Dr.MAHALINGAM COLLEGE OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF INSTRUMENTATION AND CONTROL ENGINEERING

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OPPORTUNITIES TO ASPIRE

Most of the engineering students will have a dream company in which they would like to work. This section will help the readers to identify such aspiring industry. This segment gives the idea about two best companies in India.

1.GAIL

2.IOC

The part also explicates about the company profile and recruitment process involved.

"Nothing is Impossible , the word itself says I'm Possible"

GAIL (Gas Authority of India Ltd.)

OFFICIAL WEBSITE: www.gail.nic.in

Placement Trends

- Recruits through gate exam
- Mechanical, Electrical, Instrumentation and Chemical Engineers with 65% marks and clear the gate exam are eligible
- The upper age limit is 28 years
- Selection process comprises of written test
- Short listed candidates from written test will have to appear for Group Discussion and Personal Interview
- Salary:Rs. 24900 -50500/-

GAIL (India) Limited is the largest state-owned natural gas processing and distribution company headquartered in New Delhi, India. It has six segments: Transmission services of natural gas and liquefied petroleum gas (LPG), Natural gas trading, petrochemicals, LPG and Liquid hydrocarbons, GAILTEL and Others.

The company was previously known as Gas Authority of India Ltd. It is India's principal gas transmission and marketing company. It was set up by the Government of India in August 1984 to create gas sector infrastructure.

GAIL commissioned the 2,800 kilometres (1,700 mi) Hazira-Vijaipur-Jagdishpur (HVJ) pipeline in 1991. Between 1991-93, three liquefied petroleum gas (LPG) plants were constructed and some regional pipelines acquired, enabling GAIL to begin its gas transportation in various parts of India.

GAIL began its city gas distribution in New Delhi in 1997 by setting up nine compressed natural gas (CNG) stations.

GAIL has built a network of trunk pipelines covering length of around 11,000 km. Leveraging on the core competencies, GAIL also laid 1,900 km of LPG pipeline across the country which includes world's longest exclusive LPG pipeline, Jamnagar-Loni pipeline. GAIL played a key role as gas market developer in India for decades catering to major industrial sectors like power, fertilizers, and city gas distribution. Currently GAIL transmits more than 160 MMSCMD of gas through its dedicated pipelines and have more than 70% market share in both gas transmission and marketing. GAIL diversified from gas marketing and transmission into Polymer business by setting up North India's first gas based Petrochemicals complex at Pata, UP. Even without having any prior experience in petrochemicals, GAIL commissioned the plant successfully in year 1999 by rigorous team work and project management capabilities.

About GATE EXAM

- Application will be distributed in the month of September
- Application Fee: Rs.1200/- (for Male only)
- Exam will be in the month of February
- Test conducted for 100 marks (65 Questions)
- Test is designed to assess the candidate's Technical Knowledge of the chosen Engineering Discipline and Higher Aptitude covering area like Quantitative Aptitude, Reasoning Ability, Logical thinking, English usage

Currently petrochemical business is one of the core focus area of GAIL. GAIL recently set up a JV, Brahmaputra Cracker and Polymer Limited, to construct a Greenfield petrochemical plant in Assam. GAIL also has equity stake in OPAL petrochemical plant led by ONGC.

As per the strategy of expanding global footprint, GAIL formed a wholly owned subsidiary company GAIL Global (Singapore) Pte Ltd in Singapore 2004 to route its overseas investment. It successfully secures participation in 2 retail gas companies in Egypt, Fayum Gas Company and Shell CNG in 2003 and acquired 15% equity stake in NatGas, Egypt. GAIL forms a Joint Venture Company (JVC) with China Gas Global Energy Holdings Limited in 2007. In 2010, GAIL opened its first overseas representative office in Cairo, Egypt. GAIL always promotes the green and clean energy concept and use of natural gas as energy source. In this direction, GAIL set up several JV and subsidiaries for CGD. First such JV, Mahanagar Gas Limited formed with British Gas incorporated to implement Mumbai City Gas Distribution project followed by Indraprastha Gas Limited (IGL) to supply of gas to household sector, transport sector & commercial consumers in Delhi. In 2008, GAIL incorporated a wholly owned subsidiary, GAIL gas Ltd to focus on city gas distribution.

IOC (Indian Oil Corporation ltd.)

OFFICIAL WEBSITE: www.iocl.com

Placement Trends

- Currently 250 openings left for engineers
- Only gate score is valid for this recruitment process
- Mechanical, Electrical, Civil, Instrumentation and Chemical Engineers with 65% marks and clear the gate exam are eligible
- Age limit: 26 Years

IOC has been established in the year 1959. Total income is rs.4387009.6 million. To meet the emerging challenges of post-deregulated era of the oil sector, Indian Oil in 1995 set up the Indian Oil Institute of Petroleum Management (IIPM) as an apex centre for learning. The only one of its kind in the petroleum sector, IIPM aims to create a vibrant bridge of knowledge managers to lead the Indian energy companies. Since the last 12 years, IIPM has been conducting global standard international business management programmes for executive along with various management development programmes.

The Institute, with its sprawling campus in 16 acres of lush green landscape, has excellent facilities to accommodate over 100 participants at a time. It also has a 10 executive suites block earmarked to accommodate the visiting faculty. The institute is centrally air conditioned with 100% power backup.

In addition to the modem infrastructure, the Institute has a well-equipped library, state-of-the-art computer facility, gym, a swimming pool and other amenities to provide a highly invigorating learning ambience.

As an ISO 9001-2000 certificate institute, IIPM has been awarded the Golden Peacock National Award for 'Innovative Training Practices' by the Institute of Directors (IOD), for 1998, 2000, 2005, 2006 and for the year 2007 as well. For the year 2006-2007, the Indian Society of Training & Development (ISTD) also presented the 'Innovative Training Practices' award to IIPM. It also received the 'Best Innovation in Teaching' award from the Association of Indian Management Schools for the year 1998-99. Indian Oil has also been entrusted with the responsibility of training executives from various Iraqi oil companies by the Ministry of Petroleum & Natural Gas (MOP & NG) and the Ministry of External Affairs. Over the last one and half years, around 200 officials from the Iraqi oil industry have already completed their training at IIPM on various facets of the oil industry.

SELECTION PROCESS

- On the basis of GATE score the candidates will be shortlisted
- Group discussion is conducted for shortlisted candidates
- Selection process comprises of interview
- Salary: Rs.35,000 per month

Over the years IIPM has evolved into a world-class centre of excellence in leadership development and has become a hub for meaningful interaction between the participants and business leaders from within and outside and best-in-class academia. IIPM, considered as being Indian Oil's crucible, where its divisions, diversities and domain expertise fuse to create the integrated minds of future leadership.

Indian Oil is also deputing its experts as faculty to impart training to reputed overseas business organizations like PETRONAS (Malaysia), Oman Refinery Company, Oman (ORC), Abu Dhabi National Oil Company (ADNOC), Qatar Refinery Company, Qatar (QRC), Nigerian Nation Petroleum Company (NNPC), etc. Recently, Indian Oil has sent in-house experts to train executives of various Sudanese oil companies on pipeline operations & maintenance. During the last 12 years of carrying out intensive training development research and consultancy activities, IIPM has sharpened its skills of imparting international standard management development programmes for executives performing in the highly competitive business of oil & gas.

THE PARAMOUNT CRITIQUE

The paramount critique section opens a news doorway to technical exposure. This section enlightens and fascinates the readers of technical advancements & newer technologies.

Variable Frequency Drive

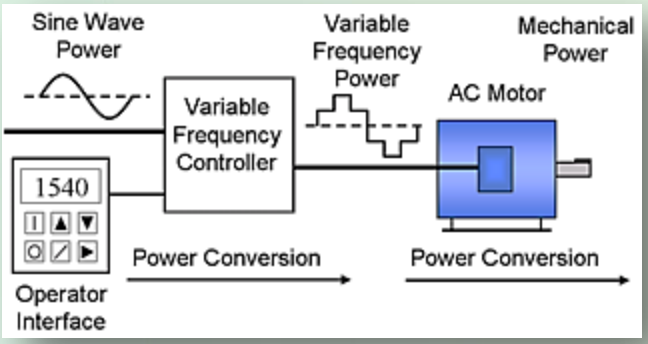
A **variable-frequency drive (VFD)** (also termed adjustable-frequency drive, variable-speed drive, AC drive, micro drive or inverter drive) is a type of adjustable speed drive used in electro-mechanical drive systems to control AC motor speed and torque by varying motor input frequency and voltage .

VFDs are used in applications ranging from small appliances to the largest of mine mill drives and compressors. However, about a third of the world's electrical energy is consumed by electric motors in fixed-speed centrifugal pump, fan and compressor applications and VFDs' global market penetration for all applications is still relatively small. This highlights especially significant energy efficiency improvement opportunities for retrofitted and new VFD installations. Over the last four decades, power electronics technology has reduced VFD cost and size and improved performance through advances in semiconductor switching devices, drive topologies, simulation and control techniques, and control hardware and software.

VFDs are available in a number of different low and medium voltage AC-AC and DC-AC topologies.

System description and operation

A variable frequency drive is a device used in a drive system consisting of the following three main sub-systems: AC motor, main drive controller assembly, and drive operator interface.



AC Motor

The AC electric motor used in a VFD system is usually a three-phase induction motor. Some types of single-phase motors can be used, but three-phase motors are usually preferred. Various types of synchronous motors offer advantages in some situations, but three phase induction motors are suitable for most purposes and are generally the most economical choice. Motors that are designed for fixed-speed operation are often used. Elevated voltage stresses imposed on induction motors that are supplied by VFDs require that such motors be designed for definite-purpose inverter-fed duty in accordance to such requirements as Part 31 of NEMA Standard MG-1.

Controller

The variable frequency drive controller is a solid state power electronics conversion system consisting of three distinct sub-systems: a rectifier bridge converter, a direct current (DC) link, and an inverter. Voltage-source inverter (VSI) drives are by far the most common type of drives. Most drives are AC-AC drives in that they convert AC line input to AC inverter output. However, in some applications such as common DC bus or solar applications, drives are configured as DC-AC drives. The most basic rectifier converter for the VSI drive is configured as a three-phase, six-pulse, full-wave diode bridge. In a VSI drive, the DC link consists of a capacitor which smooths out the converter's DC output ripple and provides a stiff input to the inverter. This filtered DC voltage is converted to quasi-sinusoidal AC voltage output using the inverter's active switching elements. VSI drives provide higher power factor and lower harmonic distortion than phase-controlled current-source inverter (CSI) and load-commutated inverter (LCI) drives. The drive controller can also be configured as a phase converter having single-phase converter input and three-phase inverter output.

Controller advances have exploited dramatic increases in the voltage and current ratings and switching frequency of solid state power devices over the past six decades. Introduced

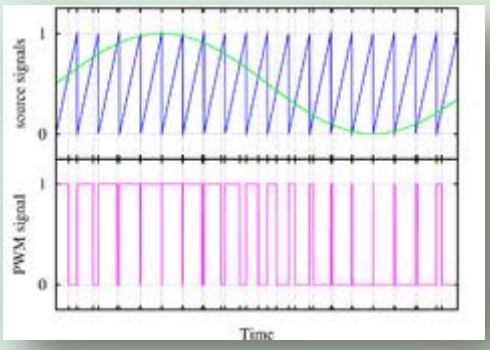
in 1983, the insulated-gate bipolar transistor (IGBT) has in the past two decades come to dominate VFDs as an inverter switching device.

In variable-torque applications suited for Volts per Hertz (V/Hz) drive control, AC motor characteristics require that the voltage magnitude of the inverter's output to the motor be adjusted to match the required load torque in a linear V/Hz relationship. For example, for 460 volt, 60 Hz motors this linear V/Hz relationship is 460/60 = 7.67 V/Hz. While suitable in wide ranging applications, V/Hz control is sub-optimal in high performance applications involving low speed or demanding, dynamic speed regulation, positioning and reversing load requirements. Some V/Hz control drives can also operate in quadratic V/Hz mode or can even be programmed to suit special multi-point V/Hz paths.

The two other drive control platforms, vector control and direct torque control (DTC), adjust the motor voltage magnitude, angle from reference and frequency such as to precisely control the motor's magnetic flux and mechanical torque.

Although space vector pulse-width modulation (SVPWM) is becoming increasingly popular, sinusoidal PWM (SPWM) is the most straightforward method used to vary drives' motor voltage (or current) and frequency. With SPWM control quasi-sinusoidal, variable-pulse-width output is constructed from intersections of a saw-toothed carrier frequency signal with a modulating sinusoidal signal which is variable in operating frequency as well as in voltage (or current).

Operation of the motors above rated nameplate speed (base speed) is possible, but is limited to conditions that do not require more power than the nameplate rating of the motor. This is sometimes called "field weakening" and, for AC motors, means operating at less than rated V/Hz and above rated nameplate speed. Permanent magnet synchronous motors have quite limited field weakening speed range due to the constant magnet flux linkage. Wound rotor synchronous motors and induction motors have much wider speed range. For example, a 100 hp, 460 V, 60 Hz, 1775 RPM (4 pole) induction motor supplied with 460 V, 75 Hz (6.134 V/Hz), would be limited to 60/75 = 80% torque at 125% speed (2218.75 RPM) = 100% power. At higher speeds the induction motor torque has to be limited further due to the lowering of the breakaway torque of the motor. Thus rated power can be typically produced only up to 130...150% of the rated nameplate speed. Wound rotor synchronous motors can be run at even higher speeds. In rolling mill drives often 200...300% of the base speed is used. The mechanical strength of the rotor limits the maximum speed of the motor.



An embedded microprocessor governs the overall operation of the VFD controller. Basic programming of the microprocessor is provided as user inaccessible firmware. User

programming of display, variable and function block parameters is provided to control, protect and monitor the VFD, motor and driven equipment.

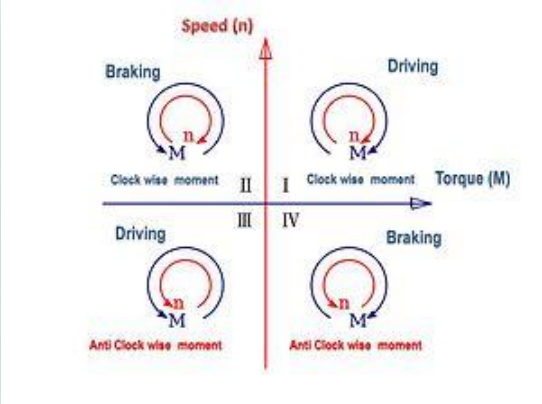
The basic drive controller can be configured to selectively include such optional power components and accessories as follows:

- Connected upstream of converter - circuit breaker or fuses, isolation contactor, EMC filter, line reactor, passive filter
- Connected to DC link - braking chopper, braking resistor
- Connected downstream of inverter - output reactor, sine wave filter, dV/dt filter.

Operator interface

The operator interface provides a means for an operator to start and stop the motor and adjust the operating speed. Additional operator control functions might include reversing, and switching between manual speed adjustment and automatic control from an external process control signal. The operator interface often includes an alphanumeric display and/or indication lights and meters to provide information about the operation of the drive. An operator interface keypad and display unit is often provided on the front of the VFD controller as shown in the photograph above. The keypad display can often be cable-connected and mounted a short distance from the VFD controller. Most are also provided with input and output (I/O) terminals for connecting pushbuttons, switches and other operator interface devices or control signals. A serial communications port is also often available to allow the VFD to be configured, adjusted, monitored and controlled using a computer.

Drive operation



Electric motor speed-torque chart

Referring to the accompanying chart, drive applications can be categorized as single-quadrant, two-quadrant or four-quadrant; the chart's four quadrants are defined as follows:

- Quadrant I - Driving or motoring, forward accelerating quadrant with positive speed and torque
- Quadrant II - Generating or braking, forward braking-decelerating quadrant with positive speed and negative torque

- Quadrant III - Driving or motoring, reverse accelerating quadrant with negative speed and torque
- Quadrant IV - Generating or braking, reverse braking-decelerating quadrant with negative speed and positive torque.

Most applications involve single-quadrant loads operating in quadrant I, such as in variable-torque (e.g. centrifugal pumps or fans) and certain constant-torque (e.g. extruders) loads.

Certain applications involve two-quadrant loads operating in quadrant I and II where the speed is positive but the torque changes polarity as in case of a fan decelerating faster than natural mechanical losses. Some sources define two-quadrant drives as loads operating in quadrants I and III where the speed and torque is same (positive or negative) polarity in both directions.

Certain high-performance applications involve four-quadrant loads (Quadrants I to IV) where the speed and torque can be in any direction such as in hoists, elevators and hilly conveyors. Regeneration can only occur in the drive's DC link bus when inverter voltage is smaller in magnitude than the motor back-EMF and inverter voltage and back-EMF are the same polarity.

In starting a motor, a VFD initially applies a low frequency and voltage, thus avoiding high inrush current associated with direct on line starting. After the start of the VFD, the applied frequency and voltage are increased at a controlled rate or ramped up to accelerate the load. This starting method typically allows a motor to develop 150% of its rated torque while the VFD is drawing less than 50% of its rated current from the mains in the low speed range. A VFD can be adjusted to produce a steady 150% starting torque from standstill right up to full speed. However, motor cooling deteriorates and can result in overheating as speed decreases such that prolonged low speed motor operation with significant torque is not usually possible without separately-motorized fan ventilation.

With a VFD, the stopping sequence is just the opposite as the starting sequence. The frequency and voltage applied to the motor are ramped down at a controlled rate. When the frequency approaches zero, the motor is shut off. A small amount of braking torque is available to help decelerate the load a little faster than it would stop if the motor were simply switched off and allowed to coast. Additional braking torque can be obtained by adding a braking circuit (resistor controlled by a transistor) to dissipate the braking energy. With a four-quadrant rectifier (active-front-end), the VFD is able to brake the load by applying a reverse torque and injecting the energy back to the AC line.

Benefits

Energy savings

Many fixed-speed motor load applications that are supplied direct from AC line power can save energy when they are operated at variable-speed, by means of VFD. Such energy cost savings are especially pronounced in variable-torque centrifugal fan and pump applications, where the loads' torque and power vary with the square and cube, respectively, of the speed. This change gives a large power reduction compared to fixed-speed operation for a relatively small reduction in speed. For example, at 63% speed a motor load consumes only 25% of its full speed power. This is in accordance with affinity laws that define the relationship between various centrifugal load variables.

In the United States, an estimated 60-65% of electrical energy is used to supply motors, 75% of which are variable torque fan, pump and compressor loads. Eighteen percent of the energy used in the 40 million motors in the U.S. could be saved by efficient energy improvement technologies such as VFDs.

Only about 3% of the total installed bases of AC motors are provided with AC drives. However, it is estimated that drive technology is adopted in as many as 30-40% of all newly installed motors.

An energy consumption breakdown of the global population of AC motor installations is as shown in the following table:

Control performance

AC drives are used to bring about process and quality improvements in industrial and commercial applications' acceleration, flow, monitoring, pressure, speed, temperature, tension and torque.

Fixed-speed operated loads subject the motor to a high starting torque and to current surges that are up to eight times the full-load current. AC drives instead gradually ramp the motor up to operating speed to lessen mechanical and electrical stress, reducing maintenance and repair costs, and extending the life of the motor and the driven equipment.

Variable speed drives can also run a motor in specialized patterns to further minimize mechanical and electrical stress. For example, an S-curve pattern can be applied to a conveyor application for smoother deceleration and acceleration control, which reduces the backlash that can occur when a conveyor is accelerating or decelerating.

Performance factors tending to favor use of DC, over AC, drives include such requirements as continuous operation at low speed, four-quadrant operation with regeneration, frequent acceleration and deceleration routines, and need for motor to be protected for hazardous area.

SUBMITTED BY: BANU PRIYA .T

SOURCE: en.wikipedia.org/wiki/variable-frequency_drive

TECHNICAL QUESTIONS

SUBMITTED BY: G. DHIVYA

1. The units whose sizes cannot be chosen independently are called
   a) Derived units b) Fundamental units
   c) Absolute d) Auxiliary fundamental
2. A passive network has
   a) no voltage source but current source
   b) no current source but voltage source
   c) no voltage source or current source
   d) none of the above
3. Zener diode is used as a
   a) Current regulator b) Voltage booster
   c) Voltage regulator d) Power regulator
4. Octal to binary conversion $(376)_8 = (\quad)_{16}$
5. The grey code is also called _____
6. Absorption law_____
7. 2's complement of $(1001)_2$
   a) 0010 b) 0110
   c) 1110 d) 0111
8. Identify the circuit
   a) Voltage dependent current source b) Current dependent voltage source
   c) Current dependent current source d) Voltage dependent voltage source
9. In the circuit shown,the value of current is
   a) 1 A b) 2 A

10. The voltage V in the given figure is

a) 10 V b) 15 V

c) 5 V d) 50 V

11. The value of resistance 'R' shown in the given figure is

a) 3.5 Ω b) 2.5 Ω

c) 1 Ω d) 4.5 Ω

12.The speed of a synchronous motor

(a) Remains constant from no load to full load.
(b) Decreases with increase in load
(c) Increases with the increase in load
(d) Varies with the variation in load

13.The function of the starter for a d.c motor

(a) To limit the starting current
(b) To limit the starting voltage
(c) To increase the field resistance
(d) To decrease the armature resistance

14.Which motor can conveniently operate at lagging as well as leading power factor?

(a) Shunt motor
(b) Squirrel cage induction motor
(c) Wound rotor induction motor
(d) Synchronous motor

15.Power factor of a synchronous motor can be varied by varying

(a) Applied voltage
(b) Supply frequency

16.If a d.c series motor is operated on a.c supply,it

(a) Will not start at all
(b) Will start & run with poor efficiency & power factor
(c) Will get damaged due to burning of its winding
(d) Will run at excessively high speed

17.A universal motor is one which has

(a) Constant speed
(b) Constant output
(c) Capability to operate on both a.c & d.c
(d) Maximum efficiency

18.The inductive reactance of a transformer depends on

(a) Electromotive force
(b) Magnetomotive force
(c) Magnetic flux
(d) Leakage flux

19.The speed of single phase induction motor can be controlled by

(a) Varying the applied voltage to the starter winding
(b) Varying the no. of poles on the stator
(c) Either (a) or (b)
(d) None

20.Transformer action requires

(a) Constant magnetic flux
(b) Increasing magnetic flux
(c) Alternating magnetic flux
(d) Alternating electric flux

GENERAL APTITUDE QUESTIONS

1. 3 pumps, working 8 hours a day, can empty a tank in 2 days. How many hours a day must 4 pumps work to empty the tank in 1 day?

A. 9 B. 10

C. 11 D. 12

2. A man complete a journey in 10 hours. He travels first half of the journey at the rate of 21 km/hr and second half at the rate of 24 km/hr. Find the total journey in km.

A. 220 km B. 224 km

C. 230 km D. 234 km

3. A train can travel 50% faster than a car. Both start from point A at the same time and reach point B 75 kms away from A at the same time. On the way, however, the train lost about 12.5 minutes while stopping at the stations. The speed of the car is:

A. 100 kmph B. 110 kmph

C. 120 kmph D. 130 kmph

4. A, B and C can do a piece of work in 20, 30 and 60 days respectively. In how many days can A do the work if he is assisted by B and C on every third day?

A. 12 days B. 15 days

C. 16 days D. 18 days

5. Two trains are moving in opposite directions @ 60 km/hr and 90 km/hr. Their lengths are 1.10 km and 0.9 km respectively. The time taken by the slower train to cross the faster train in seconds is:

A. 36 B. 45

C. 48 D. 49

6. Play is to actor as concert is to

A. symphony B. musician

C. piano D. percussion

7. A number of friends decided to go on a picnic and planned to spend Rs. 96 on eatables. Four of them, however, did not turn up. As a consequence, the remaining ones had to contribute Rs. 4 each extra. The number of those who attended the picnic was

A. 8 B. 12

C. 16 D. 24

8. Here are some words translated from an artificial language.

hapllesh means cloudburst

srenchoch means pinball

resbosrench means ninepin

Which word could mean "cloud nine"?

A. leshsrench B. ochhapl

C. haploch D. haplresbo

9. Y is in the East of X which is in the North of Z. If P is in the South of Z, then in which direction of Y, is P?

A. North B. South

C. South-East D. None of these

10. Sara lives in a large city on the East Coast. Her younger cousin Marlee lives in the Mid-west in a small town with fewer than 1,000 residents. Marlee has visited Sara several times during the past five years. In the same period of time, Sara has visited Marlee only once.

A. Marlee likes Sara better than Sara likes Marlee.

B. Sara thinks small towns are boring.

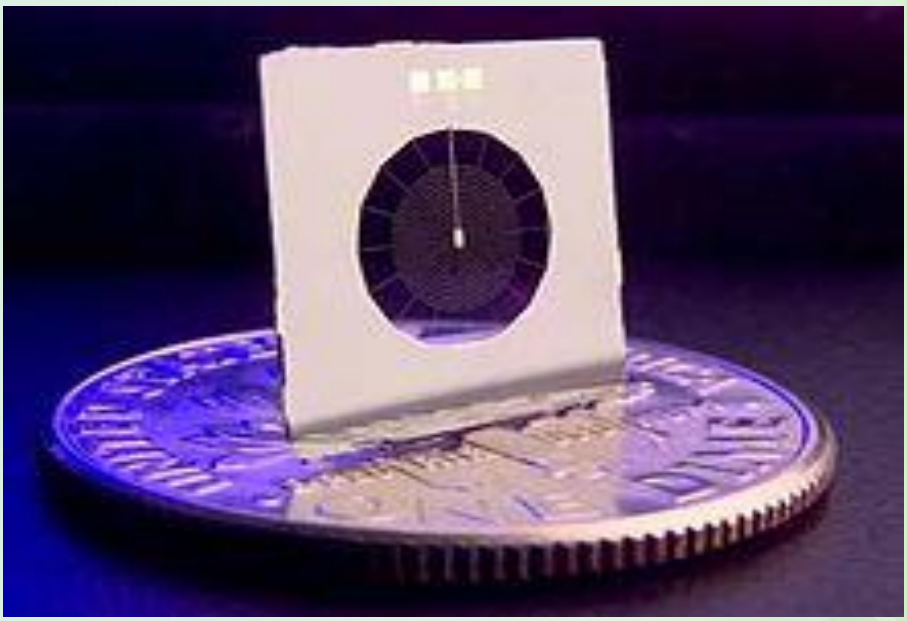
C. Sara is older than Marlee.

D. Marlee wants to move to the East Coast.

DO YOU KNOW?

SUBMITTED BY: S.YUVARAJ

SOURCE: en.wikipedia.org/wiki/bolometer



BOLOMETER

A **bolometer** is a device for measuring the power of incident electromagnetic radiation via the heating of a material with a temperature-dependent electrical resistance. It was invented in 1878 by the American astronomer Samuel Pierpont Langley. The name comes from the Greek word *bole* , for something thrown, as with a ray of light.

Principle of Operation

Conceptual schematic of a bolometer. Power P from an incident signal is absorbed by the bolometer and heats up a thermal mass with heat capacity C and temperature. The thermal mass is connected to a reservoir of constant temperature through a link with thermal conductance G. The temperature increase is $\Delta T = P/G$. The change in temperature is read out with a resistive thermometer. The intrinsic thermal time constant is $\tau = C/G$.A bolometer consists of an absorptive element, such as a thin layer of metal, connected to a thermal reservoir (a body of constant temperature) through a thermal link. The result is that any radiation impinging on the absorptive element

Bolometers are directly sensitive to the energy left inside the absorber. For this reason they can be used not only for ionizing particles and photons, but also for non-ionizing particles, any sort of radiation, and even to search for unknown forms of mass or energy (like dark matter); this lack of discrimination can also be a shortcoming. The most sensitive bolometers are very slow to reset (i.e., return to thermal equilibrium with the environment). On the other hand, compared to more conventional particle detectors, they are extremely efficient in energy resolution and in sensitivity. They are also known as thermal detectors raises its temperature above that of the reservoir — the greater the absorbed power, the higher the temperature. The intrinsic thermal time constant, which sets the speed of the detector, is equal to the ratio of the capacity of the absorptive element to the thermal conductance between the absorptive element and the reservoir. The temperature change can be measured directly with an attached resistive thermometer, or the resistance of the absorptive element itself can be used as a thermometer. Metal bolometers usually work without cooling. They are produced from thin foils or metal films. Today, most bolometers use semiconductor or superconductor absorptive elements rather than metals. These devices can be operated at cryogenic temperatures, enabling significantly greater sensitivity.

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