



Associate Degree Program

Specialization	Common
Course Number	020202121
Course Title	Engineering Materials
Credit Hours	2
Theoretical Hours	2
Practical Hours	0

Brief Course Description:

Introduction to engineering materials, definition, classification: Metallic and non-metallic, alloys and composites, woods, ceramics, polymers and their characteristics, material selection and industrial applications of different types of materials and material selection. Mechanical properties: Strength, hardness, elasticity, plasticity, ductility, toughness, brittleness, stiffness, creep and fatigue. Structure of materials: Bonding, Packing, dislocation. Metallic Solid solutions, phase equilibrium, Phase diagrams, Iron carbon phase diagram. Control of mechanical properties by manipulation and heat treatment. Electrical characteristics and Thermal properties, conductors, insulators and semiconductors. Magnetic properties.

Course Objectives:

The course is designed to introduce students in engineering program specializations to the basic concepts of engineering materials and their applications.

Detailed Course Outline:

Unit Number	Unit Title	Unit Content	Time Needed
1.	Introduction to engineering materials	<ul style="list-style-type: none"> ▪ Importance ▪ Classification of engineering materials: metals, ceramics, polymers, alloys and composites 	
2.	Mechanical properties	<ul style="list-style-type: none"> ▪ Strength, hardness, elasticity, plasticity, ductility, toughness, brittleness, stiffness, hardness ▪ Engineering stress-strain relation ▪ Engineering stress-strain diagram ▪ Creep and fatigue 	
3.	The structure of materials	<ul style="list-style-type: none"> ▪ General overview ▪ Atoms ▪ Crystals and grains ▪ Unit cell ▪ Correlation of data on unit cells with measurements of density, atomic radius, planer density, and linear density ▪ Crystal Structures: FCC, BCC, HCP ▪ Effect of mechanical properties on metal structure 	
4.	Solid solutions and phase equilibrium	<ul style="list-style-type: none"> ▪ Types of solid solutions ▪ Properties of solid solutions ▪ Eutectiferous alloys ▪ Equilibrium diagrams ▪ Effect of alloying upon behavior during solidification 	

		<ul style="list-style-type: none"> ▪ Complete solubility in solid state ▪ Non solubility in solid state ▪ Limited solubility in solid state 	
5.	Control of mechanical properties by manipulation and heat treatment	<ul style="list-style-type: none"> ▪ Control of grains ▪ Cold working ▪ Hot working ▪ Strengthening mechanism ▪ Heat treatment 	
6.	Electrical properties of materials	<ul style="list-style-type: none"> ▪ Electrical conductivity ▪ Conduction and carriers ▪ Conductors, semiconductors, insulators ▪ Applications 	
7.	Magnetic properties of materials	<ul style="list-style-type: none"> ▪ Magnetic circuit and magnetic permeability ▪ Magnetic domains ▪ Magnetic saturation ▪ Effect of temperature on magnetization 	

Evaluation Strategies:

Exams		Percentage	Date
Exams	First Exam	20%	
	Second Exam	20%	
	Final Exam	50%	
Quizzes		10%	

Teaching Methodology:

- ❖ Lectures and presentations

Text Book

1. Engineering Materials and their applications, Richard A. Flinn and Paul K. Torjon, Houghton Mifflin Company.