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BUSTA 1

a) Nell'ambito di un processo di riqualificazione di un edificio uso uffici, il candidato fornisca indicazioni in merito all'installazione di pannelli fotovoltaici con eventuale sistema di accumulo con finalità di riduzione dei consumi dei dispositivi quali PC, Server, stampanti.

L'orario operativo indicativo degli uffici è 8 – 18, copertura piana, 2 piani fuori terra, esposizione SUD, anno di costruzione 1990, struttura in calcestruzzo armato e solai in laterocemento.

b) Il candidato presenti, con chiarezza e sintesi, il curriculum vitae ed eventuali prodotti presentati (rapporti tecnico/gestionali e/o pubblicazioni o brevetti), sottolineando le esperienze professionali che ritiene essere più significative relativamente all'attinenza con la tematica del bando.

c) 1. Nell'ambito dell'applicativo MS Excel, indicare quale tra le seguenti espressioni è corretta:
SOMMA(D1:D8)=
=SOMMA(D1:D8)
SOMMA=(D1:D8)

2. Un disegno creato con Autocad 2023 e salvato come file .dwg come può essere aperto da applicativi CAD meno recenti?

d) Il candidato legga e traduca il paragrafo evidenziato in giallo a pag.30, tratto dal libro: "Electric Power Systems: A Conceptual Introduction" by Alexandra von Meier, Edited by John Wiley & Sons, Inc. (2006)

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CHAPTER 2

Basic Circuit Analysis

2.1 MODELING CIRCUITS

As a general definition, a *circuit* is an interconnection of electric *devices*, or physical objects that interact with electric voltages and currents in a particular manner. Typically, we would imagine the devices in a circuit to include a power *source* (such as a battery, a wall outlet, or a generator), *conductors* or wires through which the electric current can flow, and a *load* in which the electric power is being utilized (converted to mechanical or thermal energy). To analyze a circuit means to account for the properties of all the individual devices so as to predict the circuit's electrical behavior. By "behavior" we mean specifically what voltages and currents will occur at particular places in the circuit given some set of conditions, such as a voltage supplied by a power source. This behavior will depend on the nature of the devices in the circuit and on how they are connected.

For the purpose of circuit analysis, individual devices are represented as ideal objects or *circuit elements* that behave according to well-understood rules.[1] From the circuit perspective, the events inside these elements are irrelevant; rather, we focus on measurements at the elements' *terminals*, or points where the elements connect to others.

The scale of analysis can shift depending on the information that is of interest. For example, suppose we are analyzing a circuit in our house to see whether it might be overloaded. We find that several appliances are plugged into this circuit, including a radio. We would consider this radio as one of the loads and conceptualize it simply as a box with two terminals (the two prongs of its plug) that draws a particular amount of current when presented with 120 volts by the outlet. On the other hand, suppose we wish to understand how the radio can be tuned to different frequencies. Now we would draw a diagram that includes many of the radio's interior components. Still, we might not include every single little resistor or capacitor; rather, we would group some of the many electronic parts together and represent

[1]Most real devices match their simple idealized versions very closely in behavior (for example, a resistor that obeys Ohm's law). If not, there is always some way of combining a set of abstract elements so as to represent the behavior of the physical gadget to the desired accuracy.

Electric Power Systems: A Conceptual Introduction, by Alexandra von Meier

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BUSTA 2

a) Alla luce delle sempre più ricorrenti precipitazioni piovose brevi ma di elevata intensità, il candidato illustri quali possono essere delle possibili strategie di gestione e mitigazione delle potenziali problematiche connesse a tali eventi con particolare riguardo allo smaltimento/accumulo delle acque piovane.

   L'orario operativo indicativo degli uffici è 8 – 18, copertura piana, 2 piani fuori terra, esposizione SUD, anno di costruzione 1990, struttura in calcestruzzo armato e solai in laterocemento.

b) Il candidato selezioni esperienze professionali o rapporti tecnico/gestionali e/o pubblicazioni o brevetti, tra quelli presentati, che ritiene abbiano più attinenza alla tematica del bando e ne discuta in maniera chiara e sintetica.

c) 1. Nell'ambito dell'applicativo MS Excel, il comando Ordinamento Crescente può essere utilizzato per il:
   Formato testo e numeri
   Formato numeri
   Formato testo

   2. Nell'ambito dell'applicativo Autocad, Il candidato descriva brevemente il funzionamento del comando RUOTA.

d) Il candidato legga e traduca il paragrafo evidenziato in giallo a pag. 24, tratto dal libro: "Electric Power Systems: A Conceptual Introduction" by Alexandra von Meier, Edited by John Wiley & Sons, Inc. (2006)

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1.5.4 Electromagnetic Induction

While electric current creates a magnetic field, the reverse effect also exists: magnetic fields, in turn, can influence electric charges and cause electric currents to flow. However, there is an important twist: the magnetic field must be *changing* in order to have any effect. A static magnetic field, such as a bar magnet, will not cause any motion of nearby charge. Yet if there is any *relative* motion between the charge and the magnetic field—for example, because either the magnet or the wire is being moved, or because the strength of the magnet itself is changing—then a force will be exerted on the charge, causing it to move. This force is called an *electromotive force* (*emf*) which, just like an ordinary electric field, is distinguished by its property of accelerating electric charges.

The most elementary case of the electromotive force involves a single charged particle traveling through a magnetic field, at a right angle to the field lines (the direction along which iron filings would line up). This charge experiences a force again at right angles to both the field and its velocity, the direction of which (up or down) depends on the sign of the charge (positive or negative) and can be specified in terms of another right-hand rule, as illustrated in Figure 1.3.

This effect can be expressed concisely in mathematical terms of a *cross product* of vector quantities (i.e., quantities with a directionality in space, represented in boldface), in what is known as the Lorentz equation,

$$\mathbf{F} = q\mathbf{v} \times \mathbf{B}$$

where **F** denotes the force, q the particle's charge, **v** its velocity, and **B** the magnetic field. In the case where the angle between **v** and **B** is 90° (i.e., the charge travels at right angles to the direction of the field) the magnitude or numerical result for **F** is simply the arithmetic product of the three quantities. This is the maximum force

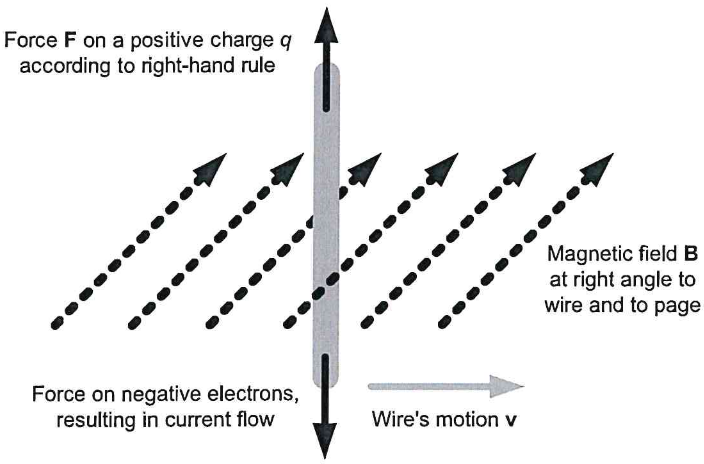

Figure 1.3 Right-hand rule for the force on a charge.

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BUSTA 3

a) Nell'ambito di un processo di riqualificazione di una centrale termica a servizio di una serie di edifici ad uso uffici, il candidato fornisca spunti in merito all'allacciamento alla rete del teleriscaldamento cittadino rispetto all'utilizzo dell'ordinario generatore di calore a metano.

   Si consideri a titolo indicativo una distribuzione del calore ibrida (radiatori, ventilconvettori) e generatori gemelli da circa 1200 kW cadauno

b) Il candidato descriva, in maniera chiara e sintetica, l'esperienza, i rapporti tecnico/gestionali e/o pubblicazioni o brevetti tra quelli presentati, che ritiene essere più rappresentativi delle proprie competenze, argomentando l'attinenza con le competenze richieste dal bando.

c) 1. Supponendo di avere in un foglio MS Excel i seguenti valori nelle celle: A1=10, A2=4, A3=2, qual è il risultato della formula =(A1+A3)/A2?

   2. Nell'ambito dell'applicativo Autocad, Il candidato descriva brevemente il funzionamento del comando COPIA.

d) Il candidato legga e traduca il paragrafo evidenziato in giallo a pag. 85, tratto dal libro: "Electric Power Systems: A Conceptual Introduction" by Alexandra von Meier, Edited by John Wiley & Sons, Inc. (2006)

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CHAPTER 4

Generators

An electric generator is a device designed to take advantage of *electromagnetic induction* in order to convert movement into electricity. The phenomenon of induction (introduced in Section 1.5.4) can be summarized as follows: an electric charge, in the presence of a magnetic field in relative motion to it—either by displacement or changing intensity—experiences a force in a direction perpendicular to both the direction of relative motion and of the magnetic field lines. Acting on the many charges contained in a conducting material—usually, electrons in a wire—this force becomes an *electromotive force* (*emf*) that produces a voltage or potential drop along the wire and thus causes an electric current (the *induced current*) to flow.

A generator is designed to obtain an induced current in a conductor (or set of conductors) as a result of mechanical movement, which is utilized to continually change a magnetic field near the conductor. The generator thus achieves a conversion of one physical form of energy into another—energy of motion into electrical energy—mediated by the magnetic field that exerts forces on the electric charges. In this sense, a generator is the opposite of an electric motor, which accomplishes just the reverse: the motor converts electrical energy into mechanical energy of motion, likewise mediated by the magnetic field. As far as the physical principles are concerned, electric generators and motors are very similar devices; in fact, an actual generator can be operated as a motor and vice versa. To achieve the best possible performance, however, there are many subtleties of design that specialize a given machine for one or the other task.[1] These subtleties have to do almost exclusively with geometry (though the choice of materials may also be important). Indeed, geometry is what distinguishes the many different types of specialized generators: the particular way in which the conducting wires are arranged within the generator determines the spatial configuration of the magnetic field, which in turn affects the precise nature of the current produced and the behavior of the machine under various circumstances.

[1]One example of a situation where it is practical to install a single machine for both generating and motoring is in the case of pumped hydroelectric storage or tidal power plants, where large water pumps are operated reversibly as turbine generators.

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BUSTA 4

a) Nell'ambito di un processo di riqualificazione di un edificio uso uffici, il candidato fornisca brevemente le principali voci di costo per l'acquisto, gestione, manutenzione e le principali criticità in merito all'installazione di pannelli fotovoltaici con e senza sistema di accumulo.

L'orario operativo indicativo degli uffici è 8 – 18, copertura piana, 2 piani fuori terra, esposizione SUD, anno di costruzione 1990, struttura in calcestruzzo armato e solai in laterocemento.

b) Il candidato discuta, in maniera chiara e sintetica, le principali attività, esperienze professionali e competenze attestate dal curriculum vitae e da eventuali prodotti presentati (rapporti tecnico/gestionali e/o pubblicazioni o brevetti), pertinenti alla tematica del bando.

c) 1. Nell'ambito dell'applicativo MS Excel, una formula incomincia sempre con il simbolo di:

punto interrogativo (?)
cancelletto (#)
uguale (=)

2. Nell'ambito dell'applicativo Autocad, Il candidato descriva brevemente il funzionamento del comando TAGLIA.

d) Il candidato legga e traduca il paragrafo evidenziato in giallo a pag. 33, tratto dal libro: "Electric Power Systems: A Conceptual Introduction" by Alexandra von Meier, Edited by John Wiley & Sons, Inc. (2006)

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2.2.2 Resistance in Parallel

When resistors are combined in parallel, the effect is perhaps less obvious than for the series case: rather than adding resistance, we are in fact *decreasing* the overall resistance of the combination by providing alternative paths for the current. This is so because in the parallel case the individual charge is not required to travel through every element, only one branch, so that the presence of the parallel elements "alleviates" the current flow through each branch, and thereby makes it easier for the charge to traverse. It is convenient here to consider resistors in terms of the inverse property, *conductance* (Section 1.1.5). Thus, we think of the resistor added in parallel not as posing a further obstacle, but rather as providing an additional conducting option: after all, as far as the current is concerned, any resistor is still better than no path at all. Accordingly, the total resistance of a parallel combination will always be *less* than any of the individual resistances.

Using conductance ($G = 1/R$), the algebraic rule for combining any number of resistive elements in parallel is simply that the conductance of the parallel combination equals the sum of the individual conductances.

For example, suppose a 10-Ω and a 2.5-Ω resistor are connected in parallel, as in Figure 2.2. We know already that their combined (parallel) resistance must be less than 2.5 Ω. To do the math, it is convenient to first write each in terms of conductance: 0.1 mho and 0.4 mho. The combined conductance is then simply the sum of the two, 0.5 mho. Expressed in terms of resistance, this result equals 2 Ω. In equation form, we would write for resistors in parallel:

$$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2} + \cdots$$

where R is the combined resistance, and R_1, R_2, and so forth are the individual resistances.

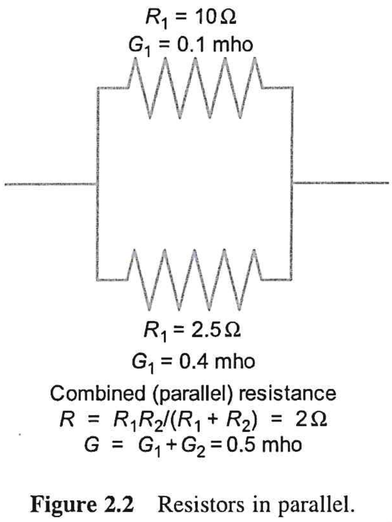

Figure 2.2 Resistors in parallel.

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BUSTA 5

a) Nell'ambito di un processo di riqualificazione di una sala a uso biblioteca/deposito di materiale cartaceo il candidato illustri quale possa essere un sistema di estinzione incendio fisso e automatico da installarsi nel locale.

b) Il candidato descriva, con chiarezza e sintesi, le proprie esperienze lavorative e competenze mettendo in risalto la loro attinenza alla tematica del presente bando di concorso. Il candidato fornisca inoltre informazioni relative ad eventuali prodotti presentati (rapporti tecnico/gestionali e/o pubblicazioni o brevetti).

c) 1. Supponendo di avere in un foglio MS Excel i seguenti valori nelle celle: A1=10, A2=4, A3=2, qual è il risultato della formula =SOMMA(A1:A3)?

   2. Nell'ambito dell'applicativo Autocad, Il candidato descriva il funzionamento degli OSNAP

d) Il candidato legga e traduca il paragrafo evidenziato in giallo a pag. 268, tratto dal libro: "Electric Power Systems: A Conceptual Introduction" by Alexandra von Meier, Edited by John Wiley & Sons, Inc. (2006)

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with at least several years and sometimes a decade passing between a unit's inception and its operation. It was also considered part of prudent practice in the regulated U.S. industry to maintain a substantial generation reserve margin of 20% above peak demand. Therefore, unit construction plans were typically based on conservative demand projections for ten or twenty years out. This approach made sense until the 1980s, when electric demand growth fell behind projections and many U.S. utilities suddenly found themselves with excess capacity.

The problem of anticipating demand and implementing appropriate levels of generation capacity remains difficult and controversial in the restructured environment. For example, the design of the deregulated California market in the 1990s assumed plenty of excess generation capacity to be in place and therefore failed to carefully consider the system's behavior under a hypothetical generation shortage. When a dramatic shortage appeared in 2001 that resulted in extreme wholesale price spikes and rotating outages, it was not immediately obvious to what extent this crisis resulted from an actual physical generation scarcity, or to what extent it was manufactured through profit-maximizing behavior on the part of power generators. In theory, a competitive market ought to provide incentives not only for short-term production but long-term investment, including generation and power delivery. How such investment signals will occur in practice and how closely the results will match society's expectations is anything but clear; some of the associated difficulties are outlined in Section 9.3.

9.2 NEW TECHNOLOGY

9.2.1 Storage

Energy storage alleviates the need to generate power at the same time as it is demanded. This may be desirable both for economic reasons and to guarantee sufficient supply during times of peak demand or when resources are unavailable.

On the subutility scale, electricity storage is practically synonymous with batteries. Stand-alone power systems, whether residential or commercial, typically use banks of lead–acid batteries to store intermittently generated energy from renewable sources or to provide a reliable backup in case of a generator failure. They are similar to car batteries, but designed to be more tolerant of repeated deep discharge. Batteries of different chemical makeup exist, but are very expensive and rarely used on the scale of building energy supply. Even the cost of standard lead–acid batteries to supply loads on the order of kilowatts for any appreciable duration is significant compared to the cost of generating the energy itself. Besides being expensive, batteries are toxic, corrosive, potentially explosive, and bulky; also, their performance is sensitive to proper treatment and maintenance. If a convenient and affordable alternative existed, it would no doubt revolutionize the field.

Batteries intrinsically work with direct current (d.c.), so that their use for a.c. systems always requires an inverter. The basic principle of energy storage in a battery is that an exothermic (energy-releasing) chemical reaction proceeds

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BUSTA 6

a) Nell'ambito di un processo di riqualificazione di un edificio uso uffici, il candidato fornisca indicazioni in merito ai vantaggi/svantaggi relativi all'installazione di pannelli solari termici rispetto a quelli fotovoltaici.

   L'orario operativo indicativo degli uffici è 8 – 18, copertura piana, 2 piani fuori terra, esposizione SUD, anno di costruzione 1990, struttura in calcestruzzo armato e solai in laterocemento.

b) Sulla base del curriculum vitae e degli eventuali prodotti presentati (rapporti tecnico/gestionali e/o pubblicazioni o brevetti), il candidato illustri le proprie competenze ed esperienze facendo esplicito riferimento alla loro attinenza con la tematica del presente bando di concorso.

c) 1. Supponendo di avere in un foglio MS Excel i seguenti valori nelle celle: A1=10, A2=4, A3=2, qual è il risultato della formula =(A1*A3)/A2?

   2. Qual è la tipologia di file di interscambio classico di AutoCAD?

d) Il candidato legga e traduca il paragrafo evidenziato in giallo a pag. 66, tratto dal libro: "Electric Power Systems: A Conceptual Introduction" by Alexandra von Meier, Edited by John Wiley & Sons, Inc. (2006)

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not the negative sign) is directly proportional to the relationship between R and X. Thus, a device whose reactance outweighs its resistance also has a susceptance that outweighs its conductance.

Example

Consider a transmission line that has a resistance $R = 1\ \Omega$ that is small compared to its reactance $X = 10\ \Omega$. What, approximately, are the conductance and susceptance?

The magnitude of Z is very close to 10 (by the Pythagorean theorem, we find $Z = \sqrt{R^2 + X^2} = \sqrt{101} = 10.05$). From $G = R/Z^2$ we obtain $G \approx 1/100$ or 0.01 mho, and $B = X/Z^2 \approx 0.1$ mho. Thus, the susceptance is ten times greater than the conductance, just as the reactance is ten times the resistance.

3.3 POWER

3.3.1 Definition of Electric Power

Power is a measure of energy per unit time. Power therefore gives the *rate* of energy consumption or production. The units for power are generally watts (W). For example, the watt rating of an appliance gives the rate at which it uses energy. The total amount of energy consumed by this appliance is the wattage multiplied by the amount of time during which it was used; this energy can be expressed in units of watt-hours (or, more commonly, kilowatt-hours).

As we saw in Section 1.3, the power dissipated by a circuit element—whether an appliance or simply a wire—is given by the product of its resistance and the square of the current through it: $P = I^2R$. The term "dissipated" indicates that the electric energy is being converted to heat. This heat may be part of the appliance's intended function (as in any electric heating device), or it may be considered a loss (as in the resistive heating of transmission lines); the physical process is the same.

Another, more general way of calculating power is as the product of current and voltage: $P = IV$. For a resistive element,[12] we can apply Ohm's law ($V = IR$) to see that the formulas $P = I^2R$ and $P = IV$ amount to the same thing:

$$P = IV = I(IR) = I^2R$$

Example

Consider an incandescent light bulb, rated at 60 W. This means that the filament dissipates energy at the rate of 60 W when presented with a given voltage, which we assume to be the normal household voltage (120 V). The power equals the

[12]In the general case (where there may also be reactance), Ohm's law becomes $V = IZ$, so the substitution is not as straightforward. It will still be true, though, that $P = I^2R$ gives the power dissipated by resistive heating.