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Technical Language
MSc exam, May 2009
Three hours

This exam focuses on your abilities to read and write effectively in technical English. It consists of two parts.

1 Correct the following sentences by choosing the suitable words

Please write the number and the correct choice only.

- May I sit between you and **(1: he, him)**?
- Please come to see **(2: me, I, myself)** in the office tomorrow.
- It is **(3: too, very)** cold to play outside.
- Ahmed and Mohamed are friends of **(4: us, we, ours, our)**.
- The current was measured **(5: by, with)** the engineer.
- Sally was waiting **(6: since, for)** two hours.
- She walked **(7: in, into)** the office and answered the phone.
- My mother lets me stay up **(8: to, till, til)** nine o'clock.
- I will speak **(9: about, for, to)** aging society at the conference.
- Be sure to divide the candy **(10: among, between, to)** all of the children.
- We want to buy the new equipment **(11: at, for, upto)** any price.
- Mike was deeply **(12: affected, effected, infected)** by the news of his mother's death.
- She **(13: borrowed, borrows, lent)** me a pencil yesterday.
- Hany has always been an **(14: independent, independence)** person.
- The child's tooth is **(15: lose, loss, loose)**.
- Jane always gets really **(16: embarrased, embraced, ashamed, ashaming)** when speaking in front of an audience.
- There **(17: isn't, aren't)** enough juice for everyone to have some.
- There wasn't **(18: many, much)** traffic on the road.

- There **(19: are, is)** a lot of people who are interested in what you are doing.
- Yusuf is not **(20: so, very)** smart that he does not need to study.
- It is **(21: too, very)** cold today.
- The passengers have arrived **(22: just now, presently)** and the train will arrive **(23: just now, presently)**.
- The news of his dismissal hit him **(24: hard, hardly)**.
- If you **(25: wear, wore, had worn)** a lighter jacket, the car driver would have seen you earlier.
- She wouldn't have had two laptops if she **(26: does not sign, did not sign, had not signed)** the contract.
- If I **(27: were, wear)** a millionaire, I **(28: will give, would give, would have given)** to charity causes.
- You would save energy if you **(29: switch off, switched off, had switched off)** the lights more often.
- I speak **(30: about, for)** all of us when I say how much we have enjoyed the class.

2 Academic writing

Please read the following articles then write *a single article* about energy ***in Egypt***. I hope that this effort will help you in your future research careers. In your writing, please remember the following issues.

- Your work should be a coherent article with an introduction, body, and conclusion not just a list of unrelated points!
- If your article is divided into sections and subsections then those divisions should have informative titles and be numbered in sequence.
- Your article must not plagiarize! Clearly credit the ideas to their original authors and cite the provided articles as your references. You may cite other references as well obviously.
- The reference list should appear at the end of your article according to the order of appearance within your article.
- Your article should have neither spelling nor grammar mistakes.
- Your article must address at least the following points and is expected to discuss other ideas either from the provided articles or from your own background information:

1. The sources of traditional and renewable energy in Egypt as far as you know.
2. The problems of electric energy generation and distribution in Egypt. Furthermore,
   (a) in your opinion, is the general population in Egypt aware of these problems?
   (b) If yes, describe their actions to mitigate the problems, otherwise, indicate the means to increase the awareness.
3. The needs of Europe and the USA in their future grids.
4. The similarities and differences between these needs and those of Egypt.
5. Potential research directions within the Electronics and Communications department to serve the global as well as the local needs. (Categorize those research directions based on the subfields within the department.)
6. Pick at least two different subfields from your categories and give further details on the research directions: the technical challenges, the impact on society, the economic value, ...

2.1 Vision and Strategy for Europe's Electricity Networks of the Future

By the Directorate-General for Research on Sustainable Energy Systems, European Union, April 2006. Available at `http://www.smartgrids.eu/documents/vision.pdf`

Europe's electricity networks have provided the vital links between electricity producers and consumers with great success for many decades. The fundamental architecture of these networks has been developed to meet the needs of large, predominantly carbon-based generation technologies, located remotely from demand centres. The energy challenges that Europe is now facing are changing the electricity generation landscape.

The drive for lower-carbon generation technologies, combined with greatly improved efficiency on the demand side, will enable customers to become much more inter-active with the networks. More customer-centric networks are the way ahead, but these fundamental changes will impact significantly on network design and control.

In this context, the European Technology Platform (ETP) SmartGrids was set up in 2005 to create a joint vision for the European networks of 2020 and beyond. The platform includes representatives from industry, transmission and distribution system operators, research bodies and regulators. It has identified clear objectives and proposes an ambitious strategy to make a reality of this vision for the benefits of Europe and its electricity customers.

2.1.1 The energy policy context

The European Commission's 2006 Green Paper "A European Strategy for Sustainable, Competitive and Secure Energy" emphasises that Europe has entered a new energy era. The overriding objectives of European energy policy have to be sustainability, competitiveness and security of supply, necessitating a coherent and consistent set of policies and measures to achieve them.

Europe's electricity markets and networks lie at the heart of our energy system and must evolve to meet the new challenges. The future trans-European grids must provide all consumers with a highly reliable, cost-effective power supply, fully exploiting the use of both large centralised generators and smaller distributed power sources throughout Europe.

2.1.2 A shared vision

The SmartGrids vision is about a bold programme of research, development and demonstration that charts a course towards an electricity supply network that meets the needs of Europe's future.

Europe's electricity networks must be:

Flexible: fulfilling customers' needs whilst responding to the changes and challenges ahead;

Accessible: granting connection access to all network users, particularly for renewable power sources and high efficiency local generation with zero or low carbon emissions;

Reliable: assuring and improving security and quality of supply, consistent with the demands of the digital age with resilience to hazards and uncertainties;

Economic: providing best value through innovation, efficient energy management and 'level playing field' competition and regulation.

The vision embraces the latest technologies to ensure success, whilst retaining the flexibility to adapt to further developments. Network technologies to increase power transfers and reduce energy losses will heighten the efficiency of supply, whilst power electronic technologies will improve supply quality. Advances in simulation tools will greatly assist the transfer of innovative technologies to practical application for the benefit of both customers and utilities. Developments in communications, metering and business systems will open up new opportunities at every level on the system to enable market signals to drive technical and commercial efficiency.

2.1.3 Making it happen

Enabling Europe's electricity grids to meet the challenges and opportunities of the 21st century and fulfil the expectations of society requires intensified and sustained research efforts. It is essential that this takes place in a coherent way addressing technical, commercial and regulatory factors, to minimise risk and allow business decisions to be made by companies in an environment of stability.

Key elements of the vision include:

- Creating a toolbox of proven technical solutions that can be deployed rapidly and cost-effectively, enabling existing grids to accept power injections from all energy resources;

- Harmonising regulatory and commercial frameworks in Europe to facilitate cross-border trading of both power and grid services, ensuring that they will accommodate a wide range of operating situations;
- Establishing shared technical standards and protocols that will ensure open access, enabling the deployment of equipment from any chosen manufacturer;
- Developing information, computing and telecommunication systems that enable businesses to utilise innovative service arrangements to improve their efficiency and enhance their services to customers;
- Ensuring the successful interfacing of new and old designs of grid equipment to ensure inter-operability of automation and control arrangements.

These and other elements will be addressed through a Strategic Research Agenda that the Technology Platform will produce in 2006.

2.1.4 Delivering the benefits

The projects resulting from the SmartGrids vision will stimulate innovation in new network and associated information technologies. The benefits of new technologies will have a positive effect for Europe's citizens and for international business. Job opportunities will be broadened as the networks require workers with new skills and integration across new technology areas.

SmartGrids will help achieve sustainable development. Links will be strengthened across Europe and with other countries where different but complementary renewable resources are to be found. An increasingly liberalised market will encourage trading opportunities to be identified and developed. SmartGrids networks will, in addition to electricity flows, establish a two-way flow of information between supplier and user.

For a successful transition to a future sustainable energy system all the relevant stakeholders must become involved: governments, regulators, consumers, generators, traders, power exchanges, transmission companies, distribution companies, power equipment manufactures and ICT providers. Coordination at regional, national and European levels is essential and the SmartGrids Technology Platform has been designed to facilitate this process.

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2.1.5 An interactive grid

Just like the internet, the electricity grid will be interactive for both power generation sources and power consumption sinks (loads). In 2020, energy service companies will let everyone to have access to the provision of electricity supply services such as the demand management capabilities. Enabled by smart metering, electronic control technologies, modern communications means and the increased awareness of customers, local electricity supply management will play a key part in establishing new services that will create value for the parties involved.

In this context, metering services will represent the gateway for access to the grid of the future and will have a critical consequence on power demand evolution. For this reason, electronic meters, automated meter management systems and telecommunications – together with other communications systems that use electricity supply networks as their delivery infrastructure – will serve as enabling technologies. Information and Communication Technology (ICT) and business process integration will be valuable tools in the real time management of the value chain across suppliers, active networks, meters, customers and corporate systems.

Wide area monitoring and protection (WAM & WAP) systems will be applied to manage the congestions in the transmission systems in a way that improves the security and reliability of grid operation.

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2.1.6 Increasing efficiency

Advanced power electronics will allow variable-speed operation of electric generators and motors to increase the overall efficiency of the electricity supply chain as well as to increase the quality of the power supply. They may also extend the application of HVDC lines— for example with superconducting cables— which could enhance transmission and distribution. Broadband communications will be used to access virtually all power produ- cers and loads on every power level and with very low cost. This will permit new strategies to be implemented, such as the realisation of virtual power plants or the establishment of markets even for small producers or consumers.

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2.1.7 Internet-style inspiration

One possible model for the electricity network of the future would be analogous to the internet, in the sense that decision-making is distributed and that flows are bi-directional. Applying this concept to the electricity networks would lead to control is being distributed across nodes spread throughout the system. Not only could the supplier of power for a given consumer vary from one time period to the next but also the network use could vary as the network self-determines its configuration.

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2.1.8 Keeping it real

It is important to emphasise the role of ICT – in particular telecommunications – in adapting electricity networks to the real time actions and managing control distributed in the network, which may not be fully supported by the present internet generation.

Even if the internet protocol is universal, a serious effort is needed to effectively use communications equipment for a distributed real-time control of electricity networks. The real time performance of the internet as communication means is known to be very difficult to assess and it is critical given the power balance needed at any instant in time.

It is possible to conceive such a network but the real hardware, protocols, standards and markets at all levels are more difficult to realise. The question of international regulation must be addressed, not only at the technical but also at the political level.

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2.2 GRID 2030: A National Vision For Electricity's Second 100 Years

By the United States Department of Energy, Office of Electric Transmission and Distribution, July 2003.

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This vision of the future electric system builds on the existing electric infrastructure. The same types of equipment that the system uses for electric delivery today — e.g., power lines, substations, and transformers — will continue to play important roles. However, the emergence of new technologies, tools, and techniques including distributed intelligence and distributed energy resources, will increase the efficiency, quality, and security of existing systems and enable the development of a new architecture for the electric grid. The result will be improvements in the efficiency of both power delivery and market operations, and a high- quality network that provides secure sources of electricity to America.

Grid 2030 is a fully automated power delivery network that monitors and controls every customer and node, ensuring a two-way flow of electricity and information between the power plant and the appliance, and all points in between. Its distributed intelligence, coupled with broadband communications and automated control systems, enables real-time market transactions and seamless interfaces among people, buildings, industrial plants, generation facilities, and the electric network.

Technological breakthroughs in superconductivity have made it possible to deliver large amounts of energy over long distances into congested areas unobtrusively, with near-zero voltage drop. New conductor materials enable two to three times the power through existing rights-of-way. Advances in energy storage and demand-side management technologies have virtually eliminated peak-load problems. Economic losses from power outages and power quality disturbances are extremely rare (never caused by electric resource constraints), and customers routinely obtain electricity services at reliability and quality levels tailored to their individual needs with greatly reduced environmental impacts.

Workably competitive markets are in place at wholesale levels and customers widely acknowledge the resulting benefits. Effective public oversight and well-designed markets ensure that market power problems are kept to a minimum. Electric transmission and distribution operates under a consistent and stable set of regulations, which rely on performance-based principles and involve Federal and state agencies, multi-state entities, voluntary industry associations, and public interest groups to enforce proper business practices and ensure consumer protection.

The Grid 2030 workforce draws from the Nation's best scientists, engineers, technicians, and business professionals. Workplaces are safe, and workers enjoy rewarding careers in high-paying jobs.

Grid 2030 consists of three major elements:

1. A national electricity "backbone"
2. Regional interconnections, which include Canada and Mexico
3. Local distribution, mini- and micro- grids providing services to customers and obtaining services from generation resources anywhere on the continent

2.2.1 National Electricity Backbone

High-capacity transmission corridors link the east and west coasts, as well as Canada and Mexico. It is possible to balance electric supply and demand on a national basis. This gives customers "continental" access to electricity supplies, no matter where they or their suppliers are located. The national electricity backbone enables expanded distribution of electricity from:

- Efficient generation from a multitude of sources, serving customers in a non-discriminatory manner, and
- A more efficient system that can take advantage of seasonal and regional weather diversity on a national scale, including demand- side management

The backbone system consists of a variety of technologies. These include controllable, very-low-impedence superconducting cables and transformers operating within the synchronous AC environment; high voltage direct current devices forming connections between regions; and other types of advanced electricity conductors, as well as information, communications, and controls technologies for supporting real-time operations and national electricity transactions. Superconducting systems reduce line losses, assure stable voltage, and expand current carrying capacities in dense urbanized areas with a minimal physical footprint. They are seamlessly integrated with high voltage direct current systems and other advanced conductors for transporting electric power over long distances.

Advanced materials such as high temperature diamond materials could be applied to the transmission, distribution, and control of electricity. Diamond technology could replace silicon and yield revolutionary improvements in current density.

The cryogenc equipment used for achieving superconductivity in electric transmission is available for other purposes, such as the conversion of hydrogen gas into liquid form. Liquid hydrogen is one of the long-distance transport options for the hydrogen economy. With electricity, hydrogen is the second main energy carrier for the economy. Coupling the development of advanced electricity and hydrogen technologies lowers overall infrastructure costs.

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