Università degli Studi della Basilicata
Scuola di Ingegneria

COURSE: : Materials technology and applied chemistry

TEACHER: Milena Marroccoli

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Language: Italian

ECTS: 6	n. of hours: 60	Academic year: 2014-2015	Campus: Potenza	Semester: II

TOPICS

Classification and examination of engineering materials according to their chemical composition, structure as well as thermal and mechanical properties. Phase diagrams. Production technology, characteristics and utilization of ferrous metals (steel and cast iron). Complement materials for mechanical engineering: fuels and lubricants. Water treatment for industrial use.

TEACHING METHODS (please tick one or more options)

x Theoretical lessons
x Tutorials in classroom
☐ Tutorials in laboratory
☐ Project works
x Technical visits
Other activities (please specify) _____

TEXTBOOKS

W. F. Smith – Scienza e Tecnologia dei materiali, McGraw Hill Italia.
C. Brisi – Lezioni di Chimica Applicata, Editrice Universitaria Levrotto & Bella, Torino.
AIMAT – Manuale dei materiali per l'ingegneria, McGraw Hill Italia.

ON-LINE EDUCATIONAL MATERIAL

web address:

LEARNING OUTCOMES

Aim of the course is to provide students with an overview of the relationships between composition, microstructure, properties and production technology of metallic, ceramic and polymeric materials. In particular, at the end of the course the student will acquire a critical understanding of different classes of materials for industrial engineering and will be able to choose the most suitable for a specific application by foreseeing their expected behavior once carried out; the student will know the characteristics and uses of the main categories of fuels and will learn the basic knowledge of the chemical and physical methods applied to the treatment of water for industrial usage.

REQUIREMENTS

None.

EVALUATION METHODS (please tick one or more options)

☐ Intermediate verifications
x Written examination
☐ Discussion of a project work
☐ Practical test
☐ Oral examination
Other methods (please specify) _____

DETAILED CONTENT

The classes of materials. Primary and secondary chemical bonds. The crystal structure of metals and ceramics. Coordinates of Atomic Positions, Directions and Planes. Dense Planes and Directions. Defects in Crystalline solids. Dislocations Mechanism of Plastic Deformation.

Strengthening a Metal: solid solution hardening, precipitate and dispersion strengthening, cold work-hardening, the dislocation yield strength . Increasing the ductility by annealing

Mechanical properties. Stresses and strains. Linear and non linear Elasticity. Anelastic behaviour. Engineering and true stress-strain curves. Plastic deformation of metals. Hardness. Fracture. Fatigue. Creep.

Thermal properties. Heat capacity. Thermal expansion. Thermal conductivity. Thermal stresses.

Phase Diagrams. Gibb's rule. Behaviour of Binary Alloys. Phases, Components and Phase Diagrams. Solid Solutions. Analysis of Binary Phase Diagrams. The Binary Eutectic Phase Diagram. Intermediate Compounds and Intermediate Phases. Peritectic solidification.

Metals. Cast iron and steel manufacturing process. The Iron-Carbon System. Steels. Carbon content influence on the technical behaviour of steels. Cast iron.

Combustion and fuels. Heating value. Combustion chemistry. Stoichiometric amount of air and excess air. Theoretical combustion temperature. Burning gas volume. Ignition temperature. Flammable limits. Fossil fuels: combustibile and incombustibile components. Fossil coal and coke coal. Petroleum distillation. Liquid fuels: gasoline, diesel, kerosene and combustibile oil. Gaseous fuels: natural and synthetic gas. Non traditional fuels.

Lubricants. Classification, components, properties, function.

Water. Properties. Analysis. Industrial water treatment method. Suspended solids separation: sedimentation, coagulation, filtration. Degasification. Temporary and permanent water hardness. Dissolved solid separation. Water softening. Demineralization. Sea water treatment processes.

SEMINARS BY EXTERNAL EXPERTS YES ☐ NO x

FURTHER INFORMATION