directly in response to the input.

### **Sensitivity Shift:**

A change in slope of the calibration curve due to a change in sensitivity.

### **Sequential Access:**

An access mode in which records are retrieved in the same order in which they were written. Each successive access to the file refers to the next record in the file.

### **Serial transmission:**

In this transmission, the data are sending one bit at a time on a single transmission line. The data rate is slow, compare with parallel transmission.

### **Settling Time:**

The time taken for the display to settle within one digit final value when a step is applied to the meter input.

### **Shear Stress:**

The normal stress is perpendicular to the designated plane,

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shear stress is parallel to the plane.

**Shearing Strain:**

A measure of angular distortion also directly measurable, but not as easily as axial strain.

**Signal Conditioner:**

A circuit module which offsets, attenuates, amplifies, linearizes and/or filters the signal for input to the A/D converter. The typical output signal conditioner is +2V DC.

**Signal Conditioning:**

To process the form or mode of a signal so as to make it intelligible to, or compatible with a given device, including such manipulation as pulse shaping, pulse clipping, compensating, digitizing and linearizing.

**Single Precision:**

The degree of numeric accuracy that requires the use of one computer word. In single precision, seven digits are stored, and up to seven digits are printed. Contrast with double precision.

**Single-Plane (Static) Balancing Machine:**

A single plane balancing machine is a gravitational or centrifugal balancing machine that provides information for accomplishing single plane balancing.

**Smallest Bending Radius:**

The smallest radius that a strain gage can withstand in one direction, without special treatment and without suffering visible damage.

**Software:**

The programs loaded into a computer from external mass storage but also extended to include operating systems and documentation.

**Solvation:**

Ions in solution are normally combined with at least one molecule of solvent. This phenomenon is termed as solvation.

**Source Code:**

A non-executable program written in a high-level language. A compiler or assembler must translate the source code into object code (machine language) that the computer can understand and process.

**Span Adjustment:**

The ability to adjust the gain of a process or strain meter so that a specified display span in engineering units corresponds to a specified signal span. For instance, a display span of 200°F may correspond to the 16 mA span of a (4-20) mA transmitter signal.

**Specific Gravity:**

The ratio of mass of any material to the mass of the same volume of pure water at 4°C.

**Strain Gauge:**

A measuring element for converting force, pressure, tension, etc., into an electrical signal.

**Strouhal Number:**

A non dimensional parameter important in vortex meter design defined as,

$$S = Fh/V$$

where F = Frequency, V = Velocity, h = Reference Length

**By:**

**Ms.N.Gomathi,  
Second Year (MEIEA).**

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## Denis Papin



**Born** :22<sup>nd</sup> August 1647  
**Nationality** :France

**Denis Papin** was a French physicist, mathematician and inventor, best known for his pioneering invention of the steam digester, the forerunner of the steam engine and of the pressure cooker.

### **Early life:**

Papin first visited **London** in 1675, and worked with **Robert Boyle** from 1676 to 1679, publishing an account of his work in Continuation of New Experiments (1680). During this period, Papin invented the steam digester, a type of **pressure cooker** with a **safety valve**.

He first addressed the Royal Society in 1679 on the subject of his digester, and remained mostly in London until about 1687, when he left to take up an academic post in Germany.

He found himself greatly affected by the increasing restrictions placed on Protestants by Louis XIV of France and by the King's ultimate revocation of the Edict of Nantes in 1685. In Germany he was able to live with fellow Huguenot exiles from France.

In 1689, Papin suggested that a force pump or bellows could maintain the pressure and fresh air inside a diving bell. Engineer John Smeaton utilized this design in 1789. While in Marburg in 1690, having observed the mechanical power of atmospheric pressure on his 'digester', Papin built a model of a piston steam engine, the first of its kind.



**Fig. Pressure Cooker**

Papin continued to work on steam engines for the next fifteen years. In 1695 he moved from Marburg to Kassel. In 1705 he developed a second steam engine with the help of Gottfried Leibniz, based on an invention by Thomas Savery, but this used steam pressure rather than atmospheric pressure.

During his stay in Kassel in Hesse, in 1704, he constructed a ship powered by his steam engine, mechanically linked to paddles. This made him the first to construct a steam-powered boat.

**By:**

**Mr.R.M.Aravind,  
Third Year (MEIEA).**

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## **Washing Machine That Doesn't Need Water**

British company Xeros looks forward to conquer the American market with its latest invention, a new washing system able to save a lot of water using nylon beads. The beads tumble wash clothes using 90 percent less water than traditional washers.

It claims that there would be no need for tumble drying and if the homes in the United States would switch to the new system, the emissions of carbon dioxide would be considerably reduced.

The result would be as though 5 million vehicles have been removed from the road. The company also says that the new washing machine will save 1.2 billion tons of water each year, which equals 17 million swimming pools.

The washing machine does its job using small nylon beads that eliminate stains off clothes and lock them into the molecular structure of the nylon. The beads can be used for hundreds of washes and afterwards they can be easily recycled.

## **Mind-Controlled TV Concept**

Haier's latest invention recently presented is a mind-controlled TV at CES 2012. Dubbed the "Brain Wave TV", the device features a 58-inch display and it can be seen at the company's booth. This is just a prototype that the company is currently working on.



**Fig. EEG headpiece**

To be able to control the futuristic television set, the user only needs to put on an Electro Encephalography (EEG) headpiece (on the image you can see the right position of the device that reads your brain).

However, the company did not show any TV interface. Instead it decided to demonstrate its innovation on a mini-game in which the player should try to make a barrel explode by focusing on it very hard.

Basically, the headpiece reads the electrical activity on the user's scalp. Still due to the fact that currently it only has one main sensor, the device didn't really show good results, though the whole idea is worth appreciating.

According to Haier, in the near future it plans to equip its EEG headpiece with functions that will allow the user to use their brain to adjust the volume and switch channels.

**By:**

**Ms.S.Dhanapriya,  
Third Year (MEIEA).**



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## **Applications of Neural Networks in Medicine**

Medicine has always benefited from the forefront of technology. The technology advances like computers, lasers, ultrasonic imaging, etc. have boosted medicine to extraordinary levels of achievement. Artificial Neural Networks (ANN) is currently the next promising area of interest.

It is believed that neural networks will have extensive application to biomedical problems in the next few years. It has been successfully applied to various areas of medicine, such as diagnostic systems, biochemical analysis, image analysis, and drug development.

### **Diagnostic Systems:**

ANNs are extensively used in diagnostic systems. They are normally used to detect cancer and heart problems. The benefits of using ANNs are that they are not affected by factors such as fatigue, working conditions and emotional state.

### **Biochemical Analysis:**

ANNs are used in a wide variety of analytical chemistry applications. In medicine, ANNs have been used to analyse blood and urine samples, track glucose levels in diabetics, determine ion levels in body fluids, and detect pathological conditions such as tuberculosis.

### **Image Analysis:**

ANNs are used in the analysis of medical images from a variety of imaging modalities. Applications in this area include tumour detection in ultra-sonograms, classification of chest

x-rays, tissue and vessel classification in Magnetic Resonance Images (MRI), determination of skeletal age from x-ray images, and determination of brain maturation.

### **Drug development:**

ANNs are used as tools in the development of drugs for treating cancer and AIDS. ANNs are also used in the process of modelling biomolecules.

### **Modeling and Diagnosing the Cardiovascular System:**

Neural Networks are used experimentally to model the human cardiovascular system. Diagnosis can be achieved by building a model of the cardiovascular system of an individual and comparing it with the real time physiological measurements taken from the patient. If this routine is carried out regularly, potential harmful medical conditions can be detected at an early stage and thus make the process of combating the disease much easier.

A model of an individual's cardiovascular system must mimic the relationship among physiological variables (i.e., heart rate, systolic and diastolic blood pressures, and breathing rate) at different physical activity levels. If a model is adapted to an individual, then it becomes a model of the physical condition of that individual. The simulator will have to be able to adapt to the features of any individual without the supervision of an expert. This calls for a neural network.

Another reason that justifies the use of ANN technology is the ability of ANNs to provide sensor fusion which is the combining of values from

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several different sensors. Sensor fusion enables the ANNs to learn complex relationships among the individual sensor values, which would otherwise be lost if the values were individually analyzed.

In medical modeling and diagnosis, this implies that even though each sensor in a set may be sensitive only to a specific physiological variable, ANNs are capable of detecting complex medical conditions by fusing the data from the individual biomedical sensors.

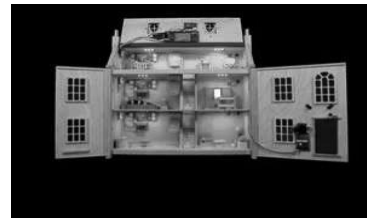
This model could be used to monitor employees in hazardous environments like fire-fighters. The system could be used to determine whether firemen have recovered sufficiently from the last inhalations of smoke to be allowed to enter smoke-filled environments again.

The advantages that such a system can offer are obvious. People can be checked for heart diseases quickly and painlessly and thus detecting any disease at an early stage. Of course, the system doesn't eliminate the need for doctors since a human expert is more reliable.

ANNs have a lot to offer to modern medicine. At the moment they are mainly used for pattern recognition using images but experiments are being done in using ANNs to model parts of the human body. Neural networks will never replace human experts but they can help in screening and can be used by experts to double-check their diagnosis.

## **Doll House that Helps Cut Co<sub>2</sub> Emissions and Serve as Security System**

The latest invention is a doll's house that could change our way of life, at least that what its developers state. The doll's house is part of a project entitled interhome and was developed with the goal of showing that our homes could be much greener and safer if homeowners took advantage of smart technologies that adapt to people's daily lives.



**Fig. Doll house**

In doll house, the software algorithm of the house analyzes the rooms that people tend to occupy and then learns when there is a need to turn on the lights, the air conditioning or heating systems and when such actions are not necessary.

The tests are carried out by researchers showed that the technology behind the interhouse can help reduce carbon emissions and cut energy bills by about 300 (\$490) per year, reports new scientist. In addition to that, the latest invention can also serve as a home security system - the lock sensors on doors and windows are connected to the main computer and whenever the homeowner forgets to lock them the system sends a text message.

**By:**

**Mr.K.Santhosh,  
Final Year (MEIEA).**

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## Intel Core i7



**Fig. Intel Core i7 processor**

### **Specifications:**

- Made From 2008
- Made by Intel
- Max. CPU clock 1.6 GHz to 3.47 GHz Min
- feature size 45 nm, 32 nm, or 22 nm
- Instruction set x86, x86-64, MMX, SSE,
- SSE2, SSE3, SSSE3, SSE4.1, SSE4.2
- Microarchitecture Nehalem Cores 2, 4, or 6
- Socket(s) LGA 1366
- LGA 1156mPGA-989

The current lineup of Core processors includes the latest Intel Core i7, Intel Core i5, and Intel Core i3, and the older Intel Core 2 Solo, Intel Core 2 Duo, Intel Core 2 Quad, and Intel Core 2 Extreme lines.

The original Core brand refers to Intel's 32-bit mobile dual-core x86 CPUs that derived from the Pentium M branded processors. The processor family used a more enhanced version of the Intel P6 microarchitecture. It emerged in parallel with the NetBurst microarchitecture (Intel P68) of the Pentium 4 brand, and was a precursor of the 64-bit Core microarchitecture

of Core 2 branded CPUs. i7 is a name that the company Intel uses for the computer processors it makes for desktop and laptop computers. Intel uses this name for the fastest processors that they think will be used to build computers for consumers instead of business people. Intel started to use this name in 2008. Before 2008, Intel used the name "Core 2" for this kind of processor.

There are different types of Core i7 processor. The name does not name a type. Instead, it is the name for all of the fast processors that Intel thinks should be sold to consumers.

Intel uses two other "Core i-" names for its processors for consumers: "Core i5" and "Core i3." Intel uses the "Core i5" name for processors that are not quite so fast as the "Core i7" processors.

The "Core i5" processors can do most things that most people want to do quickly except for playing some types of computer games. Intel uses the "Core i3" name for processors for computers that are even slower than "Core i5" processors. "Core i3" can do most simple things for most people.

Intel uses a different name, Xeon, for processors that Intel makes for "server" computers for businesses. Some of the "Core i7" processors are almost the same as some of the "Xeon" processors, but each of the Xeon processors is a little bit different than the "Core i7" processor, because a "server" computer is not the same as a consumer computer. Intel also makes other "Xeon" processors that are not the same as any "Core i7" processor.

**By:**

**Mr.R.Gurukarthick,  
Second Year (MEIEA).**

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## **Tips for soft skills enhancement**

Soft skills is a term used related to a person's Emotional intelligence Quotient (EQ) the cluster of personality traits, social graces, communication, language, personal habits, friendliness, and optimism that characterize relationships with other people.

These skills are considered important by many recruiters as they believe that soft skills complement hard skills (part of a person's IQ), which are the occupational requirements of a job and many other activities.

Speaking on the importance of soft skills, a HR professional says a candidate with proper soft skills has an edge over others in this competitive world. "It is essential to gauge a person's soft skills before recruiting because behavior is often associated with one's thought process," he adds.

One of the most important aspects of soft skills in professional world is relationship management: the ability to inspire, influence, and develop others while managing conflict.

Some soft skills for professionals are,

1. Interpersonal skills
2. Team spirit
3. Leadership skills
4. Social grace
5. Business etiquette
6. Negotiation skills
7. Behavioral traits
8. Customer service skills
9. Communication skills

1) **Awareness:** You need to begin by making a list of skills that you lack by discussing with your close friends, co-workers etc. Awareness is the first step in building up your soft skills forte.

2) **Interact:** To build an understanding with your teammates, you should interact more with them.

3) **Be optimistic:** Exude that positivism and spread the infectious optimism.

4) **Self-motivating:** Set personal goals to reach new highs and keep targets for yourself.

5) **Possess a forgiving and benevolent ego** - Humble oneself, accept and learn sincerely from criticism.

6) **Be a team player** - Learn to trust, build comradeship, set common goals, provide support, friendship & get your hands dirty!

7) **Communicate effectively** - Be clear, tactful, and diplomatic & pace the conversation.

8) **Think out of box:** Be creative and hone your innovative and creative skills

9) **Look at the Big Picture** - Consider all aspects, potential opportunities, threats & contingencies.

10) **Learn how to multitask and priorities** - Practice empowerment and delegation, manage time well when multitasking and prioritizing.

**By:**

**Mr.S.Sinaj,  
Third Year (MEIEA).**

## Contactless digital tachometer using 8051

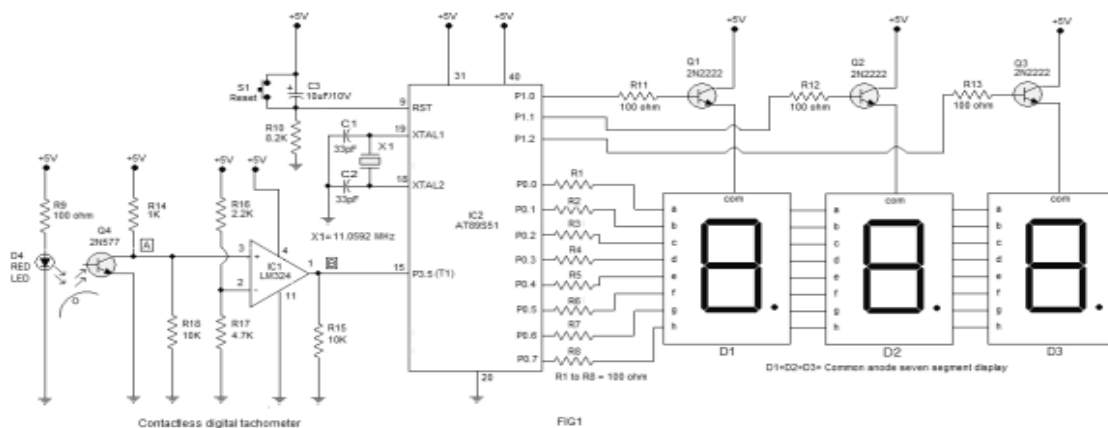
A three digit contact less digital tachometer using 8051 microcontroller which can be used for measuring the revolutions/second of a rotating wheel, disc, shaft or anything like that is introduced in this project.

The tachometer can measure up to a maximum of 255 rev/sec at an accuracy of 1 rev/sec. The sensor close to the reflective strip (aluminum foil, white paper or something like that) glued on the rotating surface and the meter shows the rev/sec on the display.

LM324 (IC1). Only one op-amp inside the quad LM324 is used here and it is wired as a comparator with reference voltage set at 3.5V (using resistors R16 and R17).

The job of this comparator unit is to convert the spiky collector wave form into a neat square pulse train so that it can be applied to the microcontroller. Every time the collector voltage of the photo transistor goes below 3.5V, the output of the

Comparator goes to negative saturation and every time the collector voltage of the phototransistor goes above 3.5V.



**Fig. Contactless Digital Tachometer**

The primary section of the circuit is the optical pickup based on photo transistor Q4 and red LED D4. Every time the reflective stripe on the rotating object passes in front of the sensor assembly, the reflected light falls on the photo transistor which makes it conduct more and as a result its collector voltage drops towards zero.

Next part is the signal conditioning unit based on the op-amp

The number of negative going edges occurring in one second, then that's the rev/sec of the rotating object and that's what the microcontroller does here.

The 8051 microcontroller performs two operations that are listed given below,

- 1) Count the number of negative going pulses available at its T1 pin (pin15).

- 
- 2) Do necessary mathematics and display the count on the 3 digit 7 segment displays.

For the counting purpose both the timers of 8051 (Timer0 and Timer1) are used. Timer 1 is configured as an 8 bit auto reload counter for registering the number of incoming zero going pulses and Timer0 is configured as a 16 bit timer which generate the necessary 1 second time span for the Timer1 to count.

**Note:**

The Local User Terminal (LUT) used here was made for a common cathode seven segment display (used in previous projects) and here we are using a common anode display. The instruction Constant Phase Limiting Amplifier (CPL) A will just complement the digit drive pattern in accumulator so that it becomes suitable for the common anode display.

This is done just because to save my time but not a text book method. The correct way is to make a dedicated LUT for common anode configuration and avoid the extra CPL A instruction.

LM324 is a quadrant op-amp and it consists of only one opamp. In this circuit the role of LM324 is act as a single supply voltage and it provides 5V.

In the dual supply opamp pin2 (+V) is connected to positive supply and negative pin connected to ground. This type of circuit is preferred without oscilloscope in the circuit.

In Contactless Digital Tachometer circuit the Timer 0 which generates the 1 second time span is configured in Mode 1 (16 bit timer), So the maximum it can count is  $2^{16}$  and that is 65536. In 8051 the crystal frequency is divided by 12 using an internal network before applying it as a clock for the timer.

The timer will increment by one for every 1/12th of the crystal frequency, for an 8051 system clocked with a 12MHz crystal the time taken for one timer increment will be  $1\mu\text{S}$  (ie; 1/12MHz).

The maximum time delay that can be obtained using one session of the timer will be  $65536\mu\text{S}$  and it is looped 14 times to get the 1 second delay.

**By:**

**Mr.A.Gokul Kumar,  
Final Year (MEIEA).**

## Measurement of moisture level in plant

Plant monitoring is the indication of soil water level inside a area of plant has covered. The circuit diagram for plant moisture level measurement is shown in figure given below which will give a visual indication when the soil water level inside your flower pot goes low below a certain limit.

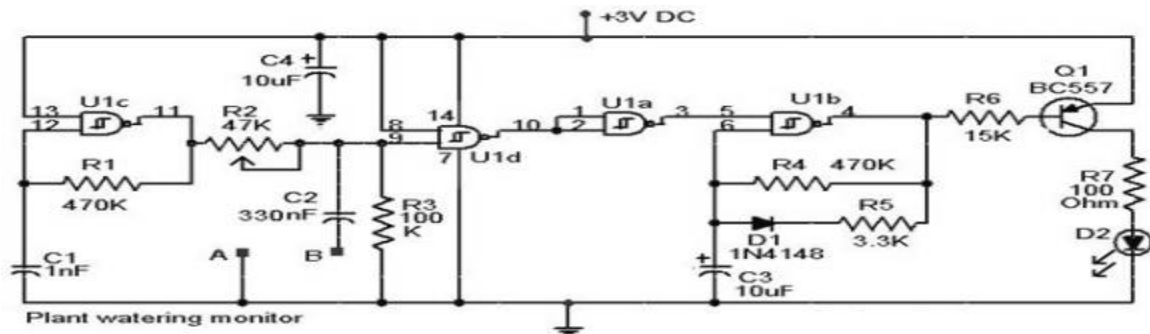
The U1c and associated components are wired as an oscillator producing a 2KHz square wave. This square wave is given to one gate input of u1d via a variable potential divider former by R1 and R2.

2KHz signal to the ground and it appears at the gate input of U1d. The output of U1d goes low, and it is inverted to high by U1a. The oscillator wired around U1b is activated and it starts oscillating.

These oscillations are amplified by Q1 to drive the LED and LED starts pulsating as an indication of low moisture. Since square wave is used there won't be any oxidation on the probes. The resistor R7 limits the current through LED and ensures a longer battery life.

### Connections:

- Power the circuit from a 3V battery.



**Fig. Plant Moisture Level Monitor**

When the resistance across the probes A and B are low that is when soil moisture level is high, the C2 will divert the square wave to ground. The output of U1d will be high. The U1a inverts this high state to low and so the IC U1b is blocked from producing oscillations.

The LED will remain OFF. When there is no moisture across the probes, the C2 cannot bypass the

- Capacitors C1 and C2 must be polyester type.
- The IC U1 is a quad two input Schmitt NAND IC 4093.
- The sensitivity can be adjusted by varying the preset R2.

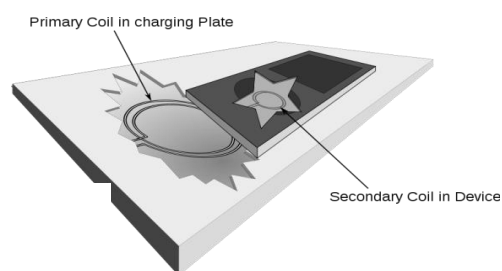
**By:**

**Mr.A.Praveen,  
Second Year (MEIEA).**

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## **Inductive charging**

Inductive charging is an electromagnetic field to transfer energy between two objects. This is usually done with a charging station. Energy is sent through an inductive coupling to an electrical device, which can then use that energy to charge batteries or run the device.



**Fig. Inductive charger panel**

Induction chargers typically use an induction coil to create an alternating electromagnetic field from within a charging base station and a second induction coil in the portable device takes power from the electromagnetic field and converts it back into electrical current to charge the battery. The two induction coils in proximity combine to form an electrical transformer.

### **Advantages:**

- Lower risk of electrical shock or shorting out when wet because there are no exposed conductors.
- Protected connections - no corrosion when the electronics are all enclosed, away from water or oxygen in the atmosphere.
- Safer for medical implants - for embedded medical devices, allows recharging/powering through the skin rather than having wires

penetrate the skin, which would increase the risk of infection.

- Convenience - rather than having to connect a power cable, the device can be placed on or close to a charge plate or stand

### **Disadvantages:**

- Lower efficiency, waste heat - The main disadvantages of inductive charging are its lower efficiency and increased resistive heating in comparison to direct contact. Implementations using lower frequencies or older drive technologies charge more slowly and generate heat within most portable electronics.
- Slower charging - due to the lower efficiency, devices can take longer to charge when supplied power is equal.
- Incompatibility

Newer approaches reduce transfer losses through the use of ultra thin coils, higher frequencies, and optimized drive electronics. This results in more efficient and compact chargers and receivers, facilitating their integration into mobile devices or batteries with minimal changes required. These technologies provide charging times comparable to wired approaches, and they are rapidly finding their way into mobile devices.

**By:**

**Mr.A.Tamilarasu,  
Final Year B.Tech IT.**



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## **TECHS & APPS:**

1. Vodafone has to come up with a new scheme "Pay Easy". They have decided to charge the first 100 calls of a Pay Easy customer @Rs1/-call the next 100 calls @Rs 1.25/-calls and the next 100 calls @Rs1.75/-call. Raj is a Pay Easy customer. He paid Rs 286.25/- as his mobile bill that month. How many calls did Raj make?

- a) 243            b) 241  
c) 242            d) 235

2. If 29th February 2004 was a Sunday, which of the following month starts with a Sunday in that year?

- a) September    b) October  
c) August        d) December

3. In a group there are 5 singers, 3 dancers, 2 artists, 1 musician, 1 guitarist and 1 teacher. The average height of the above mentioned people reduces by 2cm if I replace the guitarist with a joker. Find the height of the joker, if the height of the guitarist is 184cm.

- a) 154            b) 171  
c) 158            d) 160

4. A father with eight children takes 3 times to the zoological garden, as often as he can without taking the same 3 children together more than once. How often will he go and how often will each child go?

- a) 56,35        b) 92,42  
c) 56,21        d) 56,42

5. Find the missing term in the sequence 2,6,22,86,342,\_\_\_\_\_

- a) 728            b) 1366  
c) 912            d) 1648

6. When 5% of total wheat is lost in grinding, a country can export 9 million tons of wheat, but when 6% of the total wheat is lost in the grinding it needs to import 2 million tons of wheat. What is the total production of wheat in the country? (In million tons)

- a) 1000          b) 900  
c) 1100          d) 1150

7. Ferrari S.P.A is an Italian sports car manufacturer based in Maranello, Italy. Founded by Enzo Ferrari in 1928 as Scuderia Ferrari, the company sponsored drivers and manufactured race cars before moving into production of street-legal vehicles in 1947 as Ferrari S.P.A. Throughout its history, the company has been noted for its continued participation in racing, especially in Formula One where it has employed great success. Rohit once bought a Ferrari. It could go 4 times as fast as Mohan's old Mercedes. If the speed of Mohan's Mercedes is 46 km/hr and the distance traveled by the Ferrari is 953 km, find the total time taken for Rohit to drive that distance.

- a) 20.72          b) 5.18  
c) 238.25        d) 6.18

8. A man, a woman and a boy can do a work in 20 days, 30 days and 60 days respectively. How many boys must assist 2 men and 8 women to do the work in 2 days?

- a) 4    b) 5    c) 6    d) 8

9. Five digit numbers are formed using the digit 1, 2, 3, 4 and 5 without repetition. The probability that a number so formed is divisible by 6 is

- a)  $\frac{1}{5}$                       b)  $\frac{2}{5}$   
 c)  $\frac{3}{5}$                         d)  $\frac{4}{5}$

10. Eight coins are tossed together. The probability that all of them show the same face is 1 in

- a) 256                      b) 128  
 c) 4096                    d) 64

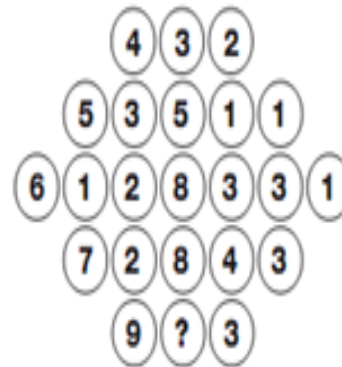
11. A horse started to chase a dog as it relieved a stable two hours ago. And the horse started to run with an average speed of 22 km/hour, crossed 10 mts road and two small ponds with a depth of 3m, and it crossed two small streets with 200 mts length. After travelling 6 hrs, 2 hours after sunset it got the dog. Compute the speed of the dog?

- a) 16.5                      b) 18.5  
 c) 16.25                    d) 16

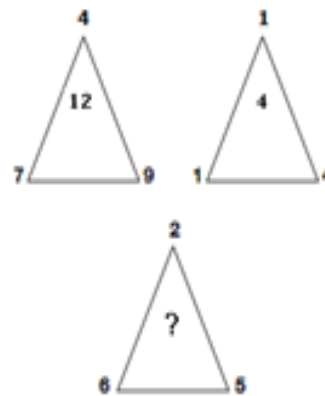
12. In a single throw of a dice, what is the probability of getting a number greater than 4?

- a)  $\frac{1}{2}$                         b)  $\frac{2}{3}$   
 c)  $\frac{1}{4}$                         d)  $\frac{1}{3}$

13. What number comes inside the circle?



14. Which number replaces the question mark?



15. Which number completes the puzzle?



By:

**Mr.S.Rajavarman,  
 Third Year (MEIEA).**



INNOVATION  
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