Passage 1:
Electricity's green roots run deep, starting with one of its earliest applications: the incandescent lamp. The lamp was a welcome advance, and not just for its light. In 1893, architect Frank T. Lent described electric incandescent light as "the acme of all methods of lighting... never impairing the air in a room." Electric light was a clean, safe alternative to the gas that was being used to light businesses and homes. Gas was sooty, consumed oxygen, and released carbonic acid into the air, damaging books, curtains, and carpets. "Smoke, ashes, and cinders are unknown because electricity is used now for which formerly fires had to be built," novelist Solomon Schindler wrote in 1894. That was not entirely true; coal-fired stations still generated most of the electricity. Although generating power centrally back then does not qualify as green by today's standards, it was less harmful to the environment that the scores of dispersed coal-burning furnaces would have been. In the 19th century, factories were clustered in cities, instead-as nowadays-outside of them, so clean power sources were a civic necessity. Steam replaced water power as the primary source of energy used by industries in the United States and Europe, and that resulted in grimy, smoke-shrouded cities.

1: Why was an incandescent lamp considered to be Green in the early days of electricity?
1) Because the lamp was the acme of lighting technology.
2) Because the new lamp consumed oxygen and carbonic acid.
3) Because Gas lamp soot tarnished curtains, books, and carpets.
4) Because the lamp replaced lighting methods that polluted living areas.

2: It can be deduced from the text that ———
1) Grimy and smoke-shrouded cities are unknown to well-developed countries
2) Nowadays smoke, ashes and cinders are unknown because electricity has replaced them
3) Electricity generation was not necessarily Green given the fact that it is generated by coal-fired stations.
4) A century ago factories were dispersed out of the cities but nowadays they are in central urban areas

Passage 2:
The High Electron Mobility Transistor or HEMT is a form of field-effect transistor (FET) that is used to provide very high levels of performance at microwave frequencies. It offers a combination of low noise figures combined with the ability to operate at microwave frequencies. The key element within a HEMT is the PN junction that it uses. It is known as hetero-junction and consists of a junction that uses different materials on either side. The most common materials used are aluminum gallium arsenide (ALGaAs) and gallium arsenide (GaAs). Gallium arsenide is generally used because it provides a high level of electron mobility which is crucial to the operation of the device. On the other hand, Silicon has a much lower level of electron mobility and that is why it is never used in a HEMT. There are a variety of different structures that can be used within a HEMT. However, they all basically use the same manufacturing processes.

3: A HEMT transistor offers ———
1) low noise
2) high power
3) operate at microwave frequency
4) 1 & 2

4: Gallium arsenide is generally used in a HEMT transistor since ———
1) it can not form a PN junction
2) it has a high level of electron mobility
3) it has a low level of electron mobility
4) Si has a high level of electron mobility

Passage 3:
For fault-finding, you must have at least a multimeter, either analogue or digital. An oscilloscope is not absolutely essential but you will find yourself very restricted without one. It's like trying to repair a car while wearing a blindfold. For audio equipment, a signal source is needed. Clearly, a function generator is useful but simpler and cheaper alternatives work well in most cases. You only need a fixed frequency source, say 400 or 1000Hz sine or square wave. For cassette recorders, a tape with a constant 400Hz wave recorded on both channels is adequate for most fault-finding. However, for checking playback levels and frequency response and aligning the tape head, proper test tapes, which are expensive, are required. For serious work, a collection of test leads and audio connectors is essential. Most modern audio equipment uses Phono sockets so it's worthwhile investing in cables that terminate in phono pugs. For other types of sockets, adaptors are available.

5: What is a less complicated and less expensive alternative for a function generator?
1) Signal source.
2) A fixed source.
3) Audio equipment.
4) Fault-finding test tapes

6: What are phono sockets associated with?
1) Adaptors.
2) Tests leading to audio connectors.
3) Cables that lead to phono plugs.
4) All of the above.

Passage 4:
Industrial automation spans a huge spectrum of complexity in terms of both the physical structures of machines and the tasks that they perform. This has led to an equally wide range of control system hardware and software building blocks. The general lack of standardization between different control system components makes industrial control systems difficult to maintain, modify and integrate. This has encouraged users to go to a single vendor for all their machine control needs in order to minimize such problems. The dominance of closed, vendor-specific solutions has generally resulted in stagnation rather than innovation and improvement in control systems.

7: Which of the following does the author NOT list as a characteristic of "industrial automation" that would result in difficulties in control systems?
1) Novelty.
2) Complicacy.
3) Lack of uniformity in parts.
4) Difficulty in making changes.

8: There is information in the passage to support which of the following conclusions?
1) The vendor dependency has slowed down enhancement in control systems quality
2) The adoption of better design approaches is severely handicapped due to lack of knowledge
3) The components are usually selected on a performance basis rather than vendor dependency.
4) The machines consisting of suitable combinations of system hardware and software are easier to improve.

Passage 5:
The MASS POWER project and its development represents a future model for how power generation projects may be put together in the new competitive energy arena in the United States and in many countries throughout the world. Gone are the days when electric utilities built large central generation stations on a cost-of-service basis as the only alternative to providing electric power and gone also are the early days of cogeneration when thinly capitalized entrepreneurs obtained power contracts while working out of their suitcases. The advent of formal competitive bidding programs as a way of supplying new electric power has expedited the maturing of the non-utility power generation industry. The survivors of the inevitable consolidation we are currently witnessing will need to take the considerable market and financial risk before reasonable assurance can be obtained about a project's success. MASS POWER was one of the first projects to be developed in this new climate and to have such a significant amount of development capital put at risk. Understanding its development process can help us understand what it will take to be successful at profitably building power plants in the future.

9: The author believes that those interested in the Mass power project ———
1) have accepted its financial risk
2) do not fully understand its difficulties

3) are thinking of finding a way to ensure its success before building power plants
4) have accepted that power generation based on the cost of service is a good alternative to Mass power generation

10: The passage provides information that would answer all of the following questions EXCEPT –

1) what is considered an inviting program?
2) what does the author think of large central power stations?
3) does the Masspower project present a positive competitive energy activity?
4) does the author suggest the Mass power project as the only alternative to providing electric power?

11: We may conclude from the passage that ———

1) the project initially conceived should be centered around important factors
2) mass power project will be of little success unless profitable power plants are developed
3) if all the details of the development process are digested, the Mass power project can be a success
4) the entrepreneurs should have the required knowledge and skills to plan improved strategies

Passage 6:

The beauty of three-dimensional graphics packages used by engineers and scientists is that viewers can not only see an image in depth from different angles but can also manipulate it with software. The resolution of the image, however, is limited to the resolution of the graphics program, or of the screen on which the graphics are viewed, which is typically megapixels at most. Holograms, on the other hand, can contain terapixels of data and are inherently 3-D. But because these holographic images are fixed in the holographic film, the viewer cannot manipulate the image or interact with it, except to view it from different angles. But now, a research group at the Bauhaus University in Weimar, Germany, has developed a method for combining the interactivity of computer graphics with the data richness of the hologram by superimposing the holographic image and the 3-D graphics image. To understand how Bauhaus University's method works, consider how a hologram is made and how it re-creates a 3-D image of an object. To make a hologram, laser light is split into two light waves that are initially in phase. One of the waves illuminates the object to be imaged, and the light reflected from the object travels to a holographic film. The second light wave, the reference wave, falls directly onto the film. Because the distance that the first light wave travels varies according to where it strikes the object, it will generally arrive at the film out of phase with the reference wave. The amount by which it is out of phase depends precisely on where it strikes the object. The two-out-of-phase light waves create an interference pattern on the film. And this interference pattern contains all of the information needed to re-create a high-resolution image of the object when a third light wave strikes the hologram at the same angle as the reference wave that helped to create it. In most holograms, white light, typically from a halogen bulb, rather than laser light, is used to re-create the image. To create the superposition of the two images, Bauhaus University researchers mainly use three pieces of equipment: an autostereoscopic display, which allows viewing of 3-D graphics without the use of special glasses: a white-light hologram; and a digital projector, such as one used to display presentations stored on a computer onto a large screen. The autostereoscopic display shows images of 3-D graphics through a plastic sheet of tiny lenses that direct a different image to each eye. The holographic film is directly attached to the front of the display screen. When the digital projector illuminates the hologram, the recreated 3-D images from the hologram and the display appear to the viewer in the same volume of space. The power of the technique comes from the ability to control the direction and intensity of the light from the digital projector, and thus to control which parts of the hologram are re-created and which are not.

12:What is the difference between a 3-D image and a holographic image?

1) The former image is limited to the graphics program while the latter is interactive
2) A 3-D image is limited in resolution while a holographic image can contain terapixels of data.
3) In the former the image has depth and can be manipulated with the help of software while in the latter the image is fixed
4) All of the above

13: What has the research group at Bauhaus University achieved? A Method ———

1) to recreate a 3-D image of an object
2) to manipulate the holographic image
3) for combining the interactivity of computer graphics
4) to superimpose the holographic image and the 3-D graphics image.

14: What is meant by the reference wave?

1) Laser light
2) The light wave that falls directly onto the film.
3) The third light wave that strikes the hologram.
4) The light wave that illuminates the object to be imaged.

15: What are the principal tools used to create the image discussed in the passage?

1) An autostereoscopic display, tiny lenses, and a digital projector.
2) An autostereoscopic display, a large screen, and a digital projector.
3) An autostereoscopic display, tiny lenses, and a digital projector.
4) An autostereoscopic display, a white-light hologram, and a digital projector.

Passage 7:
Most current commercial packages for harmonic analysis use a direct solution method whereby a harmonic current source, specified in advance, it injected into the linear network to determine the voltage and current distortion levels. This approach provides realistic frequency domain models of the linear ac system. However, a harmonic current source is usually an oversimplified model of the non-linear plant. The overall solution for the twelve pulse converter test system depends not only on the system voltage source, current source, and impedances but on converter variables such as controller characteristics, firing angle constraints, etc. Iterative techniques are thus necessary to solve all these variables together to reach a final correct solution. In the harmonic models of the ac-dc system available in the literature, the emphasis is on the solution technique, with a clear trend towards the Newton method. In comparison, the question of model accuracy has been given very little attention and some early models are still superior to those recently described. Under realistic conditions, the switching instant of the bridge valves are not equispaced over one cycle due to converter action. The incorporation of switching angle modulation in the converter model permits an accurate derivation of the individual switching instants; their effect on transfers between the ac and do system must be quantified, and all causes influencing the modulation must be accounted for. An early cause of firing angle modulation was the use of individual firing control.

16- Which method is used in commercial packages for harmonic analysis?
1) Iterative solution.
2) Direct solution.
3) Indirect solution.
4) Injection solution.

17- For what kind of system does the direct solution method provide realistic frequency domain models?
1) Linear ac systems.
2) Linear dc systems.
3) Non-linear systems.
4) Linear ac and dc systems.

18. Which of the following items does the overall solution for the twelve-pulse converter test system depend on?
1) Converter variables
2) System voltage sources
3) Current sources and impedances
4) All of the above

19. Which techniques are important to solve for variables such as controller characteristics and firing angle constraints?
1) Direct solution.
2) Newton's method.
3) Indirect solution.
4) Iterative techniques.

20- What was an early cause of firing angle modulation?
1) The use of frequency control.
2) The use of individual firing control.
3) The use of impedance variable control.
4) The use of harmonic current source control.

Passage 8:
Factors associated with the scaling of CMOS technology such as reliability and density are driving down supply voltages. Furthermore, the rapid growth of portable applications promotes battery operation which favors low voltage and low power circuits. As a result, many suggest that future implementation of mixed analog-digital circuits using standard CMOS will have power supplies of 1.5 V or less. Communication large-scale integrations (LSI's) are predicted to be the target. Threshold voltages of future standard CMOS technologies may not decrease much below what is available today. This poses a great challenge to CMOS analog/mixed-signal circuit design. Consider the standard push-pull CMOS amplifier/inverter and transmission gates. These circuits require the analog power supply to be at least equal to the sum of the magnitudes of the n-channel and p-channel thresholds. Probably the most important solution to the threshold voltage limitation is the bulk-driven MOSFET. The gate-source potential is taken to a de voltage that is sufficient to turn on the MOSFET. The drain is connected normally and the signal is applied. Between the bulk and the source, The current flowing from the source to drain is modulated by the reverse bias on the bulk-channel junction. The result is a junction field-effect transistor with the bulk as the signal input gate. Consequently, a high-input impedance depletion-mode device results.

21- What factors are the driving forces for reduced supply voltages of CMOS?
1) Device density.
2) Device reliability.
3) Hybrid technology.
4) Both 1 and 2.

22- What can be predicted as the great challenge in designing analog circuits?
1) Low power CMOS.
2) Threshold voltage.
3) Mixture of analog and digital blocks
4) Portable instruments and battery using capability.

23- The threshold voltage of standard CMOS technologies —
1) need not change at all
2) would be reduced drastically
3) will have to decrease to meet the current challenge
4) may not decrease much below what is available today

24- What is the most viable solution for the threshold voltage limitations?
1) Using BJT or JFET.
2) Further consumption of nMOS in output.
3) Applying signal to bulk instead of the gate.
4) Applying signal to the source instead of the gate.

25- Taking the gate-source potential to a dc voltage sufficient to turn on the MOSFET, connecting, drain normally and applying the signal between the bulk and the source would result in —
1) low-input impedance depletion-mode device
2) high-input impedance depletion-mode device
3) low-input impedance enhancement-mode device
4) high-input impedance enhancement-mode device

Passage 9:
During the 20th century, infrastructure networks were the most transformative technology for industrial nations and a powerful engine for economic growth. They were also the most complicated and expansive efforts of the time. In the next 50 years, new materials and information technologies will enable a shift from massive, centralized networks to modular, scalable, lightweight grids. MEMS will shift the scale of materials processing, perhaps making possible home-based miniature plants to generate power, process waste, and purify water. The components will be organized more efficiently, more flexibly, and more securely than the capital-intensive networks of the 20th century. Already today, voice over Internet Protocol, or VoIP, communication promises to disrupt the well-established players and business models of telephony. And in the developing world, solar-powered Wi-Fi network hubs and ultra-low-cost laptop computers are starting to bring the information age to rural communities. Also, in poorer regions, carbon nanotube filters are enabling the creation of portable personal water purification systems, about the size of a roll of paper towels that do not require electricity. And that's just the beginning of the new, light infrastructure. Today, flipping on a light switch is an act of faith in the central utilities that serve the cities. They sell, we buy. However, distributed power systems could lead to energy markets where any of us can deal in juice. Whatever our future sources of energy might be, expect energy-efficient devices to be in wide use. This includes light-emitting diodes(LEDs) instead of incandescent light bulbs in-home lighting and much more efficient photovoltaics, made possible by advances in nanoscience and nano-engineering. Meanwhile, software-defined radio will transform our communications systems, making them highly versatile, dynamic, and easily upgradeable. Ideally, a single device would be able to navigate the wireless world's diverse networks with their myriad protocols. Software-defined radios do this by using software instead of hardware to modulate radio signals.

26 - Which of the following adjectives can be suited MEMS?
1) Efficient
2) Flexible
3) Miniature
4) None of the above

27- In what way does life undergo changes within 50 years from now considering the technological developments stated in the above passage?
1) Life will be less monopolized and more decentralized
2) Life will be less complicated and more organized
3) Life will be less expansive and more outgoing
4) Life will be far more convenient

28 - What is meant by software-defined radio?
1) Software is used instead of hardware for modulating radio signals
2) Software that navigates diverse networks and upgrades its environment
3) Software is used upgrading the communication systems
4) All of the above

29- According to the passage, at present, how has the Voice over the Internet Protocol transformed our communication systems?
1) It has dominated the business models of telephony
2) It has interfered with the business models of telephony
3) It has divulged the business models of telephony
4) It has disregarded the business models of telephony

Passage 10:
Mechatronics draws heavily on the concepts of synergistic integration of mechanical engineering with electronics, computers, and control in the design and manufacturing of products and processes. The key spirit of mechatronic products is to add intelligent components and systems which combine an optimum use of multidisciplinary technologies to shorten the development cycle with reduced cost and increased quality. Intelligence and flexibility are essential in a mechatronic product. To achieve the primary function of an integrated system, it is essential that the functional interaction and spatial integration between mechanical, electronic, control, and information technologies be accomplished in a synergistic way. Sensor technologies are as important in the mechatronic system as the senses are to human beings. It has been estimated that 80% of all measurements made in industry are of a displacement nature. Proximity distance measurement constitutes the largest group of measurements made in science and technology. Therefore, this paper focuses on the discussion on proximity sensors with different physical sensing principles such as inductive, capacitive, photoelectric, ultrasonic, linear variable differential transformer, etc., including sensors that are useful in mechatronic systems such as silicon sensors, fiber-optic sensors, force/torque sensors, and load cells. Furthermore, advances in the manufacturing of silicon chips that can integrate sensing devices and signal-processing electronics have opened the world to the development of microsensors on a scale approaching three orders of magnitude smaller than the diameter of a human hair. A combination of microsensors and multi-sensors and multisensor fusion will make possible a new range of applications. Continuing developments in microsensor technology demonstrate that it may soon be practical to consider using very dense populations of highly redundant sensors in mechatronic products in much the same way that they appear in biological systems. A modern appliance is an example of a mechatronic product. A washing machine requires several sensors, about 10 or more, to detect the level of water, the type of materials to be washed, the degree of dirt, the concentration of detergent, etc., so that it can provide the required immediate feedback for reliable, flexible operation.

30 - What are the essential ingredients of mechatronic products?
1) Combination of inductive, capacitive, photoelectric, and ultrasonic sensors.
2) Intelligence and flexibility.
3) Proximity sensing and distance measurements.
4) Sensors similar to those in the human body.

31 - Which of the following has helped develop microsensors on extremely small scales?
1) Advances made in the manufacturing of silicon chips.
2) Combination of microsensors and multi-sensors and multisensor fusion.
3) Use of signal-processing electronic in sensing devices.
4) Use of intelligence and flexibility in sensor technology.

32 - The operation of sensors discussed in this paper is mainly based on:
1) Ferromagnetic, resistive, and signal processing principles.
2) Inductive, capacitive, and photoelectric principles.
3) Principles imitating human senses.
4) Proximity distance measurement.

Passage 11:

NASA May not return to the moon for another 10 years, but that's not stopping the U.S. space agency from conducting lunar expedition. In June, research teams from seven NASA centers gathered at Moses Lake, M central Washington state, to test prototypes for new moon-worthy robots, vehicles, and spacesuits. During the two-week-long field test, the teams and their machines replicated logistical and scientific operations that might be carried out on the moon. It was the first time that all the centers were involved in such a test, which gave the teams a chance to see how well the equipment they'd designed played with others. The field test also offered a "much broader area to stretch your legs," says Bill Bluethmann, a robotics engineer at NASA's Johnson Space Center, in Houston, who served as the expedition's leader. Moses Lake boasts 1200 hectares of sand dunes, popular with the off-road crowd. NASA liked the spot, too, because the loose sand and treeless horizon roughly simulated the lunar surface. Among the vehicles fielded was a gold-toned, six-wheeled lunar truck called Chariot. Intended to carry up to four suited astronauts, Chariot has an active suspension that lets any part of the truck be lifted and lowered independently. "If one wheel fails, we can just pick it up and continue the mission," says Lucien Junkin, the vehicle's chief engineer. The chariot was designed and built in just 12 months. Under such a compressed schedule, he says, the team became experts at "5-minute design reviews." Also on hand was a four-wheeled lunar prospecting robot called Scarab, which can operate in daylight as well as at night, Built by the Robotics Institute at Carnegie Mellon University, in Pittsburgh, the robot totes a 1-meter-long drill for taking geological samples.

33 - Why were the tests performed near Moses Lake?
1) Because the area was nearest to Washington D.C.
2) Because there were enough sand dunes to stretch your legs.
3) Because robotic engineers thought the robots were moon-worthy.
4) Because the widely-spanned sand-covered area resembled the moon surface.

34 - The Chariot —
1) is a 4 wheel drive, 4 astronauts carrying truck
2) has been built using a 5-minute design review
3) is a vehicle which can carry a few astronauts with 6 independently suspended wheels
4) is a 4 wheel drive vehicle built in 12 months at Carnegie Mellon University

Passage 12:
The PRICEY MacBook Air you covet, with its small, lightweight, shock-resistant solid-state drive (SSD), may have a secret. Despite their advantages, solid-state drives suffer not just from enormous price tags but also from slow performance during certain key operations. Now Korean engineers report that through a clever mix of two types of memories, they can give solid-state drives a boost without also jacking up their price. Unlike a traditional hard-disk drive, which can write new data directly over recorded data, the NAND flash memory that makes up solid-state drives requires free memory space in which to write. That's usually not a problem when you have to write large chunks of sequential data, such as a video clip. But it is a problem when you have to make frequent small additions and changes to existing data. If, for instance, you need to update a file, the original data must be copied to a fresh memory block so that the first block can be erased. The new data can then be merged with the original and written back to the first block. But like engineers at Seoul National University in South Korea report in a recent issue of IEEE Computer Architecture Letters, there's a better way. They developed a prototype solid-state drive, dubbed Chameleon that employs a small amount of ferroelectric RAM (FRAM), a comparatively expensive niche nonvolatile memory, to more efficiently deal with such small data changes.

35 - Solid-state drives —
1) are widely used in present days
2) are very efficient in replacing data
3) benefit from low price tag to replace hard-disk drives
4) suffer from the incapability to rewrite data over recorded ones

36 - The Korean researchers —
1) have basically developed MacBook Air
2) have reduced the price of ferroelectric RAM's
3) have made a new SSD using ferroelectric material
4) have developed a new type of FRAM

Passage 13:
Our goal is to develop an underwater vehicle that can autonomously explore and collect data in aquatic environments while surviving the harsh saltwater conditions and often turbulent waters of the open sea. In building Aqua, we are tackling one of the most challenging topics in robotics: integrating vision and locomotion into an amphibious machine that can determine what it is "seeing," where it is, and where it is going. Unlike many earlier UVs (underwater vehicles), Aqua is intended for shallower waters, and its design reflects this. Although the majority of UVs are large and unwieldy-some require a crane to lower them into the water-Aqua measures only 50 by 65 by 13 centimeters and weighs just 18 kilograms. Aqua is thus easier to deploy: you can literally throw it into the water, or it can launch itself from the beach. Even though Aqua's compact size and amphibious locomotion make it ideal for operating around coral reefs, some of our collaborators have other ideas for the robot. They believe Aqua could serve as the basis for other robotic ma-chines that could do environmental inspections in deep water or near shorelines; perform routine monitoring in aquacultures, and also help human divers with predive safety checks and physical tasks underwater. Aqua, which releases no bubbles and is much smaller than a human, can collect similar data using its underwater cameras while being less intrusive to the fish. True, Aqua can't yet recognize coral or other stationary marine life, let alone moving fish. But the video data the robot collects can be analyzed by an expert.

37 - Why was Aqua built?
1) To understand "What is seeing?"
2) To prove that an amphibious machine can be built.
3) To find a solution for one of the most challenging topics in robotics.
4) To independently and safely collect data from harsh under water environments.

38 - Which statement is true?
1) Aqua is as big as many other UVs.
2) It is hard to throw Aqua into water.
3) UVs usually can launch themselves into water.
4) Many earlier UVs were made for exploring deep waters.

39 - The text implies that the designers of Aqua think that in the future the machine —
1) can be less intrusive to the fish
2) can send better video data
3) will be able to work with human beings
4) might be able to recognize stationary marine life

Passage 14: The First commercial ocean energy project is scheduled to launch this summer off the coast of Portugal. Three snakelike wave-power generators built by Edinburgh's Pelamis Wave Power will deliver 2.25 megawatts through an undersea cable to the Portuguese coastal town of Agucadoura. Within a year, another 28 generators should come online there, boosting the capacity to 22.5 MW. That may be a trickle of power, but the project represents a new push into wave and tidal power as governments eye the oceans as a way to meet their renewable energy targets. Engineers have come up with a variety of schemes to harness the power of waves, the flow of currents, and the motion of the tides. The Pelamis generators, part of a class of wave-energy converters called linear absorbers, each comprises three long canisters that look like giant oxygen tanks. Hinged joints link the canisters; when the waves change the segments' positions relative to one another, the joints push hydraulic rams, which pump high-pressure oil through the turbines inside the canisters. Though Portugal may be the site of the first commercial installation, the UK-Scotland in particular leads in the research and development of ocean energy and is expected to end up with the most installed capacity in the coming years, say experts. Pelamis's generator was first tested at the European Marine Energy Center (EMEC), which is located amid the Orkney Islands off Scotland's northeastern coast.

40 -How the electric power is generated in the tidal wave generators?
1) Turbines are rammed by the oxygen tanks.
2) Hydraulic pistons pressure the oil inside the turbines.
3) Hinged joints in the canisters are pulled by the rams.
4) Giant oxygen tanks pressure the oil through the turbines.

41 - It is expected that —
1) the United Kingdom will lead long canister fabrication
2) Portugal will lead the research in the development of ocean energy
3) Portugal will have the highest capacity of tidal waves energy use in the long run
4) in the long run Scotland will have the largest installations of the ocean energy harvest

Passage 15:
Cost overruns and project delays have led to a cloudy forecast for the United States' new polar-orbiting weather satellites, which were originally supposed to start circling the North and South Poles in 2008. The greatly upgraded satellites, to consist of a group of three with three replacements, are meant to beam back weather data that would enable scientists to better predict hurricanes such as Katrina. But development of the satellites is far behind schedule and their total estimated cost has ballooned from US 6.5 billion to more than 10 billion. Consider that the whole annual budget for Earth observation from space is about 3 billion. The new satellites would improve long-term weather prediction by producing more detailed images of ocean surface temperatures and winds, ocean color, land surface temperatures, terrestrial vegetation, and land cover characteristics. They also transmit that information at much higher speed than is currently possible. The 22-channel VIERS will provide complete global coverage of Earth in one day, based on infrared imaging, yielding the first-ever color pictures to be seen from a satellite in real time. This improved fidelity will allow a closer look at the intensity of particular weather patterns, because the cameras won't just look at the top of the clouds but will be able to peer into hurricanes and drag out data on their interior temperature and moisture, information U.S. forecasters now get from less-capable sensors mounted on aircraft.

42 - The new polar-orbiting satellites project has (a) problem(s).
1) financial
2) technical
3) financial and schedule
4) financial and technical

43 - The color pictures sent by new satellites will be notable because —

1) of their real-time operation
2) of their long-term weather prediction
3) it will be the first time that a satellite sends high fidelity pictures
4) they provide complete global coverage of the Earth for the first time

Passage 16:
The last half of the 20th century could be called the microelectronics era. During those 50 years, the world witnessed a revolution based on a digital logic of electrons. From the earliest transistor to the remarkably powerful microprocessor in your desktop computer, most electronic devices have employed circuits that express data as binary digits, orbits. Furthermore, the communication between microelectronic devices occurs by the binary flow of electric charges. Recently, investigators have been eager to exploit another property of the electron—a characteristic known as spin. Spin is a purely quantum phenomenon roughly akin to the directional behavior of a compass needle. Electrons have a spin of a sort in which their compass needles can point either "up" or "down" in relation to a magnetic field. Spin, therefore, lends itself elegantly to a new kind of binary logic of ones and zeros. The movement of spin, like the flow of charge, can also carry information among devices. One advantage of spin overcharge is that spin can be easily manipulated by externally applied magnetic fields, a property already in use in magnetic storage technology. Another more subtle (but potentially significant) property of spin is its long coherence, or relaxation, time—once created it tends to stay that way for a long time, unlike charge states, which are easily destroyed by scattering or collision with defects, impurities or other charges. These characteristics open the possibility of developing devices that could be much smaller, consume less electricity, and be more powerful for certain types of computations than is possible with electron-charge-based systems. Those of us in the spintronics (short for spin electronics) community hope that by understanding the behavior of electron spin in materials we can learn something fundamentally new about solid-state physics that will lead to a new generation of electronic devices based on the flow of spin in addition to the flow of charge. In fact, the spintronics dream is a seamless integration of electronic, optoelectronic, and magnetoelectronic multi functionality on a single device that can perform much more than is possible with today's microelectronic devices.

44 - The comparison made between the spin and the compass needle —

1) clarifies the subject matter
2) notifies the electron properties
3) exemplifies the magnetic field
4) clarifies the movement of a compass needle

45 - The information in the last paragraph supports which of the following conclusions?
1) Spintronics is based on the flow of spins.
2) Spintronics can lead to the development of more powerful microelectronic devices.
3) It is not realistic to understand the behavior of electrons in materials.
4) Smaller devices are now made by the integration of electronic, optoelectronic, and magneto-electronic multi functionality on a single chip.

Passage 17:
Capacitors are one of the crucial elements in integrated circuits and are used extensively in many applications such as data converters, sample and holds, switched capacitor circuits, radio-frequency oscillators, and mixers. Capacitors can occupy a considerable area in integrated circuit designs. Therefore, an area-efficient capacitor is highly desirable. The problem is more pronounced in modern process technologies where the vertical spacing of the metal layers does not scale much, if at all. There are four types of capacitors that have been commonly used in IC design. They are gate capacitors, junction capacitors, conventional metal-to-metal/poly capacitors, and thin-insulator capacitors. Gate capacitors have a high density - i.e. high capacitance per unit area. However, they are nonlinear and require a do bias voltage to operate. Moreover, gate capacitors have a low breakdown voltage due to the thin gate oxide, and also have a medium quality factor. Junction capacitors suffer from some of the above problems as well. They are highly nonlinear and need a dc bias voltage. In addition, factors such as their sensitivity to process variations, poor quality factor, and large temperature coefficient limit their use in many applications. Metal-to-metal and metal-to-poly capacitors, on the other hand, are linear and have high Q. They also exhibit very small temperature variations. Unfortunately, the density of a traditional metal to metal capacitor is very low due to the relatively thick inter-level oxide layers. The problem becomes more severe with scaled technologies since the vertical spacing of the metal layers stays relatively constant. As a result, standard parallel plate capacitors consume a larger percentage of the die area as technology scales down. There has been a recent growth in the use of thin-insulator capacitors in IC applications. Double-poly capacitors and metal-insulator-metal (MIM) capacitors use a thin oxide to achieve high density. The capacitance density is much higher than the density of a standard metal-to-metal capacitor, but it is lower than the density of a gate capacitor built in the same technology. The need for additional masks and process steps makes these capacitors more expensive compared to other types of capacitors. Double-poly capacitors and MIM capacitors are highly linear and have high-quality factors, but due to the cost overhead, they are generally not available in standard digital processes

46 - According to the text, — arc linear and possess a high Q factor ?
1) gate capacitors
2) junction capacitors
3) switched capacitors
4) metal-to-metal capacitors

47 - What makes MIM capacitors unsuitable for standard digital processes?
1) Their nonlinearity.
2) Higher mask and processing cost.
3) Use of a thicker oxide to achieve the desired density.
4) Low capacitor density compared to standard metal-to-metal capacitors.

Passage 18:

A typical organic light-emitting diode (OLEO) lighting structure is composed of films of organic compounds and conductive layers sandwiched between two electrodes that provide positive and negative charges. When the two charges recombine in the organic layer, energy is given off in the form of photons, creating a patch of soft visible light. In the theory, the efficiency of this energy conversion could reach 100 percent, researchers say. Such a structure (excluding the substrate) has a depth that C3I1 be measured in mere nanometers, making for extremely thin, lightweight lighting products (and displays) that could be manufactured in sheet form. This opens the way for large area lighting and differentiates the OLED from its cousin, the light-emitting diode, or LED—a device designed to be a point light source. In the lab, at least, OLED material can be put on a variety of substrates, including plastic. The material also is environmentally friendly, containing no harmful elements such as the mercury found in fluorescent tubes. A major challenge all OLED manufacturers face is how to make their products cost-competitive with the ultracheap incandescent and fluorescent lighting products on the market. "Cost will be the key to penetrating the marketplace," agrees Toyohit Tanaka, general manager and head of business development in Konica Minolta

48 - Which one is likely to be an OLED structure?
I) Electrode, the conductive layer, electrode, films of organic compounds.
2) Electrode, the conductive layer, films of organic compounds. electrode.
3) Conductive layer. electrode. electrode, films of the organic compound.
4) Films of the organic compound. electrode, electrode, conductive layer.

49 - — differentiates OLED from the LED.
1) Ability for large area lighting
2) Lightweight lighting
3) Being measured in nanometers
4) Extremely thin in displaying

50 -According to the text fluorescent tubes —
1) do not contain mercury
2) are environmentally friendly
3) are not environmentally friendly
4) arc-like OLEDs

51 - Which one is among the remaining challenges for OLED's manufactures?
1) Making them environmentally friendly.
2) Having mercury in their structure.
3) Making them as point light sources.
4) Making them cheaper

Passage 19:
It may be a first: an office building with a net of electricity use of zero or less, that burns no fossil fuels for heating and produces no greenhouse gas, and that makes the people working there at least as comfortable as those in conventionally heated and cooled buildings. The building, in San Jose, Calif., opens in October, and if all goes according to plan, it will raise the bar for designers of energy-efficient buildings worldwide. Though other so-called z-squared buildings exist they are highway rest stops, nature centers, and event locations, not office structures with computers and printers and cubicles full of employees. The building was once a bank. Kaneda, the owner of the San Jose building, embarked on the project of renovating the old bank in September 2005, with the goal of creating an environmentally friendly building that could earn a Platinum rating—the highest —from the U.S. Green Building Council, an association of builders in Washington D. C. At that time, global climate—change was not at the forefront of the public eye. So Kaneda thought he was being very forward-thinking when he proposed to renovate the bank to meet the council's specifications. But when he hired architect Scott Shell to work on the project Shell went even further, suggesting they designed a building with no net electricity usage and no carbon dioxide emissions. To reduce the amount of energy used for lighting, Kaneda's builders sawed through the concrete perimeter of the building to install windows and skylights. Special window glass lets visible light through but blocks infrared and ultraviolet light, keeping the office cool. An overhang on the south side shades the windows from the direct sun; on the east side, electrochromic glass controlled by a sensor darkens the window when the sun hits them directly and makes them transparent the rest of the day. Because the ceilings are high, the skylights bathe much of the office space in diffuse light; in areas where the skylight illumination is too strong, Kaneda is experimenting with different types of diffusers.

52 – Why is the mentioned office building different from the other offices?

1) Because it saves a lot of energy.
2) Because it makes the employees feel comfortable.
3) Because it is not conventionally heated or cooled.
4) Because it's comfortable, environmentally friendly, and does not use electricity as well.

53 - Which sentence is true?
l) Highway rest stops can not be z- squared buildings.
2) The mentioned office is the first building to use zero electricity.
3) Nature centers spend more energy than office buildings.
4) The mentioned office is the first & office structure which uses zero electricity

54 - Whose idea was to build a building which does not emit carbon dioxide?
1) The architect of the project.
2) The old bank owner.
3) Kaneda.
4) Green Building Council.

55 - Having high ceilings in the building makes it possible to —
1) have diffused light.
2) have skylight
3) bathe in the building.
4) to have light.

Passage 20:
In experiments and even limited human clinical trials, electrode arrays implanted on the brain's surface have given monkeys and humans the ability to move objects with their thoughts. The experiments are proof that brain-computer interfaces could improve the lives of severely paralyzed people. But these systems rely on wires snaking out from the skull, which would affect a person's mobility and leave an opening in the scalp prone to infection. Wireless brain-machine interfaces would be much more practical and could be implanted in several different areas of the brain to tap into more neurons. A typical scheme would have electrodes penetrating brain tissue picking up neuronal electrical impulses, called spikes. A chip would amplify and process the signals and transmit them over a broadband RF connection through the skull to a receiver. Then, just as in wired systems, algorithms would decode these signals into commands for operating a computer or a robot. The key requirement for such a system is that it should consume very little power to keep the heat down. "Most of the guidelines for implantable devices say that you should not raise the surrounding tissue temperature by more than 1C; otherwise, you'll kill the cells you're trying to record from,- says Reid Harrison. Sending the complex analog impulses as they are would take up so much bandwidth. So it will be necessary to convert them into a simpler, robust form as close as possible to that of the neuron, says Brown University neuro engineers Arto Nurmikko. He and some of his colleagues were associated with the now-defunct Foxborough, Mass., start-up Cyberkinetics Neurotechnology Systems, which did the first human clinical trials of an implanted brain-computer interface.

56 - Which is NOT mentioned as one of the problems with electrode arrays implanted on the brain skull?
1) The probability of infection.
2) The reduction of movement for target users.
3) The high financial consequences
4) The fact that many pieces of wires surround the target user

57 - What are spikes?
1) Neuronal electrical impulses.
2) Specific kinds of brain tissue.
3) Electrodes that penetrate brain tissue.
4) typical scheme.

58 - If the temperature of the surrounding tissue heats up more than 1° —
I) the patient will die.
2) too much heat will be wasted.
3) the targeted cells will die.
4) the experiment will fail.

59 - Which statement is correct according to the text?
1) Cyberkinetics Neurotechnology Systems is a company that exists in Massachuset.
2) Cyberkinetics Neurotechnology Systems is where the first human clinical trial of an implanted brain-computer interface was performed.
3) Arto Nurmikko is now working for Cyberkinestics Neurotechnonolgy Systems.
4) Arto Nurmikko performed the first human clinical trials of an implanted brain-computer interface

Passage 21 - Chances are your health and happiness rely on sensors, those ubiquitous little devices that tell us if a fridge is too cold, a nuclear reactor's safety systems arc operating, or a factory production line is processing components correctly. But sensors have a dim, little secret: it's all too easy for them be in perfect working order, reporting all is well when, in fact, your milk is turning into a frozen block, the reactor's safety system is impotent, and that factory has filled a warehouse with useless - and possibly dangerous products. Fortunately, help is on the way with a new standard for analog sensors, the most common kind in use today. The dirty little secret of sensors is calibration, the process by which data from a sensor are mapped to real-world conditions, and the new standard should hcip make iniscalibration a thing of the past. Miscalibrated sensors can cause problems ranging in severity from a wasted morning's research to what happened at the Bruce 13 nuclear generating station near Toronto in 2002. There it was discovered that a backup reactor shutdown system that had been operating for weeks, in whet appeared to. be working order, was actually incapable of catching a dangerous rise in radiation, owing to an incorrectly calibrated neutron detector. Like most standards, the new standard goes by an unlovely name - in this case, IEEE 1451.4. But 1451:4 marks a huge advance in sensor technology and is already being applied in research and industrial laboratories. This new standard marries the tried-and-true robustness and cost-effectiveness of analog sensors with the intelligence of digital equipment. Now, what does that mean in practice? it means a lot of things in the long term. One of the most important aspects of 1451.4 is that it offers a standard interface and protocol by which a sensor can describe itself over a network. With the advent and adoption of intelligent networked and wireless sensors, the notion of self-identifying devices may seem fairly elementary, but this has taken more than a decade to happen with analog sensors. Most commercially available sensor networks today are based on proprietary communications protocols, limiting their usefulness and hampering their adoption. IEEE 1451.4 could change all that.

60 - Based on the text, what are sensors?
1) What our health and happiness totally rely on.
2) Amphibious devices that tell us if a nuclear reactor's systems are operating.
3) Ambiguous devices that tell us if a refrigerator is too cold.
4) Tiny devices that tell us if a factory production line is processing components correctly.

61 - What is the possible result of miscalibration?
1) A dirty little secret.
2) An important reactor safety system.
3) Erroneous feedback.
4) The process by which data from a sensor are mapped to real-world conditions.

62 - What is so lovely about the name of Standard IEEE 1451.4?
1) It makes a huge advance in sensor technology.
2) Nothing is so lovely about this name.
3) It could cause a backup reactor shutdown.
4) It can cause various problems.

Passage 22 - Millions of people suffer organ and tissues loss every year from accidents, birth defects, and diseases such as cancer and diabetes. In the last quarter of the 20th century, innovative drugs, surgical procedures, and medical devices have greatly improved the care of these patients. Yet these treatments are imperfect and often impair the quality of life. The control of diabetes with insulin shots, for instance, is only partly successful. Injection of hormone insulin once or several times a day helps the cells of diabetics to take up the sugar glucose from the blood. However, the appropriate insulin dosage for each patient may vary widely from day to day and even hour to hour. Often amounts can not be determined precisely enough to maintain the blood sugar level in the normal range and prevent complications of diabetes — such as blindness, kidney failure, and heart disease — later in life. Innovative research in biosensor design and drug delivery will someday make insulin injections obsolete. In many diabetics, the disease is caused by destruction in the pancreas. In others, the pancreas makes insulin, but not enough to meet the body's demands. It is possible to envision a sensor-controlled device that would function like the pancreas, continuously monitoring glucose levels and releasing the appropriate amount of insulin in response. This device could be implanted or worn externally.

63 - The text hopes that someday —
1) biomedical approaches help diabetics to have a better life
2) we can decrease the number of organ losses due to birth defects
3) the insulin injection will be increased in the patient population
4) people learn how to prevent blindness and kidney failure caused by diabetes

64 -In the sentence "It will someday make the insulin injection obsolete." The word "obsolete" can be replaced by
1) useless
2) popular
3) out-of-order
4) up-to-date

65 - According to the text, the biosensor has to —
1) remove the pancreas
2) be implanted inside the body by surgery
3) observe the glucose level and act accordingly
4) monitor all hormones including the glucose level

66 - According to the text, what is the major disadvantage of insulin injection?
1) Implanting a sensor is easier than injection
2) The patients, especially children, can not inject themselves
3) Insulin injection can not prevent kidney disease or heart failure
4) The adequate insulin for each patient depends on his/her body and changes with time

67 - Which word has the closest meaning to "innovative research" ?
1) recent research
2) ingenious research
3) initiating research
4) traditional research

Passage 23 -
Mobile networks have enabled dramatic advances and changes in telecommunications over the last two decades, and mobile operators have offered their subscribers a service set as rich as their wireline competitors, plus mobility. However, with the broadband market success in cable, xDSL, and Wi-Fi, the competitive landscape is changing. Although 3G technologies deliver significantly higher bit rates than 2G technologies, there is still more opportunity for wireless operators to capitalize on the ever-increasing demand for "wireless broadband", even lower latency and multi-megabit throughput. Consequently, there is an expanding revenue opportunity from a growing pool of underserved consumers that can only be satisfied with next-generation networks. The solution is "LTE" (Long Term Evolution), the next-generation network beyond 3G. In addition to enabling fixed to mobile migrations of Internet applications such as Voice over IP, video streaming, music downloading, mobile TV, and many others, LTE networks will also provide the capacity to support an explosion in demand for connectivity from a new generation of consumer devices tailored to those new mobile applications. Competing technologies are already emerging to address the growing nomadic wireless broadband market space. However, mobile operators, thanks to their incumbent position, have a unique opportunity to evolve their infrastructures to next generation wireless networks and capitalize on this great opportunity to further grow their dominant market share. Their decision on which technology and when to evolve to the higher performing next generation networks will underpin their market success.

68 - In the sentence "However, the mobile operators thanks to — ", what does "thanks to" mean?
1) due to
2) trying to
3) despite to
4) appreciation

69 - Based on the text, which of the following has the lowest "throughput"?
1) DSL
2) LTE
3) 3G systems
4) 2G systems

70 - In the last sentence of the text: "Their decision — , will underpin their success". What does "underpin" mean

1) destroy
2) convey
3)establish
4) accomplish

Passage 24 - Nanotechnology is the manipulation of matter for use in particular applications through certain chemical/physical processes to create materials with specific properties. There are both "bottom-up'' processes that create nanoscale materials from atoms and molecules, as well as "top-down'' processes that create nanoscale materials from their macro-scale counterparts. Nanoscale materials that have macro-scale counterparts frequently display different or enhanced properties compared to the macro-scale form. Such engineered or manufactured nanomaterials are referred to as "intentionally produced nanomaterials". The definition of nanotechnology does not include unintentionally produced nanomaterials, such as diesel exhaust particles or other friction or airborne combustion byproducts, or nanosized materials that occur naturally in the environment, such as viruses or volcanic ash. Nanotechnology has the potential to improve the environment, both through direct applications of nanomaterials to detect, prevent, and remove pollutants, as well as indirectly by using nanotechnology to design cleaner industrial processes and create environmentally responsible products. However, there are unanswered questions regarding the impacts of nanoproducts on human health and the environment. Thus the Environmental Protection Agency has the obligation to ensure that potential risks are adequately understood to protect human health and the environment.

71 -"Unintentionally produced nanomaterials" refers to —
1) Non-natural nanomaterials
2) Nanomaterials which have been produced prudentially
3) Nanomaterials which have been produced in laboratories
4) Nanomaterials which have not been produced deliberately

72 - Which of the following phrases described the term "environmentally responsible products" the best?
1) Recyclable products
2) Manufactured products
3) Products which will be used in the environment
4) Products whose producers is responsible for them

73 - In the last sentence of the text, "adequately understood" can be replaced by —
1) Suitably ignored
2) Thoroughly studied
3) Inherently responsive
4)Insufficiently discussed

74 - According to the text, how nanotechnology can improve human health?
1) By collecting all the combustion byproducts
2) By using nanomaterial products in medical applications
3) By removing viruses and volcanic ash from the atmosphere
4) By exploiting nanotechnological approaches in the industrial world

Passage 25 - Another source of noise is loose lamination. The magnet body and plunger (armature) are made up of thin sheets of iron laminated and riveted together to reduce eddy currents and hysteresis, iron losses showing up as heat. Eddy currents are shorted currents induced in the metal by the transformer action of an ac coil. Although these currents are small, they heat up the metal, create an iron loss, and contribute to inefficiency. At one time, laminations in magnets were insulated from each other by a thin, nonmagnetic coating; however, it was found that the normal oxidation of the metallic laminations reduces the effects of eddy currents to a satisfactory degree, thus eliminating the need for a coating.

75 - All the following can be the cause of inefficiency in the magnets except:
1) heating
2) iron loss
3) oxidation
4) eddy currents

76 - It is stated that the disturbances to the magnet core such as eddy currents, and hysteresis —
1) may be small
2) are demonstrated as heat
3) reduce efficiency
4) all of the above

77 - The word "rivet" is closet in meaning to —
1) combine
2) fasten
3) inject
4) weld

Passage 26 - Reclosers are essentially circuit breakers of lower capacity, Both as normal current and interrupting duty. They are usually installed on major branches of distribution feeders in series with other sectionlizing devices; they perform the same function as repeater fuses connect in the circuit or circuit breakers at the substation.
Reclosers are designed to remain open, or 'locked out' after a selected sequence of tripping operations, A fault will trip the recloser, of the fault is temporary in nature and no longer exists, the next tripping operation does not take place and the recloser returns to its normally closed position, ready for another incident. If the fault persists, the recloser will close and the operation will be repeated until the recloser locks out. The reclosers are usually set for three automatic reclosing operations before locking out; the first operation is usually '*instantaneous*' i.e.; occurring as quickly as the breaker contacts can open with no time delayl the seond and third operations have time delay inserted, that for the second tripping smaller than that for the third; a fourthtripping will result in the recloser's remaining open until it is automatically or manually restored to normal, ready for the next incident.
Reclosers can operate on one or more time -current characteristic curve. The reclosing characteristic of the recloser for each operation are coordinated with those of fuses at the coordinating points in the circuit and with those of the relays controlling the circuit circuitbreakerat the substation.
Where the fault current beyond the ability of a fuse or reclosers to interrupt it safetly or where repeated operation within a short period of time makes more economical, a circuit breaker is used. The circuitbreakers must not on interrupt the load current, which in turn also depends on the voltage of the circuit, the stresses that must be accommodated depend on both these values. Their time-current characteristics, however, are dependent on the protective relays associcated with them and must be coordinated with *those* of down-line reclosers, fuses, and other protective devices.

79 - The operation of reclosers is similair to —
1) the function of circuit breaekrs at lowest capacity
2) the operation of repeater fuses at the substations
3) the operation of circuit breakers at the substations
4) 1 and 3

80 - "Those" in last paragraph refers to —
1) reclosing characteristics
2) operation
3) time-current characteristics
4) characteristics

81 - Which one is true?
1) Circuit breakers are more powerful than fuses.
2) Circuit breakers work in high capacity than reclosers
3) Circuit breakers have different time-current characteristics from recloser
4) All of the above

82 - This passage can be continued about —
1) time-current characteristics of circuit breakers
2) other kinds of circuit breakers
3) the future of protective devices
4) down-line recloser

83 - In the first automatic reclosing operation, "instantaneous" operation, which of the followings should decrease as much as possible?

1) The efficiency of the operation
2) The time of the operation
3) The cost of the operation
4) The accuracy of the operation

Passage 27 - With the advent and development of embedded system and signal processing technique, there is a tendency to apply the embedded system technique to Brain Computer Interface(BCI). An electroencephalogram based Brain Computer Interface (EEG-based BCI) provides a novel concept for the communication between the human brain and the computer. Traditionally, the variations of brain waveforms are measured on subject's scalp by the PC-based measuring instruments. For the inconvenience of PCsm we need to develop wearable and inexpensive Brain Computer Interface systems-small devices with long battary life that can be carried indoors or outdoors. Real-time and embedded systems offer a better platform to build wearable and inexpensive BCI systems, their limited processor and memory resources are efficiently utilized. The application may be easy to migrate to newer platforms whenever smaller and more powerful devices are developed. We have implemented a wireless embedded brain computer interface. We used a DSP processor as a coprocessor with ARM, because the processing of the EEG date analysis needs a large number of calculations. We also implemented wireless transmission in BCI system to make it more convenient for users. But the system cannot ensure timing accuracy. In order to increase timing accuracy of the system we propose an embedded multi-task scheduling system to manage tasks. The overall system we developed can be divided into three units: (1) signal acquisition and amplifying unit, (2) wireless data transmission unit, and (3) dual core processing and display unit. The data flow of the system can be divided into two flows; (1) the EEG signal was first acquired by signal acquisition and amplifying unit and then transmitted from wireless data transmission unit to wireless data receiver. Second, the data processing unit will process the EEG data and transmit the row data to remote PC at the same time; (2) after processing EEG data; the system will transmit the result to a remote PC.

84 - Which of the following is NOT mentioned as one of the results of PC - based measuring instruments?
1) Developing wearable Brain Computer Interface systems
2) Developing small devices with long battery life
3) Developing devices that only can be carried indoors
4) None of the above

85 - What is an ARM?
1) It is a wireless transmission system
2) It is a kind of processor
3) It is a BCI system
4) It is a DSP processor

86 - If it is necessary to gain more comfort in a BCI system, —
1) We have to implement a wireless transmission in BCI
2) We have to increase time accuracy
3) We have to use a scheduling system
4) All of the above

87 - Which statement is correct according to the last paragraph?
1) The difference between kinds of data flows is based on the sequence of processing data and transmission
2) In first data flow, processing is done first
3) Transmission is done first in the second data flow
4) One core processing unit is one part of the system

88 - The word "advent " underlined means —
1) Arrival
2) Shift
3) Move
4) Growth

Passage 29 - Power systems undergoing rapid extension may experience that existing switchgear will not any loner be adequate to meet the increased short circuit currents. One the other hand, countries which do not have a rapid growing demand can nevertheless also suffer from increased short circuit currents. Environmental and economic requirements more and more require shut-down of old power plants. New Power plants may not necessarily be built at the same site and of the same power. Thus, Power flow and short circuit currents will change. One alternative to alleviate the fault level problems is to upgrade or replace existing switchgear. This option normally require major modifications and shut-downs. Inserting reactors between busbar sections or in series connection to feeders has been considered as another possible solution to limit short circuit currents. These reactors will increase losses and are in the system all the time. Today, thyristor controlled devices can be introduced into transmission systems which reduce the downtime of the system during installation and commissioning. Additionally, they reduce losses as they are only inserted if a short circuit is detected.

89 - Which of the following is the best topic for this passage?
1) Power System rapid extension
2) Thyristor controlled devices
3) Introducing methods of current limiting
4) Thyristor controlled devices, best method for current limiting

90 - The current limiter reactors is installed at —
1) near to thyristor
2) series to transmission line
3) Between busbars
4) both 2 & 3

91 - Why are we constrained to shut down old power plants?
1) Because the level of their short circuit current is high
2) Because of technical requirements
3) Because maintenance of this plant is not affordable
4) All of the above

92 - The word "alleviate" underlined means —
1)Modify
2) Boost
3) Cure
4) add

93 - What is the advantages of thyristor controlled devices?
1) They can limit short circuit current
2) They increase efficiency
3) They can be installed between busbar sections
4) Both 1 & 2

Passage 30 - The term 'broadcasting' means to send out in all directions. The transmitting antenna radiates electromagnetic radio waves that can be picked up by the receiving antenna. For commercial television broadcast stations, the service area is about 25 to 75 mi in all directions from the transmitter. The radiation is in the form of two RF carrier waves, modulated by the desired information. Amplitude modulation (AM) is used for the picture signal. However, frequency modulation (FM) is used for the sound signal. We know that the desired sound for the televised program is converted by the microphone to an audio signal, which is amplified for the sound-signal transmitter. For transmission of the picture, the camera tube converts the visual information into electrical signal variations. A camera tube is a cathode-ray tube with a photoelectric image plate. The electrical variations from the camera tube become the video signal, which contains the desired picture information. The video signal is amplified and coupled to the picture-signal transmitter for broadcasting to receivers in the service area. Separate carrier waves are used for the picture signal and sound signal, but they are radiated by one transmitting antenna. Furthermore, the picture and sound signals are included in the broadcast channel for each station. A television channel for a commercial broadcast station is made 6 M1-1z wide to include both the picture and sound. At the receiver also, one antenna is used for the picture and sound signals. The receiving antenna intercepts the radiated picture and sound carrier signals, which are then amplified and detected in the receiver. The detector output includes the desired video signal containing the information needed to reproduce the picture. Then the recovered video signal is amplified and coupled to a picture tube that converts the electric signal back into the light.

94 - Which kind of modulations is/are used for TVs by the receiving antennas?
1) Amplitude modulation
2) It depends on the type of antenna
3) Frequency modulation
4) 1 and 3

95 - — separates sound and picture signals.
1) The receiving antenna
2) The transmitting antenna
3) Carrier waves
4) Photoelectric image plate

96 - The radiated sound and picture carrier signals —
1) first will be separated, then detected, and finally amplified.
2) at first will be intercepted by transmitting antenna, then will be amplified detected in the receiver.
3) are converted into video signals.
4) are radiated by the same antenna.

97 - Which one is true about sound signal and picture signal?
1) Only one antenna is needed to transmit both picture signals and sound signals.
2) One antenna is needed to transmit only sound signals and another one to receive only picture signals.
3) Sound and picture signals are included in the broadcast channel for all stations.
4) Sound and picture signals are broadcasted by the same carrier waves.

98 - According to the text —
1) electrical signal variations are converted from picture signals by cathode-ray tube
2) the receiving antenna picks up electromagnetic radio waves from the transmitting antenna.
3) the video signal is amplified to the picture signal transmitter for broadcasting to transmitters.
4) sound signals are converted by microphones and picture signals are converted by cathode-ray tube

Passage 31 - Recent advances in wireless communications and electronics have enabled the development of small (in size), low-cost, low-power, and multifunctional sensors that are communicated over short distances. Smart, wireless, networked sensors will become more widely used, collectively processing vast amounts of previously unrecorded data to help monitor the condition of the environment, machining systems, and other applications. Standardized transducer interfaces, high-level programming languages, and wireless network technologies are serving to shape the next generation, wireless monitoring landscape. The Institute of Electrical and Electronics Engineers (IEEE) Instrumentation and Measurement Society's Technical Committee on Sensor Technology have developed a family of Smart Transducer Interface Standards called IEEE 1451. The standards define a set of open, common, network-independent communication interfaces for connecting transducers (defined as sensors or actuators) to microprocessors, instruments, and control/field networks. The IEEE 1451 family provides a set of protocols for wired and wireless distributed sensor applications. According to architecture, IEEE 1451 defines a Transducer Interface Module (TIM) and Network Capable Application Processor (NCAP). The TIM can be wired or wireless IEEE 1451. X module consisting of up to 255 transducers, signal conversion, and processing electronics, and Transducer Electronic Data Sheets (TEDS). The TEDS provides transducer ID (identification), measurement range, location, calibration and user information, and more. The NCAP can access the TIM and pass the transducer information to the network. The IEEE 1451.0 standard defines a set of common functionality, commands, and TEDS for the IEEE 1451 family. This functionality is independent of the physical communications media. It includes the basic functions for the NCAP to read and write to each transducer and its TEDS, and to send configuration, control, and operation commands to the TIM. Through a communication interface module, IEEE 1451.0 can talk to the IEEE 1451. X on the NCAP. The IEEE 1451. X on the NCAP can talk to the IEEE 1451. X on the TIM through the IEEE 1451. X physical interfaces.

100- Based on the first paragraph which statement is NOT correct?
1) Sensors owe their development to wireless communication
2) The next generation of wireless monitoring will be shaped by high—level programming languages
3) Smart, wireless, networked sensors can't help in monitoring machining systems.
4) 2 and 3

101- What is the possible application of IEEE 1451?
1) Providing a set of protocols for wireless sensors applications only.
2) Defines communication interfaces for connecting transducers to microprocessors.
3) It is just a standard and has no application.
4) It is a kind of microprocessor.

102 -What is the importance of IEEE 1451.0?
1) It defines a set of common functionality dependent on the physical communication media
2) It defines a set of common functionality independent of the physical communicator media
3) Through a communication interface module, IEEE 1451/0 can talk to IEEE 1451. X
4) 2 and 3

103 - According to the passage, the TIM consists of all of the following EXCEPT:
1) Signal conversion and processing electronics
2) Less than 265 transducers 3) An IEEE 1451.X module using no wires
4) TEDS

104 - The pronoun "it" in the 3rd paragraph is refers to —
1) TIM
2) NCAP
3) IEEE 1451 standard
4) TEDS

Passage 32 - The basic approach to the design of any practical control system will necessarily involve trial-and-error procedures. The synthesis of linear control systems is theoretically possible, and the control engineer can systematically determine the components necessary to perform the given objective. In practice, however, the system may be subjected to many constraints or maybe nonlinear, and for such cases, no synthesis methods are available at present. In addition, the characteristics of components may not be precisely known. Thus, trial-and-error procedures are always necessary. Situations are often encountered in practice where a plant is unalterable (that is, we are not free to change the dynamics of the plant), and the control engineer has to design the rest of the system so that the whole will meet the given specifications in accomplishing the given task. The specifications may include such factors as the speed of response, reasonable damping, steady-state accuracy, reliability, and cost. In certain cases, the requirements or specifications may be given explicitly and in other cases, they may not be. All requirements or specifications must be interpreted in mathematical terms. In the conventional design, we must make sure that the closed-loop system is stable and has acceptable transient response characteristics (that is, reasonable speed and reasonable damping) and acceptable steady-state accuracy. It is important to remember that some of the specifications may not be realistic. In such a case, the specifications must be revised in the early stages of the design. Also, the given specifications may include conflicting requirements. Then the designer must successfully resolve the conflicts among many given requirements.

105 - Which one is the duty of designers or control engineers?
1) Solving the requirements and specifications, using mathematics.
2) Making sure about the stability of the closed-loop system.
3) Resolving the conflicts among requirements and Specifications.
4) 2 and 3

106 - According to the passage, which one is true?
1) In certain cases the requirements or specifications may be given partially and in other cases, they may not be.
2) Even in theoretical control systems, trial-and-error procedures are always necessary.
3) Designers are allowed to change the static's of the plant.
4) Some of the specifications may be realistic.

107 - Which of the following according to the passage is NOT of requirements for conventional designs?
1) Transient response with reasonable speed and reasonable damping
2) Reasonable steady-state
3) Stability of a closed system
4) Implementation of an open system

108 - The word "transient" in the 3rd paragraph has the closest meaning to —
1) transcendence
2) temporary
3) permanent
4) persistence

109 - According to the passage, which of the following is true about the design of practical control system?
1) The only specific procedure in the design of practical control systems is trial-and-error procedures.
2) Solving conflicts between criteria is done only by trial-and-error procedures.
3) Generally in practice, systems don't encounter any limitations.
4) Error-and-trial procedures are one of the requirements of any practical system control design.

Passage 33 - Vehicles driven by electric motors use the motor as a generator when using regenerative braking: it is operated as a generator during braking and its output is supplied to an electrical load; the transfer of energy to the load provides the braking effect. Regenerative braking is used on hybrid gas/electric automobiles to recoup some of the energy lost during stopping. This energy is saved in a storage battery and used later to power the motor whenever the car is in electric mode. Early examples of this system were the front-wheel drive conversions of horse-drawn cabs. The Krieger electric landaulet had a drive motor in each front wheel with a second set of parallel windings (bifilar coil) fob regenerative braking. In England, the Raworth system of "regenerative control" was introduced by tramway operators in the early 1900s, since it offered them economic and operational benefits. Slowing down the speed of the cars or keeping it in hand on descending gradients, the motors worked as generators and braked the vehicles. The tram cars also had wheel brakes and track slipper brakes which could stop the tram should the electric braking systems fail. In several cases, the tram car motors were shunt wound instead of series wound. Regenerative braking has been in extensive use on railways for many decades. The Baku-Tbilisi-Batumi railway started utilizing regenerative braking in the early 1930s. This was especially effective on the steep and dangerous passes. From Riksgransen on the national border to the Port of Narvik, the trains use only a fifth of the power they regenerate. The regenerated energy is sufficient to power the empty trains back up to the national border. Any excess energy from the railway is pumped into the power grid to supply homes and businesses in the region, and the railway is a net generator of electricity. During braking, the traction motor connections are altered to turn them into electrical generators. The motor fields are connected across the main traction generator (MG) and the motor armatures are connected across the load. The MG now excites the motor fields. The rolling locomotive or multiple unit wheels turn the motor armatures, and the motors act as generators, either sending the generated current through onboard resistors (dynamic braking) or back into the supply (regenerative braking). Compared to electro-pneumatic friction brakes, braking with the traction motors can be regulated faster improving the performance of wheel slide protection. For a given direction of travel, current flow through the motor armatures during braking will be opposite to that during motoring. Therefore, the motor exerts torque in a direction that is opposite from the rolling direction.

110 - According to the text —
1) the trains on the Port of Narvik to the national border use only a fifth of the power they regenerate.
2) regenerative braking is always a good source of energy for pumping into the power grid
3) the recouped energy is used when the car's fuel is retrieved.
4) for steep roads, regenerative braking is much more used

111 - Based on the text, which is NOT mentioned about the "regenerative control"?
1) It offered economic and operational benefits for the operators.
2) Unlike other systems having regenerative braking, the motors work on generator mode.
3) When the wheel brakes are in use, the electric braking system should fail.
4) The tram car motors were shunt wound instead of series wound.

112 - What is the duty of the "traction connections" in an electric/hybrid car?
1) traction motor connections are altered to turn them into electrical generators.
2) They regulate the performance of wheel slide protection.
3) They restore the energy into the supply.
4) They turn the motor armatures, and the motors act as generators.

113 - Which of these statements is NOT true about the process of braking?
1) The traction motor connections are altered to turn them into electrical generators.
2) Multiple-unit wheels turn. the motor armatures, the motors act as generators and vice versa.
3) MG works like a start-up and excites the motor fields.
4) Rolling locomotive wheels and multiple-unit wheels do the same work in the system.

Passage 34 - A current mirror is a circuit designed to copy a current through one active device by controlling the current in another active device of a circuit, keeping the output current constant regardless of loading. The current being 'copied' can be, and sometimes is, a varying signal current. Conceptually, an ideal current mirror is simply an ideal inverting current amplifier that reverses the current direction as well or it is a current-controlled current source (CCCS). The current mirror is used to provide bias currents and active loads to circuits. There are three main specifications that characterize a current mirror. The first is the transfer ratio (in the case of a current amplifier) or the output current magnitude (in the case of a constant current source CCS). The second is its AC output resistance, which determines how much the output current varies with the voltage applied to the mirror. The third specification is the minimum voltage drop across the output port of the mirror necessary to make it work properly. This minimum voltage is dictated by the need to keep the output transistor of the mirror in active mode. The range of voltages where the mirror works are called the compliance range and the voltage marking the boundary between good and bad behavior is called the compliance. voltage. There are also a number of secondary performance issues With mirrors, for example, temperature stability. A bipolar transistor can be used as the simplest current-to-current converter but its transfer ratio would highly depend on temperature variations, beta tolerances, etc. To eliminate these undesired disturbances, a current mirror is composed of two cascaded current-to-voltage and voltage-to-current converters placed at the same conditions and having reverse characteristics. It is not obligatory for them to be linear; the only requirement is their characteristics to be mirrorlike. Usually, two identical converters are used but the characteristic of the first one is reversed by applying negative feedback. Thus a current mirror consists of two cascaded equal converters. If a voltage is applied to the BJT base-emitter junction as an input quantity and the collector current is taken as an output quantity, the transistor will act as an exponential voltage-to-current converter. By applying negative feedback (simply joining the base and collector) the transistor can be "reversed" and it will begin acting as the opposite logarithmic current-to-voltage converter; now it will adjust the "output" base-emitter, voltage so as to pass the applied "input" collector current.

114 - It is referred from the text that:
1) A current mirror keeps the output current constant according to the loading.
2) An ideal current mirror is simply an ideal inverting current amplifier that only reverses the current direct
3) A bipolar transistor transfer ratio highly depends on temperature variations.
4) Usually two identical converters with the same characteristics are applied for designing a current mirror.

115 - Based on the text, which statement is the definition of the compliance range?
1) The voltage marking the boundary between good and bad behavior is called the compliance range.
2) The range of voltages where the mirror works are called the compliance range.
3) The voltage range applied to the BJT base-emitter junction as an input quantity is called the compliance range.
4) The range of varying signal current transferred to the output is called the compliance range.

116 - According to the text, how can a collector work as an input current?
1) By applying negative feedback in the transistor.
2) By using the BJT transistor in saturation mode.
3) By using a cascade model for a current source.
4) By connecting the base to the emitter.

117 - Which is NOT mentioned as the specifications of a given current mirror?
1) the transfer ratio
2) the minimum voltage drop
3) temperature stability
4) negative feedback

Passage 35 - Bluetooth is a wireless technology standard for exchanging data over short distances (using short-wavelength radio transmissions in the ISM band from (2400-2480 MHz) from fixed and mobile devices, creating personal area networks (PANs) with high levels of security. Bluetooth was originally conceived as a wireless alternative to RS-232 data cables. It can connect several devices, overcoming problems of synchronization. Bluetooth is managed by the Bluetooth Special Interest Group, which has more than 19,000 member companies in the areas of telecommunication, computing, networking, and consumer electronics. Bluetooth was standardized as IEEE 802.15.1, but the standard is no longer maintained. The SIG oversees the development of the specification, manages the qualification program, and protects the trademarks. To be marketed as a Bluetooth device, it must be qualified to standards defined by the SIG. A master Bluetooth device can communicate with a maximum of seven devices in a piconet (an ad-hoc computer network using Bluetooth technology), though not all devices reach this maximum. The devices can switch roles, by agreement, and the slave can become the master (for example, a headset initiating a connection to a phone will necessarily begin as master, as an initiator of the connection; but may subsequently prefer to be slave).The Bluetooth Core Specification provides for the connection of two or more piconets to form a scattemet, in which certain devices simultaneously play the master role in one piconet and the slave role in another

118 - According to the text —
1) The Bluetooth Core Specification provides for the connection of two or more piconets to form a scatternet
2) piconet is an ad-hoc computer network used in Bluetooth technology.
3) Packet exchange is based on the basic clock which is in either master or slave.
4) To be marketed as a Bluetooth device, it must be quantified to standards defined by the SIG.

120 -which is NOT mentioned in the text as the characteristics of the Bluetooth?
1) It has high levels of security
2) It overcomes the problem of synchronizing between several devices.
3) It worts in ranges of frequencies which are used for industrial works.
4) It has a master-slave structure and all devices share their own clock.

121 - What is NOT concluded from the text?
1) Bluetooth was originally conceived as a wireless alternative to RS-232 data cables.
2) Bluetooth has a master-slave structure and all devices share the master's clock.
3) From 2402 MHz up to 2480 MHz there are 78 Bluetooth channels.
4) All slave devices have the same frequency that the master has.

122 - According to the text, which tick is related to the master transmission of simple case of single-slot packets?
1) $312.5\mu s$
2) $625\mu s$
3) $2500\mu s$
4) $1875\mu s$

Passage 36 - To connect to a Wi-Fi LAN, a computer has to be equipped with a wireless network interface controller. The combination of computer and interface controller is called a station. All stations share a single radio frequency communication channel. Transmissions on this channel are received by all stations within range. The hardware does not signal the user that the transmission was delivered and is therefore called a best-effort delivery mechanism. A carrier wave is used to transmit the data in packets, referred to as "Ethernet frames". Each station is constantly tuned in on the radio frequency communication channel to pick up available transmissions. A Wi-Fi-enabled device can connect to the Internet when within range of a wireless network which is configured to permit this. The coverage of one or more (interconnected) access points—called hotspots—can extend from an area as small as a few rooms to as large as many square miles. Coverage in the larger area may require a group of access points with overlapping coverage. iV 11 A wireless access point (WAP) connects a group of wireless devices to an adjacent wired LAN. An access point resembles a network hub, relaying data between connected wireless devices in addition to a (usually) single connected wired device, most often an Ethernet hub or switch, allowing wireless devices to communicate with other wired devices. Wireless adapters allow devices to connect to a wireless network. These adapters connect to devices using various external or internal interconnects such as PCI, miniPCI, USB, ExpressCard, Cardbus, and PC Card. Wireless routers integrate a Wireless Access Point, Ethernet switch, and internal router firmware application that provides IP routing, NAT, and DNS forwarding through an integrated WAN interface. A wireless router allows wired and wireless Ethernet LAN devices to connect to a (usually) single WAN devices such as a cable modem or a DSL modem. A wireless router allows all three devices, mainly the access point and router, to be configured through one central utility. This utility is usually an integrated web server that is accessible to wired and wireless LAN clients and often optionally to WAN clients. This utility may also be an application that is run on a computer.

123 - According to the text —
1) A Wi-Fi-enabled device can connect to the Internet when within range of a wireless network.
2) A carrier wave is used to transmit the data in packets and then change them into piconet.
3) A wireless router allows the access point and router to be configured through one central utility.
4) Networks employing wireless extenders are more prone to degradation from interference.

124 - Based on the text, which is NOT true about the station?
1) All stations share a single radio frequency communication channel.
2) All stations that have an overlapping can transmit data.
3) A station is the combination of computer and interface controller.
4) A station consists of four main parts connecting different parts together.

125 - It is revealed from the text that a wireless router —
1) allows Ethernet LAN devices to connect to a single WAN device.
2) makes the wireless connections easier by extending the bandwidth.
3) connects two DSL modems to each other by Wi-Fi signals.
4) can be less secure than wired connections like LAN networks

Passage 37 - As an important part of the signal preconditioning module, neural amplifiers need to be designed carefully. This is because they significantly contribute to the quality of the signals recorded in terms of the strength of the neural activities recorded and also their signal-to-noise ratio. As a result, neural amplifiers are designed with high enough mid-band gain and low input-referred noise. Considering the fact that in high-density neural recording per-channel amplifiers are used, it is of crucial importance to design these amplifiers with low power consumption and small silicon area. Some of the key design parameters for neural amplifiers are noise, silicon area, and power. In intra-cortical extracellular neural recording peak-to-peak amplitude of action potentials at the input of the signal preconditioning 1 module is in the order of tens to hundreds of microVolts. As a result, the input-referred noise of neural amplifiers for this type of recording is typically kept below 5-30 uV. Input-referred noise of a neural amplifier has two main components: thermal noise and flicker noise. The former is caused by recording electrodes and amplifier transistors, and the latter is caused by existing amplifier transistors. The thermal noise component can be reduced by choosing a larger transconductance for the transistors used at the input of the neural amplifier. In low-frequency applications such as neural recording, extra care should be taken to keep the flicker noise low. This is because flicker noise significantly increases at low frequencies. There are two techniques used to reduce the contribution of the flicker noise component in the input-referred noise. As a device-level technique, pMOS transistors with a considerably large channel area are used as the amplifier input transistors. As a circuit-level technique, the Chopper technique is used to eliminate both the offset of the amplifier and the flicker nois component, which are both of low-frequency nature .To implement this technique an auxiliary amplifier and a few integrated capacitors are needed, which makes it difficult to achieve low flicker noise, low power consumption, small silicon area occupation at the same time.

126- According to the text —
1) as a general prerequisite for being implantable, neural amplifiers need to be small in physical dimensions
2) a neural amplifier is expected to consume a small chip area and contains no off-chip components.
3) some of the key design parameters for neural amplifiers are noise, silicon area, and power.
4) for a specific level of noise, the power consumption of a neural amplifier cannot be reduced as much as the circuit designer wishes.

127 - Which amount of action potentials at the input of the signal preconditioning module is NOT suitable for a noise in the range of 10 uV?
1) 20 uV
2) 50 uV
3) 100 uV
4) 5 uV

128 - What is the disadvantage of the "Chopper technique" in reducing the flickering part of the input-referred noise?
1) Chopper technique significantly increases the flicker noise at low frequencies.
2) Chopper technique does not lead to low power consumption.
3) Chopper technique is not helpful in decreasing the thermal noise.
4) Chopper technique significantly increases the flicker noise at high frequencies.

Passage 38 - Free-space point-to-point optical links can be implemented using infrared laser light, although low-data-rate communication over short distances is possible using LEDs. Infrared Data Association (IrDA) technology is a very simple form of free-space optical communications. Free Space Optics are additionally used for communications between spacecraft. The maximum range for terrestrial links is of the order of 2 to 3 km, but the stability and quality of the link are highly dependent on atmospheric factors such as rain, fog, dust, and heat. Amateur radio operators have achieved significantly farther distances using incoherent sources of light from high-intensity LEDs. One reported 173 miles (278 km) in 2007. However, the physical limitations of the equipment used limited bandwidths to about 4 kHz. The high sensitivities required of the detector to cover such distances made the internal capacitance of the photodiode use a dominant factor in the high-impedance amplifier which followed it, thus naturally forming a low-pass filter with a cut-off frequency in the 4 kHz range. On the other side use of lasers, radiation source allows reaching very high data rates which are comparable to fiber communications. For example, in 2008 the Company MRV Communications has introduced the free-space optics (FSO)-based TereScope TS-10GE system with a data rate of 10 Gbps at a distance of 350 m. Now, this equipment is not presented on the FSO market. In 2013 the company MOSTCOM started the serial production of the new wireless communication system with a data rate of 10 Gbps and a distance up to 2.5 km. In outer space, the communication range of free-space optical communication is currently of the order of several thousand kilometers, but has the potential to bridge interplanetary distances of millions of kilometers, using optical telescopes as beam expanders.

129 - According to the text —
1) the communication range of free-space optical communication in outer space is currently of the order of several thousand kilometers
2) The distance records for optical communications involved detection and emission of laser light by space probes.
3) The infrared diode neodymium laser is able to communicate across a distance of 15 million miles.
4) To compensate for atmospheric interference for terrestrial links, an error correction code algorithm similar to that used in CDs was implemented.

130 - What is NOT inferred from the text?
1) Use of lasers' radiation source allows reaching very high data rates which are comparable to fiber communications.
2) The communication range of free-space optical communication has the potential to bridge interplanetary distances of millions of kilometers.
3) The stability and quality of the terrestrial links is highly dependent on atmospheric factors such as rain, fog, dust and heat.
4) Physical limitations of the equipments for Amateur radio operators lead to low bandwidth and farther range.

131 - Based on the text, how can we achieve much longer ranges with terrestrial links?
1) By using incoherent sources of light from high-intensity LEDs
2) By using internal capacitance in photodiode lasers.
3) By using high frequency fiber communications.
4) By using free-space optical communications.

Passage 39 - Satellite radio offers audio services in some countries. Mobile services allow listeners to roam a continent, listening to the same audio programming anywhere. A satellite radio or subscription radio (SR) is a digital radio signal that is broadcast by a communications satellite, which covers a wide geographical range. Satellite radio offers a meaningful alternative to ground-based radio services in some countries. Mobile services, allow listeners to roam across an entire continent, listening to the same audio programming anywhere they go. Other services, such as Music Choice or Muzak's satellite-delivered content, require a fixed-location receiver and a dish antenna. In all cases, the antenna must have a clear view of the satellites. In areas where tall buildings, bridges, or even parking garages obscure the signal, repeaters can be placed to make the signal available to listeners. Initially available for broadcast to stationary TV receivers, by 2004 popular mobile direct broadcast applications made their appearance with the arrival of two satellite radio systems: Sirius and XM Satellite Radio Holdings. Later they merged to become the conglomerate SiriusXM. Radio services are usually provided by commercial ventures and are subscription-based. The various services are proprietary signals, requiring specialized hardware for decoding and playback. Providers usually carry a variety of news, weather, sports, and music channels, with the music channels generally being commercial-free. In areas with a relatively high population density, it is easier and less expensive to reach the bulk of the population with terrestrial broadcasts. Amateur radio operators have access to the amateur radio satellites that have been designed specifically to carry amateur radio traffic. Most such satellites operate as spaceborne repeaters and are generally accessed by amateurs equipped with UHF or VHF radio equipment and highly directional antennas such as Yagis or dish antennas. Due to launch costs, most current amateur satellites are launched into fairly low Earth orbits and are designed to deal with only a limited number of brief contacts at any given time. Some satellites also provide data-forwarding services using the X.25 or similar protocols.

132 - Based on the text, satellite radio —
1) is much more commodious compared with other radio services.
2) offers a meaningful alternative to ground-based radio services.
3) allows listeners to roam across an entire continent, listening to the same audio programming anywhere they go.
4) is a digital radio signal that is broadcast by a communications satellite, which covers a wide geographical range.

133 - What is common between all radio services?
1) In all cases, there should be a fixed-location receiver and a dish antenna
2) In all cases, the antenna must have a clear view of the satellites.
3) In all cases, repeaters should be mounted at far distances.
4) In all cases, satellites are launched into fairly low Earth orbits.

134 - What is NOT concluded from the text?
1) In areas with a relatively high population density, it is easier and less expensive to reach the bulk of the population with ground-based broadcasts.
2) Radio services are usually provided by commercial ventures and are subscription-based.
3) Amateur radio operators have access to the professional radio satellites that have been designed specifically to carry amateur radio traffic.
4) Due to launch costs, most current amateur satellites are launched into fairly low Earth orbits and are designed to deal with only a limited number of brief contacts at any given time.

Passage 40 - A proportional-integral-derivative controller is a generic control loop feedback mechanism(controller) widely used in industrial control systems. A PID controller calculates an "error" value as the difference between a measured process variable and a desired setpoint. The controller attempts to minimize the error by adjusting the process control Outputs. The PID controller algorithm involves three separate constant parameters, and is accordingly sometimes called three-term control: the proportional, the integral, and derivative values, denoted P, I, and D. Simply put, these values can be interpreted in terms of time: P depends on the present error, I on the accumulation of past errors, and D is a prediction of future errors, based on the current rate of change. The weighted sum of these three actions is used to adjust the process via a control element such as the position of a control valve, a damper, or the power supplied to a heating element. In the absence of knowledge of the underlying process, a PID controller has historically been considered to be the best controller. By tuning the three parameters in the PID controller algorithm, the controller can provide control action designed for specific process requirements. The response of the controller can be described in terms of the responsiveness of the controller to an error, the degree to which the controller overshoots the setpoint, and the degree of system oscillation. Note that the use of the PID algorithm for control does not guarantee optimal control of the system or system stability. Some applications may require using only one or two actions to provide the appropriate system control. This is achieved by setting the other parameters to zero. A PID controller will be called a PI, PD, P, or I controller in the absence of the respective control actions. PI controllers are fairly common, since derivative action is sensitive to measurement noise, whereas the absence of an integral term may prevent the system from reaching its target value due to the control action.

135 - According to the text —
1) stabilization of the response is required and the process must not oscillate for any combination of process conditions and setpoints.
2) If the PID controller parameters are chosen incorrectly, the controlled process input can be unstable.
3) Some processes have a degree of non-linearity and so parameters that work well at full-load conditions don't work when the process is starting up from no-load.
4) A PID controller will be called a PI, PD, P, or I controller in the absence of the respective control actions.

136 - In the sentence "The weighted sum of these —" What does "weight" mean?
1) The coefficients are multiplied by the factors.
2) The RMS effect of each of the three factors.
3) The mass of each of the factors.
4) The coefficient added to the factors.

137 - What is NOT inferred from the text?
1) The derivative value of past errors, is an accumulation of future errors.
2) The absence of an integral term may prevent the PI system from reaching its target value due to the control action.
3)A PID controller attempts to minimize the error by adjusting the process control Outputs.
4) The use of the PID algorithm for control does not guarantee optimal control of the system or system stability.