Gruppo domande **scelta D**

1. Lei viene assegnato ad un Dipartimento e da subito si rende conto che la mole di lavoro è alta e anche le prestazioni richieste sono di alto livello. È il lavoro che le piacerebbe fare, ma per motivi personali sa che potrebbe fare alcune assenze che potrebbero impattare sulle scadenze delle attività di ricerca e didattica del laboratorio nel quale ora lavora. Quali riflessioni fa e quali azioni prevede di fare?
2. Il Candidato illustri problematiche *real time* in sistemi di controllo.
3. Il Candidato descriva i regolatori standard e loro caratteristiche nei controlli automatici.
4. Il Candidato illustri le funzioni e gli Organi di governo di un Dipartimento universitario.
5. Lettura e traduzione del brano seguente
   (fonte: https://en.wikipedia.org/wiki/Automation)

Automation describes a wide range of technologies that reduce human intervention in processes, namely by predetermining decision criteria, subprocess relationships, and related actions, as well as embodying those predeterminations in machines.

Automation has been achieved by various means including mechanical, hydraulic, pneumatic, electrical, electronic devices, and computers, usually in combination. Complicated systems, such as modern factories, airplanes, and ships typically use combinations of all of these techniques. The benefit of automation includes labor savings, reducing waste, savings in electricity costs, savings in material costs, and improvements to quality, accuracy, and precision.

Automation includes the use of various equipment and control systems such as machinery, processes in factories, boilers, and heat-treating ovens, switching on telephone networks, steering, and stabilization of ships, aircraft, and other applications and vehicles with reduced human intervention. Examples range from a household thermostat controlling a boiler to a large industrial control system with tens of thousands of input measurements and output control signals. Automation has also found space in the banking sector. In control complexity, it can range from simple on-off control to multi-variable high-level algorithms.

In the simplest type of an automatic control loop, a controller compares a measured value of a process with a desired set value and processes the resulting error signal to change some input to the process, in such a way that the process stays at its set point despite disturbances. This closed-loop control is an application of negative feedback to a system. The mathematical basis of control theory was begun in the 18th century and advanced rapidly in the 20th.

Gruppo di domande **scelta C**

1. Il Coordinatore le ha fornito indirizzi in merito all'utilizzo degli spazi e delle attrezzature del laboratorio da parte degli utenti (es. docenti, ricercatori, studenti, dottorandi, ecc.). Operativamente individua alcune difficoltà e vorrebbe proporre alcune modifiche. Come si comporta?
2. Il Candidato illustri problematiche di *safety* in sistemi automatici.
3. Il Candidato illustri la generazione di traiettorie e il loro impatto nei sistemi meccatronici.
4. Il Candidato illustri le funzioni del Consiglio di un Dipartimento universitario.
5. Lettura e traduzione del seguente brano
   (fonte: https://en.wikipedia.org/wiki/Tensor)

In mathematics, a **tensor** is an algebraic object that describes a multilinear relationship between sets of algebraic objects related to a vector space. Objects that tensors may map between include vectors and scalars, and even other tensors.

There are many types of tensors, including scalars and vectors (which are the simplest tensors), dual vectors, multilinear maps between vector spaces, and even some operations such as the dot product.

Tensors are defined independent of any basis, although they are often referred to by their components in a basis related to a particular coordinate system.

Tensors have become important in physics because they provide a concise mathematical framework for formulating and solving physics problems in areas such as mechanics (stress, elasticity, fluid mechanics, moment of inertia, ...), electrodynamics (electromagnetic tensor, Maxwell tensor, permittivity, magnetic susceptibility, ...), general relativity (stress–energy tensor, curvature tensor, ...) and others.

In applications, it is common to study situations in which a different tensor can occur at each point of an object; for example the stress within an object may vary from one location to another. This leads to the concept of a tensor field. In some areas, tensor fields are so ubiquitous that they are often simply called "tensors".

Tullio Levi-Civita and Gregorio Ricci-Curbastro popularised tensors in 1900 – continuing the earlier work of Bernhard Riemann and Elwin Bruno Christoffel and others – as part of the *absolute differential calculus*. The concept enabled an alternative formulation of the intrinsic differential geometry of a manifold in the form of the Riemann curvature tensor.

Gruppo di domande **scelta B**

1. Lei lavora presso un Dipartimento e il responsabile del laboratorio si deve assentare per una settimana e le chiede la cortesia di supervisionare le attività del laboratorio a livello organizzativo. Una mattina si presenta un gruppo di studenti senza aver concordato nulla a monte. Lei cosa farebbe?
2. Il Candidato presenti una panoramica dei sistemi di controllo in ambito meccatronico.
3. Il Candidato descriva implementazioni di algoritmi di controllo in ambito automazione industriale.
4. Il Candidato illustri la autonomia organizzativa e finanziaria di un Dipartimento universitario.
5. Lettura e traduzione del brano riportato
   (fonte: https://en.wikipedia.org/wiki/Mechatronics)

Mechatronics, also called mechatronics engineering, is an interdisciplinary branch of engineering that focuses on the integration of mechanical, electrical and electronic engineering systems, and also includes a combination of robotics, electronics, computer science, telecommunications, systems, control, and product engineering.

As technology advances over time, various subfields of engineering have succeeded in both adapting and multiplying. The intention of mechatronics is to produce a design solution that unifies each of these various subfields. Originally, the field of mechatronics was intended to be nothing more than a combination of mechanics, electrical and electronics, hence the name being a portmanteau of the words "**mecha**nics" and "elec**tronics**"; however, as the complexity of technical systems continued to evolve, the definition had been broadened to include more technical areas.

The word *mechatronics* originated in Japanese-English and was created by Tetsuro Mori, an engineer of Yaskawa Electric Corporation. The word *mechatronics* was registered as trademark by the company in Japan with the registration number of "46-32714" in 1971. The company later released the right to use the word to the public, and the word began being used globally. Currently the word is translated into many languages and is considered an essential term for advanced automated industry.

Many people treat *mechatronics* as a modern buzzword synonymous with automation, robotics and electromechanical engineering.

French standard NF E 01-010 gives the following definition: "approach aiming at the synergistic integration of mechanics, electronics, control theory, and computer science within product design and manufacturing, in order to improve and/or optimize its functionality".

Gruppo di domande **scelta A**

1. Lei lavora all'interno di un Dipartimento e si deve occupare di alcuni aspetti legati agli acquisti per allestire un laboratorio didattico. Improvvisamente un suo collega con cui si coordina e col quale vi suddividete il lavoro si deve assentare per un periodo di 15 giorni per problemi personali. Quali riflessioni fa e quali azioni prevede di fare?
2. Il Candidato discuta di protocolli di comunicazione usualmente adottati in moderni sistemi di controllo.
3. Il Candidato affronti il problema della robustezza nel controllo.
4. Il Candidato illustri le prerogative e le funzioni del Direttore di un Dipartimento universitario.
5. Lettura e traduzione del brano seguente
   (fonte: https://en.wikipedia.org/wiki/Cybernetics)

Cybernetics is a wide-ranging field concerned with regulatory and purposive systems. The core concept of cybernetics is circular causality or feedback—where the observed outcomes of actions are taken as inputs for further action in ways that support the pursuit and maintenance of particular conditions, or their disruption.

Cybernetics is named after an example of circular causality, that of steering a ship, where the helmsperson maintains a steady course in a changing environment by adjusting their steering in continual response to the effect it is observed as having.

Other examples of circular causal feedback include:

- technological devices such as thermostats (where the action of a heater responds to measured changes in temperature, regulating the temperature of the room within a set range);
- biological examples such as the coordination of volitional movement through the nervous system;
- processes of social interaction such as conversation.

Cybernetics is concerned with feedback processes such as steering however they are embodied, including in ecological, technological, biological, cognitive, and social systems, and in the context of practical activities such as designing, learning, managing, conversation, and the practice of cybernetics itself. Cybernetics' transdisciplinary and "antidisciplinary" character has meant that it intersects with a number of other fields, leading to it having both wide influence and diverse interpretations.

Cybernetics has its origins in exchanges between numerous fields during the 1940s, including anthropology, mathematics, neuroscience, psychology, and engineering. Initial developments were consolidated through meetings such as the Macy Conferences and the Ratio Club. At its most prominent during the 1950s and 1960s, cybernetics is a precursor to fields such as computing, artificial intelligence, cognitive science, complexity science, and robotics amongst others.